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January 26, 2015

*Via Federal Express*
Bridget C. Bohac
Office of the Chief Clerk
Texas Commission on Environmental Quality
12100 Park 35 Circle, Bldg F, MC-105
Austin, Texas 78753

Re: TCEQ Docket No. 2014-1658-WR; Water Rights Permit No. 12378 Guadalupe-Blanco River Authority

Dear Ms. Bohac:

Enclosed please find 7 copies of TAP'S RESPONSE TO EXECUTIVE DIRECTOR'S RECOMMENDATION TO DENY PARTY STATUS. This document was filed via the Chief Clerk's TCEQ's E-Filing System January 26, 2015.

If you have any questions regarding this document please contact our office.

Sincerely,

BLACKBURN & CARTER, P.C.

James B. Blackburn, Jr.

cc: Mailing List

Enclosures

TCEQ DOCKET NO. 2014-1658-WR

| | | |
|---|---|---|
| APPLICATION OF THE GUDAULUPE-BLANCO RIVER AUTHORITY FOR WTER RIGHTS PERMIT NO. 12378 | § § § § | BEFORE THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY |

**TAP'S RESPONSE TO EXECUTIVE DIRECTOR'S RECOMMENDATION TO DENY PARTY STATUS**

This response addresses the Executive Director's recommendation that The Aransas Project (TAP) be denied standing to participate in a contested case hearing regarding the issuance of a permit to allow the Guadalupe Blanco River Authority (GBRA) to construct an off-channel reservoir near Gonzales, Texas (Permit Application #12378).

## A. Additional Members Offered to Establish Standing

The Executive Director has recommended against granting TAP party status to contest a permit by GBRA to construct an off-channel reservoir that has the potential impact the estuarine health of the San Antonio-Aransas Bay system. The requirement for standing is that the party be affected by the proposed activity. There are many ways to determine standing. The federal district court in *TAP v. Shaw* established standing on the part of TAP to appear in federal court and assert an interest on behalf of whooping cranes in federal court against the TCEQ commissioners, executive director and the South Texas Watermaster for their management actions regarding the allocation of surface water in the Guadalupe and San Antonio Rivers. Various testimony, arguments and fact findings relative to the standing of The Aransas Project in federal court to litigate over the impacts of water permits on the San Antonio-Aransas Bay system is attached hereto and is offered as evidence of standing in this proceeding (Excerpts in Exhibit F). The Fifth Circuit upheld TAP's standing. TAP argues that this finding on standing in federal court as well as the testimony used to support it should be relevant to this inquiry of standing before the TCEQ.

TAP is a membership organization. It includes many organizations that use the San Antonio and Aransas Bay systems, including some with property on the bay. Frankly, why the Executive Director seems to believe that ownership of property on the bay is a key criteria if the asserting party actually recreates on the bay is difficult to understand. However, there are many TAP members that meet that criteria, assuming the asserted entities do not. In support of their claim to party status, TAP offers the following members:

**Aransas County**. Aransas County is member of TAP and has property adjacent to Aransas Bay and depends upon the health of the Aransas-San Antonio- St. Charles Bay system for the strength of its tax base. If the bay is harmed and if the whooping cranes are harmed, Aransas County will suffer. Direct economic injury is considered sufficient for standing. Furthermore, the County has a district interest to protect the properties and economic interests of all its residents, many of whom own properties directly on the San Antonio Bay system. Indeed, the north-western border of the County extends to San Antonio Bay itself, includes the entire

coastline of the Aransas National Wildlife Refuge, San Jose Island, and the coastlines of Mesquite, Saint Charles, Copano, Aransas, Carlos, and Ayers Bays, all of which would be affected by this permit application. The direct testimony of County Judge Bert Mills given in federal court in 2013 for standing purposes is attached as exhibit A.

**Al and Diane Johnson, The Crane House, Rockport**. In addition to having a home where cranes can be viewed from their back porch, the Johnsons operate the Crane House that is rented during year-round, and specifically in the winter to tourists wishing to see cranes. Al and Diane's property abuts St. Charles' Bay, one of the bays that may be affected by the proposed reservoirs. As shown by the attached property map from the Aransas County Appraisal District GIS website, the Johnson's property includes and connects to portions of saltmarsh, mudflats, and open water directly connected to the Bay (Exhibit E). During high tides, water from the bay may touch the Johnsons property line. The ED claims to be "unclear" about this, but it quite clear that the Johnson's property is on St. Charles Bay, and which is a part of the San Antonio Bay system. The ED further claims that St. Charles' Bay is "unlikely to be affected" by decreased inflows. As the ED should be well aware, the S.B.3 process treated the Copano, Aransas and San Antonio Bays as a connected system along with all the lesser bays such as Hynes, and St. Charles' all fed with freshwater from four rivers. Furthermore uncontested TXBLEND modeling admitted during the *TAP v Shaw* trial (through testimony and exhibits), established that reduced inflows from the Guadalupe do in fact alter the salinity as far away as St. Charles Bay, Carlos Bay, Mesquite Bay, Ayres Bay and Espiritu Santo Bays. An example of this salinity modeling is attached as Exhibits B and C (Trungale Report). The Johnsons have a property, economic interests, to protect in this matter, as well as their environmental and aesthetic interests. The testimony of Al Johnson from federal court is attached as an exhibit D.

**Leslie "Bubba" Casterline, Casterline Fishing Company**. Casterline Fishing Company is a member of TAP and Bubba Casterline is both a county commissioner of Aransas County and the owner of Casterline Fishing Company, an oyster harvesting operation that uses the waters of the Aransas-San Antonio Bay system. In addition to his standing as an Aransas County Commissioner, Mr. Casterline and his company have a direct economic interest in freshwater inflows because the abundance of oysters is directly related to freshwater inflows. Additionally, Casterline Fishing Company has property that is adjacent to the affected bays and his boats are moored in and fish the bay system that is affected by these inflows.

**Tommy Moore, Rockport Birding and Kayak Adventures**. Tommy Moore owns an eco-tourism business that takes visitors to the Rockport area to see the whooping cranes. Mr. Moore has property adjacent to Aransas Bay and moors his boat on Aransas Bay. During the time when the whooping cranes are wintering in Aransas National Refuge, Mr. Moore makes daily trips to the designated critical habitat of the whooping crane along the Gulf Intracoastal Waterway behind Blackjack Peninsula. If this habitat is negatively impacted and cranes are killed, Mr. Moore's eco-tourism operation will be directly and negatively affected. This is an economic interest, that does not need to the combined with a property interest in order the satisfy the current law cited by the ED on who would be affected. Mr. Moore also conducts other trips into the Bays to see marine and other estuary wildlife that could be adversely affected by this permit.

**Coastal Bend Guides Association**. The Coastal Bend Guides Association is an association of fishing guides that use the waters of Aransas and San Antonio Bays for fishing. Their revenue is dependent upon a healthy bay system and good fishing. When the 23 whooping cranes died in 2013 – deaths found by Federal Judge Janet Jack to be caused by the water management actions of the Texas Commission on Environmental Quality – the fishing in the San Antonio and Aransas Bay systems was particularly bad and the guides had to trailer their boats and clients to other bay systems, if they were able to obtain clients during that time. This is an economic interest, that does not need to the combined with a property interest in order the satisfy the current law cited by the ED on who would be affected.

**Debra Copora, Aransas Bird and Nature Club**. The Executive Director rejected Ms. Corpora as having standing in her own right, a position that TAP believes is in error. Ms. Corpora uses the bay for bird-watching. She personally observes the whooping cranes and she is President of the Aransas Bird and Nature Club that leads birding tours into the bays that may be affected by this proposed reservoir. TAP re-urges that Ms. Corpora alone has standing and that the Club has standing due to its use of the San Antonio Bay.

**Jim Blackburn and Henry Hamman, Matagorda Bay Foundation**. The Matagorda Bay Foundation has a charter that extends from Matagorda Bay southward to include both Espirutu Santo and San Antonio Bays. Both San Antonio and Espiritu Santo Bays may be affected by the proposed action. Jim Blackburn is President of the Matagorda Bay Foundation and fishes, birdwatches and kayaks on San Antonio, Espiritu Santo and Aransas Bays. Mr. Blackburn lives in Houston, Texas and asserts that place of residence does not matter. The legal interest is use, not ownership. Henry Hamman is the vice-president of the Matagorda Bay Foundation and The Aransas Project and owns a home on Matagorda Bay in Port O'Conner, Texas and fishes San Antonio, Espiritu Santo and Matagorda Bays.

**George Archibald and Ann Hamilton, International Crane Foundation**. The International Crane Foundation (ICF) is a member of TAP and is an international advocate for whooping cranes. ICF conducts birding tours to the designated critical habitat of the whooping crane, conducts scientific research on the Aransas National Wildlife Refuge, including the bays potentially affected by this proposed reservoir. Mr. Archibald is the long-time leader of ICF and personally leads tours of the whooping crane designated habitat. Ms. Hamilton lives in Houston and is on the board of both ICF and TAP, and recreates on the Aransas-San Antonio Bay system, primarily through crane-watching from boats and tours led by ICF.

**David Newstead, Coastal Bend Audubon Society**. David Newstead is a warden for National Audubon Society and an officer of the Coastal Bend Audubon Society. David is a scientist who observes and studies the birds of the coastal bend area of Texas including specifically San Antonio, Carlos, Mesquite and Aransas Bays. David uses these bays professionally. Coastal Bend Audubon Society also takes tours into the San Antonio-Aransas Bay system and the designated critical habitat to see the cranes and other birds.

### B. Arguments in Federal Court Regarding Participation in TCEQ Proceedings

It is interesting to note that in the federal litigation of *TAP v. Shaw*, significant argument was presented by counsel for GBRA that TAP had the right to participate in contested case hearings before the TCEQ and therefore, the federal litigation should be dismissed because an alternative forum was available. It appears that the Executive Director does not share that position that TAP has the right to come before the TCEQ and argue about the impacts of a TCEQ permit on the interests of TAP members. By arguing against party status for TAP, the Executive Director is effectively arguing that TAP and other organizations should avail themselves of federal court rather than state administrative law processes. It would seem like in situations such as these, the state administrative law process should be available to hear the concerns of TAP and other organizations about impacts to the bay systems.

### C. Conclusion

TAP has demonstrated party status in the prior submissions in the submissions included in this response. We ask the Commissioners of the TCEQ to grant TAP party status. If the facts supporting party status or in some way unclear or incomplete, then TAP asks that, at the least, we be allowed to appear before the designated administrative law judge and present evidence in support of the claim to party status.

Respectfully submitted,

BLACKBURN CARTER, P.C.

By: /s/ *James B. Blackburn, Jr.*

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**CERTIFICATE OF SERVICE**

On this 26th day of January, 2015, a true and correct copy of the foregoing instrument was filed with the Chief Clerk of the TCEQ via the TCEQ E-Filing System and served on all persons listed on the attached mailing list by the undersigned via the method designated below.

/s/ *James B. Blackburn, Jr.*
James B. Blackburn, Jr.

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**Docket No. 2014-1658-WR; Water Right Permit 12378**

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# EXHIBIT A

IN THE UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
CORPUS CHRISTI DIVISION

| | | |
|---|---|---|
| THE ARANSAS PROJECT, | * | CIVIL ACTION |
| PLAINTIFF, | * | CA-C-10-075 |
| VS. | * | |
| BRYAN SHAW, ET AL., | * | CORPUS CHRISTI, TEXAS<br>DECEMBER 8, 2011 |
| DEFENDANT. | * | 8:35 A.M. |

* * * * * * * * * * * * * * * * * * *

TRANSCRIPT OF BENCH TRIAL - DAY 4

BEFORE THE HONORABLE JANIS GRAHAM JACK
SENIOR UNITED STATES DISTRICT JUDGE

APPEARANCES:

FOR THE PLAINTIFF: MR. JAMES B. BLACKBURN, JR.
MR. CHARLES IRVINE
MS. MARY CONNER
BLACKBURN CARTER, P.C.
4709 AUSTIN STREET
HOUSTON, TEXAS 77004

MR. DAVID A. KAHNE
LAW OFFICE OF DAVID A. KAHNE
P.O. BOX 66382
HOUSTON, TEXAS 77266

(APPEARANCES CONTINUED ON PAGE 2)

COURT RECORDER: MS. VELMA GANO

PROCEEDINGS RECORDED BY ELECTRONIC SOUND RECORDING
TRANSCRIPT PRODUCED BY TRANSCRIPTION SERVICE:
MOLLY CARTER, P. O. BOX 270203
CORPUS CHRISTI, TEXAS 78427 (361) 945-2525

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| | MR. PATRICK WAITES<br>LAW OFFICE OF PATRICK WAITES<br>P.O. BOX 402<br>BELLAIRE, TEXAS 77402-0402 |
| FOR THE STATE OFFICIAL DEFENDANTS: | MR. MATTHEW R. WILLIS<br>MR. DAVID MARSHALL COOVER, III<br>MR. JOHN R. HULME<br>OFFICE OF THE TEXAS ATTORNEY GENERAL<br>P. O. BOX 12548<br>AUSTIN, TEXAS 78711-2548 |
| FOR TEXAS CHEMICAL COUNCIL: | MR. KENNETH R. RAMIREZ<br>LAW OFFICES OF KEN RAMIREZ<br>111 CONGRESS AVENUE, 4TH FLOOR<br>AUSTIN, TEXAS 78701 |
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| FOR GUADALUPE-BLANCO RIVER AUTHORITY: | MR. EDWARD F. FERNANDES<br>MR. CHRISTOPHER H. TAYLOR<br>HUNTON & WILLIAMS, L.L.P.<br>111 CONGRESS AVENUE, SUITE 1800<br>AUSTIN, TEXAS 78701 |
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| ALSO PRESENT: | MR. TODD CHENOWETH<br>MR. BILL WEST<br>MS. SUZANNE SCOTT |

(The proceedings began at 8:35 a.m.)

(Call to Order of the Court.)

THE COURT: Sorry for the delay. Let's see. You want to start back with the witness? Y'all can be seated.

MR. BLACKBURN: Please, Your Honor. Joe Trungale, please.

THE COURT: Okay, I hate to tell you, but you need to start with the exhibit that had the three lines, the red, start over with that.

MR. BLACKBURN: The three lines with the red?

THE COURT: The black, and one of them had nothing.

MR. BLACKBURN: Right. I understand. That's a hard exhibit, and --

THE COURT: I think my mind was kind of wandering at the end of the day.

MR. BLACKBURN: Well, I understand. I was very cold and shivering over here, so it wasn't the best. But if I, may I come to that later?

THE COURT: Yes. Anyway you want to do it. I just hate to admit you have to do it again.

MR. BLACKBURN: I understand. And actually, I'm thinking that perhaps that's just too hard of an exhibit, and I might just frankly not necessarily withdraw it, but just not push it.

THE COURT: Well, what I might do, I was thinking

MR. WILLIS: We're done. Thank you.

THE COURT: Thank you, sir. You're excused.

THE WITNESS: Thank y'all very much.

THE COURT: Enjoy yourself for the rest of the week.

THE WITNESS: Thank you, ma'am.

MR. MUNDY: Plaintiffs call Judge Burt Mills, Your Honor.

THE COURT: Enjoyed hearing from you, Mr. Segovia.

THE WITNESS: Thank you, Your Honor.

BURT MILLS, PLAINTIFF'S WITNESS NO. 10, SWORN

DIRECT EXAMINATION

BY MR. MUNDY:

Q. Would you please introduce yourself to Judge Jack, sir.

A. Burt Mills, Aransas County Judge.

Q. Okay.

THE COURT: Thank you, sir.

BY MR. MUNDY:

Q. And what type of Judge are you? Let's be specific.

A. I'm not a Judicial Judge. I'm an Administrative Judge.

Q. You're elected County Judge?

A. Yes.

Q. And if you would, describe in general what your duties are as a County Judge for Aransas County.

A. I'm, well, the CEO of the county, as it were, the --

Q. Run the business, if you will, of the county?

A. I run the business, yes.
Q. And that's an elected position?
A. Yes, it is.
Q. And when were you elected?
A. This last term was January 1st of 2011.
Q. All right. If we could, Judge Mills --
THE COURT: Hold up. Only one Judge per courtroom.
MR. MUNDY: I'm sorry.
THE COURT: That's the way it goes.
MR. MUNDY: Okay.
THE WITNESS: Yes.
THE COURT: Sorry, no disrespect.
THE WITNESS: No problem.
THE COURT: Thank you.
MR. MUNDY: Of course. That was just, that's the common term so that's why I was using that. No disrespect to Your Honor, of course.
THE COURT: It's a record matter.
MR. MUNDY: Certainly. Let me readjust my mind for a second. Mr. Mills --
THE COURT: Reboot.
MR. MUNDY: Reboot. I've got to hit the reset button here.
BY MR. MUNDY:
Q. Mr. Mills, with all due respect to your position, but we

will refer to you as Mr. Mills, sir.
A. No problem.
THE COURT: I've asked them to do that.
MR. MUNDY: Yes, sir.
THE WITNESS: I was Mr. Mills a long time before I was anything else.
MR. MUNDY: Understood.
THE COURT: It's not part of our name, is it?
THE WITNESS: No.
BY MR. MUNDY:
Q. Anyway, that's an elected position, and you're currently holding office?
A. Yes.
Q. Okay. And you're here today with the authorization and on behalf of the County --
A. Yes.
Q. -- as their, the official representative of Aransas County?
A. Yes, sir.
MR. MUNDY: And Your Honor, he will be appearing as a 30(b)(6) witness on behalf of Aransas County, and then I think also offering individual testimony to blend both, but he is a 30(b)(6) authorized witness of Aransas County.
BY MR. MUNDY:
Q. And I should ask, you have received the express

authorization of Aransas County to appear here today and give testimony on behalf of the county government and residents. Is that correct, sir?

A. Yes, I have.

Q. How long have you, yourself, lived in Aransas County? If you will tell Judge Jack a little bit about your background, where you grew up.

A. Well, on my mother's side of the family, I'm the sixth generation in Aransas County. I grew up in Lamar Peninsula, 19 years, so I've been there a while. My family's been there a while.

Q. When did your family settle in that area?

A. My mother's side of the family settled in 1842. My father's in the late '20s, I believe.

Q. 1920s?

A. 1920.

Q. And I know a little bit about an interesting background. When you were a boy growing up, where did you go to school?

A. I went to school in Rockport.

Q. Okay. Then how did you get to school every day?

A. Well, the story last night was by boat, but that was my father.

Q. Okay. Excuse me. So how did he go to school when he was a boy? How did he make the trip?

A. The kids went by boat, and then by car into town.

Q. Okay. So they get from the house, drive to the edge of the water --
A. And get on a boat if the weather was permitting, they'd go across and go to school. And if weather wasn't permitting, they had to stay in town with friends, couldn't go home.
Q. That wasn't that long ago history.
A. That wasn't that long ago.
Q. You, yourself, grew up in Aransas County?
A. Yes.
Q. And as a young man, once you finished school, did you serve the country?
A. Yes, I did.
Q. What branch of the military were you in?
A. Air Force.
Q. And what, if you would, tell us about your service to the country.
A. Well, I spent some time in South Dakota, didn't like it. So the only way to get out of there was to go to Vietnam, so I spent a year in Vietnam.
Q. When did you serve in Vietnam, sir?
A. 1968.
Q. And I think you had the not opportune timing. When did you arrive in Vietnam?
A. Twenty-two days before the Tet Offensive of '68.
Q. And were you actually -- no disrespect to any of the

fellows in the Air Force whatsoever, but some folks were on the base and never leave. Tell us a little bit about your own personal experience.

A. I was assigned to Da Nang Air Force Base, but I volunteered for an off base ammo storage point for security, and that was the wrong move.

Q. And then Tet Offensive happened?

A. Yes.

Q. The, what was it like, just briefly. Give us just a few moments of what it was like to be actually out on the line.

A. Well, you didn't know where your friends were, except if they were within sight. Nights were the scariest, but it was an experience that I won't forget.

Q. How long were y'all under direct assault?

A. At one time it was eight days.

Q. You came back to, came back -- finished your tour and came back. Where did you return to?

A. I returned to Rockport. Well, actually, when I left -- when I left Vietnam, I went to Athens, Greece, for two-and-a-half years.

Q. Okay.

A. And then I came home.

Q. All right. And when you returned to Rockport, tell us a little bit about what you did for a living and your life.

A. I went into business. I bought my father's partner out of

a restaurant there in Rockport.
Q. Well-known restaurant in Rockport. What's the name of it?
A. Duck Inn.
Q. Okay. How long --
THE COURT: Oh, that's really good.
BY MR. MUNDY:
Q. My personal experience, particularly loved the stuffed flounder, so I don't --
A. Yeah.
Q. Did you come up with the recipe or inherit it?
A. No, that was Mr., or actually it was Mrs. Duck's recipe. That's how it got its name, Mr. and Mrs. Charlie Duck.
Q. So that was their real name?
A. Right.
Q. I never knew that. Anyway, you were the owner and ran that business for how long, sir?
A. Thirty-eight years.
Q. And now explain to us how you came to be involved in politics and an elected official. A big jump from running the Duck Inn to where you are now running the County.
A. Yes, sir. My oldest son --
THE COURT: Well, you know, I don't think it is a big jump.
MR. MUNDY: Well --
THE COURT: I mean, from customer service to --

MR. MUNDY: Well, I --

THE COURT: -- responding to the needs of the people.

MR. MUNDY: Absolutely.

THE WITNESS: That's true. My oldest son, when he was nine years old, informed me that he wanted to go into the Air Force Academy. I said, "Okay." And how do you do that? I checked around with several different people, and I was told I needed to get involved in politics so I'd meet some people that knew some people. So consequently, I ran for City Council and then for Mayor and served in that position for eight years.

THE COURT: Did he go to the Air Force Academy?

THE WITNESS: Pardon me?

THE COURT: Did he go to the Air Force Academy?

THE WITNESS: Yes, he did, with a lot of help from a lot of good friends.

THE COURT: That's really great.

THE WITNESS: And now he's stationed in Del Rio.

MR. MUNDY: Well, that's --

THE COURT: And getting ready to retire, unlike me.

BY MR. MUNDY:

Q. So that seems to be a recurring theme in this trial, people never quite make it out of retirement here. But we thank you for being here, sir.

Now, if you would, I'd like to focus. What is your earliest memory of the whooping cranes growing up as a boy?

A. Oh, living in Lamar, the whooping cranes were a big part of our life, because they were so close and the wildlife refuge was so close. I remember when I was six or seven years old, which was a few years ago.

Q. Now, the -- when you were a young boy and a young man, how common was it to see a whooping crane?

A. They were very scarce. Some years you could go without seeing any, unless you were a real whooping crane enthusiast and went looking into the brush for them. But they were very scarce, not very many of them.

Q. And then we've heard from some of the Whooping Crane Recovery Team members, Dr. Chavez, Dr. Archibald and others about how they've been quite successful in more recent decades. And if you would, from your time running the restaurant, when did you take over the Duck Inn?

A. 1971.

Q. Okay. From your time, personal observations, personal experience running that from 1971 till -- when did, when did you --

A. Six months after I was elected to office the first time --

Q. Until relatively recently?

A. 2007.

Q. I'm trying to do the math. 2007, then you took on your current duties. From your experience from 1971 till 2007, what was your experience about people coming to your restaurant who

were, if you will, whooping crane tourists?
A. Well, from the beginning --
Q. Did you ever have any?
A. From the beginning, the whooping cranes have always been a tourist draw for Aransas County. And over the years, the more whooping cranes that were coming down, the more tourists would come to Rockport and Aransas County to see the whooping cranes.
Q. And if you would, explain to Judge Jack how the whooping cranes, the tourists for the whooping cranes, how they filled the role seasonally, say, that winter season, the importance of those tourists in the winter season, compared to, say, the summer tourism draws for Aransas, the businesses.
A. Well, every year, when I first went into business, you could tell -- after the summer was over, you could tell there was a big lull until the whooping cranes got there. And then business picked up, because people would come to Aransas County for the whooping cranes.
Q. Okay. And were it not for the whooping cranes, there's no other particular winter draw for the tourists?
A. Duck hunting, goose hunting, but that's a draw, but I think the whooping cranes out do anything else.
Q. And through the years, the whooping crane tourism is a winter draw? Is that --
A. Yes.
Q. I think you just said that's continued to increase.

A. Yes. Every year it gets better.
Q. And how, if you will, how does the, the having, being the host of the whooping cranes, if you will, how does that affect the community's self-image? How important is it to that community, its self-awareness of the cranes or the importance of the cranes?
A. People from all over the world come to Aransas County to view the whooping cranes and learn about them. When I was in business, Japanese, Chinese, Europeans, even some Russians come by every once in a while, from everywhere. England, a lot of people from England come in, Canada, South America.
Q. And understanding -- your job is understanding the business of the County, running the business of the County. Do y'all have -- obviously, what's your tax rate on sales in the County? What's the sales tax rate for the County?
A. Sales tax rate for -- now, you got me on that one.
Q. 1 percent?
A. It's 1 percent, yeah, for the sales tax.
Q. Okay. Then obviously have other tax mechanisms, property taxes --
A. Right.
Q. -- and things like that. Has the -- the importance of tourism, how -- well, let me step back one step. Back in the '70s and '80s, there used to be ship building business in the Rockport area generally. Correct?

A. Yes.
Q. And are those still there?
A. No. I believe our main industry right now is tourism.
Q. Okay. And how, if you can, I don't know if there's a specific way to measure, but just quantitatively, your own personal observation, how important is the crane-driven and related tourism as compared to other components in the winter season?
A. I believe the cranes bring in around 5 to $6 million a year in tourism dollars.
Q. Okay. In direct spent dollars?
A. Uh-huh.
Q. Is that a --
A. Yes.
Q. I see you nodding your head.
A. Yes.
Q. You have to speak up.
A. Yes, I'm sorry.
Q. That's all right. And then the County directs, obviously directly receives a benefit from the sales tax of that. But those dollars also have a multiplier effect as they're redirected through the community?
A. Oh, certainly.
Q. What type -- when those tourists come to visit, the whooping crane tourists come to visit, obviously they pay to go

on a tour boat. Is that right?
A. That's right.
Q. What other types of businesses do they spend their dollars in when they come to visit Aransas?
A. Hotels, restaurants, all the shops downtown, grocery stores, fishing boats. They go, you know, find other things to do besides just looking at whooping cranes.
Q. Okay.
A. They stay a while. In the winter time, they stay a while.
Q. And the Chamber of Commerce and the U.S. Fish and Wildlife have done studies trying to determine the number of visitors they believe come each year to see the cranes?
A. Right.
Q. And how, what's the estimate that you've --
A. 70 to 80,000.
Q. Per year?
A. Per year.
Q. And the direct dollars, the initial dollars spent is how much?
A. Well, they say it's about $97.2 million a year. I think it's more.
THE COURT: What do you mean, the spin off of the --
THE WITNESS: The tourist dollar.
THE COURT: Sorry, the direct is 5 to 6 million?
THE WITNESS: For the whooping cranes, yes.

THE COURT: For the whooping cranes.

THE WITNESS: Correct.

THE COURT: But --

THE WITNESS: For the 1 percent sales tax for the year.

THE COURT: Oh, just for the sales tax. I'm sorry.

MR. MUNDY: And Your Honor, for the record, there is a -- he has done a declaration, if you need it, that captures the facts and figures. I believe it is Document Number 213 in the Court's files.

THE COURT: That's been admitted?

MR. MUNDY: It's not been admitted, but he did it initially as a declaration, was filed. But so I would --

THE COURT: But that's not part of -- it's okay. I can look at it. If you want to reoffer it --

MR. MUNDY: We will do that. I'd ask the Court take judicial notice of it at this time if you need it. I'm just giving it to you as a reference. I'm giving all the facts and figures now, but --

THE COURT: Got it. Thank you. Go ahead. I won't interrupt on that.

BY MR. MUNDY:

Q. Anyway, so it's 70 to 80,000 visitors annually that are estimated to come see the cranes for that specific purpose?

A. Yes.

Q. And their initial direct dollar expenditures are 5 to 6 million?
A. Yes.
THE COURT: In sales tax?
THE WITNESS: No.
MR. MUNDY: Of dollars spent.
THE WITNESS: Dollars spent.
BY MR. MUNDY:
Q. In the community, dollars spent --
A. Yes.
Q. -- from those whooping crane tourists is estimated to be 5 to 6 million?
A. Yes, sir.
Q. Those dollars then have a multiplier. They get respent. Like say if they go to an art gallery, buy something, the art gallery owner buys groceries, the art gallery owner buys property. They continue to have a multiplier effect through the community?
A. Yes.
Q. Okay.
THE COURT: And that is the 95 million?
THE WITNESS: Yes.
BY MR. MUNDY:
Q. The 97 million --
A. 97.

Q. -- is total tourism dollars spent annually, the current estimate by the Chamber of Commerce.
A. Yes.
Q. Okay. But you have a feeling that's an underestimate?
A. I believe it's an underestimate.
Q. The county has a direct sales tax of 1 percent?
A. Yes.
Q. Do you believe, in your observation and experience living in that community, that the marquis bird, if you will, the whooping cranes, add to the, or enhance property values, such as for vacation homes?
A. Most definitely.
Q. And a comparable small community immediately next up the coast I think probably would be Port O'Connor would be the next?
A. Yes.
Q. How do property values in number, just sheer number of vacation homes compare in Rockport, say, to Port O'Connor?
A. I don't know the numbers, but I can tell you that, well, one subdivision in Aransas County is 35 percent of our tax base.
THE COURT: Is that -- Rockport is in Aransas County?
THE WITNESS: Yes.
THE COURT: Okay. And that's what you're talking about?

THE WITNESS: Yes, ma'am.
THE COURT: What's that community called on the canals?
MR. MUNDY: Key Allegro.
THE WITNESS: Key Allegro.
THE COURT: That's the one you're talking about. Right?
THE WITNESS: That's the one I'm talking about.
THE COURT: Okay.
BY MR. MUNDY:
Q. That's primarily a vacation home community?
THE COURT: They're second homes.
THE WITNESS: Second homes, yes.
MR. MUNDY: Second homes.
BY MR. MUNDY:
Q. But the importance of the perception of high quality environment, high quality community is what helps attract that type of property owner or buyer, if you will?
A. I believe so, yes.
Q. Okay. And those second homes, that marquis community, the Key Allegro community, very important driver in property tax revenues to the county?
A. Very important.
Q. You said it was, what, 35 percent, I think, of the annual --

A. Of the tax base.
Q. I'm sorry, sir?
A. Of the tax base, yes.
Q. Okay. Now, I'm just looking through my notes. I'm just checking my notes here briefly, sir.
Looking here, I think there's been an estimate from the County, is it correct, that for each $100 in tax revenue in Aransas County, that $26 comes from the tourist --
A. Yes.
Q. -- from the tourism dollars?
A. Yes, sir.
Q. Okay. So roughly 26 percent is directly from the tourism dollars spent, is your understanding?
A. That's what we estimate, yes.
Q. Okay. Now, just to kind of connect the dots, Aransas County, the official governmental entity of Aransas County, has joined The Aransas Project, who is the named party bringing the case. Is that your understanding?
A. That's true.
Q. And y'all, as the Commissioners, voted and approved?
A. We did that, yes, unanimously.
Q. And you understood at the time that you would be participating in an effort which would culminate in this effort in this case?
A. Yes, we did.

Q. Okay. And that was expressly authorized, and you're here today with that understanding and in that official capacity?
A. Yes, sir.
MR. MUNDY: Thank you very much for your service and your time here today, sir.
THE WITNESS: Thank you.
THE COURT: It was good to meet you.
THE WITNESS: Good to meet you.
THE COURT: Ms. Snapka?
MS. SNAPKA: Yes, Your Honor.

CROSS-EXAMINATION

BY MS. SNAPKA:
Q. Good morning, Mr. Mills.
A. Good morning.
Q. You told us that you grew up at Lamar Peninsula. Is that correct?
A. Yes.
Q. All right. And I'm going to make a guess. That was in the '50s? Or '60s?
A. Yes.
Q. Okay.
A. You did real good.
MR. MUNDY: I think I ought to be objecting right about now.
THE COURT: We're both of a certain age apparently.

BY MS. SNAPKA:

Q. When you grew up in Lamar, you participated in a lot of the things that you could enjoy out there, like fishing. Is that right?

A. Fishing and hunting, yes.

Q. Did you do any crabbing?

A. Yes.

Q. A lot of people did crabbing back in those days, didn't they?

A. Yes.

Q. The crabbing pretty much continued by folks in the area up until recently, didn't it?

A. Yes.

Q. Just last year I think it was, there was a decision made to strictly enforce the crabbing, the illegal crabbing that was going on in the refuge. Is that right?

A. Yes, it is.

Q. We heard some testimony about that yesterday. Up until then, the residents, the locals that were used to going out there and crabbing were pretty much continuing to crab unabated. Right?

A. I believe so, yes.

Q. The, and just briefly, because I'm trying to remember growing up here. The Key Allegro subdivision actually was developed in the late '50s. Am I correct about that?

A. You're right.

THE COURT: Is that right? I didn't know it was that old.

BY MS. SNAPKA:

Q. It is a fairly, if I'm correct, Mr. Mills, it's --

A. Actually, I believe it started in -- well, late '50s, 1960 actually.

Q. Right. It, I think the plans for development of Key Allegro were sort of drawn up in the late '50s --

A. Uh-huh.

Q. -- as an upper scale retirement community or a second home community. Is that your understanding?

A. Yes.

Q. All right. And at that time the draw was not, for development of Key Allegro, was not necessarily whooping cranes when it was developed and populated by those folks, was it?

A. Probably not. It was developed for second homes.

Q. Right. It was developed for people who wanted to, to winter on the coast and to enjoy the coastal area. Correct?

A. Right.

THE COURT: Wouldn't that be part of it?

BY MS. SNAPKA:

Q. Mr. Mills, back in the late --

THE COURT: Not just the boat parties up and down the canals, but --

MS. SNAPKA: That's right.
THE COURT: -- the whooping crane?
MS. SNAPKA: Well, my point is, he was talking about Key Allegro.
THE COURT: Yeah.
MS. SNAPKA: And when Key Allegro was developed, the number of whooping cranes was actually only in the, I think, twenties or thirties at that point.
THE WITNESS: I don't remember how many in the '50s.
THE COURT: Does anybody remember? Does that sound right?
MS. SNAPKA: We have those numbers.
THE COURT: I know it's in the exhibits, but --
MR. BLACKBURN: It's in the exhibits. We think it's more in the neighborhood of forties or so.
THE COURT: Well, whatever.
MS. SNAPKA: Whatever it is.
BY MS. SNAPKA:
Q. In other words, whooping crane tourism was not, was not the purpose for the development of Key Allegro. Correct?
A. No. You're right.
Q. Now, when you purchased the, and started to run the Duck Inn, that was in, you said, 1971?
A. Yes.
Q. All right. And you noticed that people were coming in.

Is that correct?
A. Yes, I did.
Q. To see the whooping cranes? At that time in 19, in the early '70s, I think the whooping crane population was in about the fifties. Is that right?
A. Got me again.
Q. Okay. If that's what the record shows it is, you have no reason to disagree with that, do you, sir?
A. No.
Q. Okay. And I think your testimony was, is that the whooping crane tourism, even in the fifties, at the population of the fifties, there were people coming to see the whooping cranes. Is that right?
A. Yes, they were.
Q. And has Aransas County, to your knowledge, done marketing to try to broadcast more about the whooping cranes?
A. Aransas County itself? No. But in conjunction with Chamber of Commerce, most definitely.
Q. All right. And every year that you're aware of, the whooping crane tourism has increased. Is that correct?
A. Yes.
Q. Are you able to quantify for this Court how much there would be a, some sort of a financial harm if the whooping crane numbers were to drop?
A. As the whooping crane numbers were going up, the tourism

and the bird watchers, whooping crane watchers went up. So I'm saying if it went down, that would probably happen also.

Q. Are you able to quantify for this Court how much it would be?

A. No.

Q. You're just assuming it would be a, if it goes down, there would be a general trend down. Is that correct?

A. Right.

Q. Are you expecting that to happen any time soon?

A. It could very well happen, with what's going on right now.

Q. I understand that there's always a concern. Do you have a reasonable expectation of it happening very soon?

A. Personally?

Q. Yes.

A. No.

Q. No? Is that your testimony?

A. Yes.

Q. As the chief executive officer of Aransas County, I understand that, that you've stated that Aransas County voted to become a member of TAP. Is that correct?

A. Yes.

Q. Who invited Aransas County to become a member of TAP?

A. Who invited?

Q. Yes. How did Aransas County become aware of TAP's existence and purpose?

A. One of the Commissioners brought it to our attention, and we, we discussed it in Commissioner's Court and voted on it.
Q. Which Commissioner was that?
A. Charles Smith.
Q. How much in dues did Aransas County pay to TAP?
A. Nothing.
Q. Has Aransas County made any contribution to TAP?
A. No.
Q. Voluntary contribution?
MR. MUNDY: Well, can we have this clarified as financial, as opposed to -- for example, his time here today is a contribution.
MS. SNAPKA: Oh, and I --
BY MS. SNAPKA:
Q. Please, Mr. Mills, I understand that your time is very valuable, and I want to try to move this along. But what I'm saying is Aransas County has made no financial contribution, either in the way of dues or just giving money to TAP. Is that correct?
A. That's correct.
MS. SNAPKA: I'll pass the witness, Your Honor.
THE COURT: Thank you.

REDIRECT EXAMINATION

BY MR. MUNDY:
Q. Just very, very briefly, sir. Just explain, if the cranes

were dying due to a decline in the health of the bay overall, how does that affect businesses and economies and the perception?

A. Dramatically.

Q. Would you please explain that to Judge Jack?

THE COURT: I think I've got it.

MR. MUNDY: Okay. We'll leave it at that.

THE WITNESS: Well --

MR. MUNDY: Thank you.

THE WITNESS: -- the bays are very important to, to our area. And without clean water and getting the salinity right, everything's cratering. I mean, not only the whooping cranes, the fishing, hunting, everything. Shrimping. Shrimping's already gone. Oystering is gone this year. So yes, it's very important. And yes, the whooping cranes are important, but the clean water is even more important.

BY MR. MUNDY:

Q. Is it fair to say it goes to the existence of your community?

A. Of the whooping cranes -- yes.

Q. Thank you, sir.

A. You're welcome.

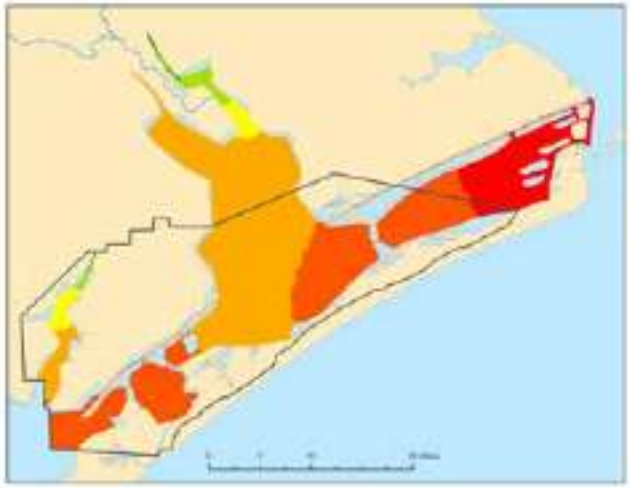
MR. MUNDY: May he be excused, Your Honor?

THE COURT: Again, thank you very much, sir.

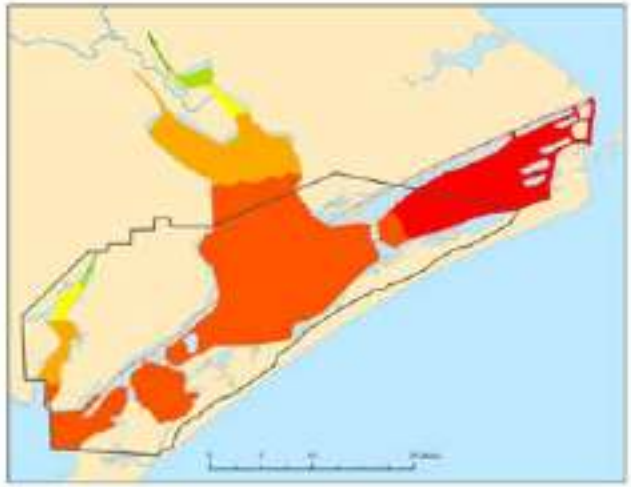
THE WITNESS: Thank you.

# EXHIBIT B

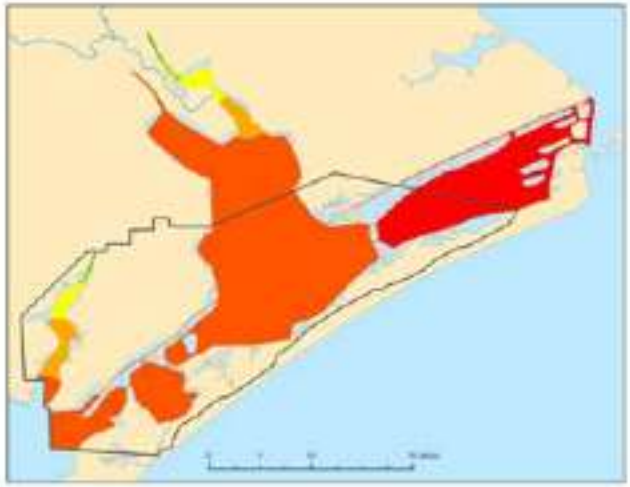
# December 2008



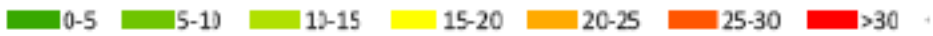
What flow would have been
if diversions were passed



Actual historical inflows
(includes effects of existing diversions)



What flows might be assuming
full use of select permits.




Salinity in PSU

# EXHIBIT C

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF TEXAS
CORPUS CHRISTI DIVISION

| | | |
|---|---|---|
| THE ARANSAS PROJECT, | § | |
| *Plaintiff*, | § | |
| | § | |
| v. | § | |
| | § | CIVIL ACTION NO. 2:10-cv-00075 |
| BRYAN SHAW, ET AL., | § | |
| *Defendants.* | § | |

**AMENDED REPORT OF PLAINTIFF'S EXPERT, JOE TRUNGALE (SEPTEMBER 14, 2011)**


**Joseph F. Trungale P.E.**

# Effect of Diversions from the Guadalupe San Antonio River Basins on San Antonio Bay

Prepared for:

The Aransas Project

Prepared By:

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August 1, 2011
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Trungale Engineering and Science (TES) is pleased to present this report analyzing the effects of water diversions from the Guadalupe-San Antonio (GSA) River Basins on San Antonio Bay. TES has a long history of evaluating the freshwater inflows necessarily to protect a sound environment in Texas bays and estuaries. Mr. Trungale has severed on numerous technical committees related to the issue of freshwater inflow to bays and estuaries including the Bay and Basin Expert Science Teams (BBESTs) for the Trinity-San Jacinto and Colorado-Lavaca River Basins. He is an expert in the use of hydrodynamic models to evaluate habitat conditions in riverine and estuarine systems and he developed salinity zonation analysis for the Trinity-San Jacinto BBEST that was the basis the BBEST freshwater inflow recommendation for Galveston Bay. For the present study, he used the official models of the state including the Texas Commission on Environmental Quality's (TCEQ) Water Availability Model (WAM) for the Guadalupe and San Antonio River Basins and the Texas Water Development Board's (TWDB) bay circulation and salinity model (TxBLEND). He used freshwater inflow datasets from the TWDB and the GSA BBEST and water use datasets from the TCEQ WAM and the South Texas Water Master. Literature reviewed as part of this study is included in the references section at the end of this report. For this work Mr. Trungale was compensated at an hourly rate of $150. In the last four years Mr. Trungale has provided expert testimony in three other legal proceedings related to flows and environmental health. These are described in his curriculum vitae attached as Exhibit A.

**INTRODUCTION**

This report presents an analysis of the effects that surface water diversions from the Guadalupe and San Antonio River Basins have on the freshwater inflows to San Antonio Bay. Freshwater inflows are the primary driver of estuarine salinity distributions. Based on this analysis, I conclude that historical diversions have had – and will have – a significant impact on estuarine salinity in San Antonio Bay. These diversions have caused freshwater inflows into San Antonio Bay to be lower which has resulted in an increase in the severity, frequency and duration of "man-made" drought conditions. Freshwater inflows that have been lowered by surface water diversion on these rivers have produced salinity conditions in this bay that are significantly higher than the preferred salinity range of some species including the Blue Crab, a primary food source for the Federally Endangered whooping crane. At Aransas National Wildlife Refuge (NWR) and throughout the central Texas coast, decreases in freshwater inflows from water diversions and reservoir construction add to the following threats: reduction in available main food items at Aransas NWR, the blue crab (*Calinectes sapidus*) and wolfberry (*Lycium carolinianum*) [and] Increased intervals when winter marsh salinities exceed the threshold of 23 parts per thousand (ppt) thereby decreasing the availability of fresh drinking water for the cranes. (CWS and USFWS 2005, USFWS 2009)

This report assesses effects of river water management on freshwater inflows into San Antonio Bay. It does this by calculating freshwater inflows into San Antonio Bay that would have occurred if water that was diverted had been, instead, passed to the bay. Actual freshwater inflows reflect data from the Texas Water Development Board (TWDB). Adjustments to the actual freshwater inflow records were made to reflect the effect of upstream diversions. Records of historical diversions were obtained from the TCEQ South Texas Water Master, these diversions were assigned to geographic locations within the basins where the water was diverted, and channel delivery factors provided in the Texas Commission on Water Quality's (TCEQ) Water Availability Model (WAM) were applied to correct for channel losses occurring between diversion locations and San Antonio Bay. This data was used to calculate what freshwater inflows would have been without the diversions. Another set of inflows were calculated to estimate the freshwater inflows assuming additional diversions of some water that has been permitted but for which the full exercise of the right has not yet occurred.

Freshwater inflow estimates for these three scenarios were compared to target inflows recommended by Texas Parks and Wildlife Department (TPWD). The TPWD's Freshwater Inflow Needs Studies (FINS) determined that a minimum flow of approximately 1.15 million acre feet per year, with an appropriate monthly distribution, is necessary to protect the health of the San Antonio Bay ecosystem. FINS recognizes that, even under naturally occurring conditions (with no diversions), periods of drought result in periods when these target flows are not satisfied, and recognizes that diversions can create even greater problems. Thus the report states: "a major concern of the TPWD is that any exacerbated increase in the severity, frequency, or duration of drought flows will alter the ecosystem structure by either reducing overall fisheries production or by favoring one fisheries species production at the expense of others, thereby reducing biodiversity." (Pulich et al. 1998)

My report explains how existing water management indeed has resulted in a significant increase in the severity, frequency and duration of these "manmade" drought conditions compared to the freshwater inflows that would occur if the water that is currently diverted were passed to the bay. As discussed below, these drought conditions manifest in significantly increased bay salinity.

The primary tool used to conduct the bay salinity analysis that is presented in this report is a two-dimensional finite-element salinity and circulation model called TxBLEND, created by the TWDB. (TWDB, 1992) TxBLEND is used to simulate estuarine salinity response to hydro-climatic conditions; primarily freshwater inflows. These simulations demonstrate that flows that have been altered by historical diversions produce significantly higher salinity conditions in the bay and, by comparison to what salinity would be without the diversions, produce less suitable habitat conditions for some of the primary food sources for the whooping crane (e.g. Blue Crab) and water unsuitable for drinking by the whooping cranes in areas adjacent to its winter territories. The current management of water resources in the Guadalupe and San Antonio Basin therefore represents a clear threat to the long term viability of this species as well as the overall health of the bay ecosystem.

Based on this analysis, I conclude that historical diversions have resulted in an increase in the severity, duration and frequency of manmade drought conditions over the long term and in unacceptably high salinity conditions during naturally low inflow periods.

Opinions

1. Inflows from the Guadalupe and San Antonio River basins are the most important factor determining salinity in the San Antonio Bay.
2. The TxBLEND model used in this study represents the best available science and is the official model developed by the state of Texas for the purpose of simulating salinities in Texas Bays.
3. TxBLEND inflow data for the Guadalupe available from the Texas Water Development Board and alternative set prepared by HDR for the GSA BBEST produce almost identical results; the analysis presented in this report is based on the TWDB dataset.
4. Water diversions from the Guadalupe and San Antonio River Basins have a significant impact on salinity conditions in San Antonio Bay.
5. Cumulative Salinity Departure approach developed for the LCRA permit 5731 is a method that could be employed to protect the health of San Antonio Bay.

## 1. Data and Methods

### *1.1. TxBLEND Salinity Model*

This report relies on the best available data and analysis tools to predict the salinity response to freshwater inflows in San Antonio Bay. The primary tool is a computer model developed by the TWDB to simulate water circulation and calculate salinity conditions in Texas estuaries (TWDB 1992). The model, called TxBLEND, is a finite element model which employs triangular elements and simulates hydrodynamics and transport in two dimensions (circulation and salinity distributions of vertical-mean parameters in the horizontal plane). Water circulation is simulated by solving the continuity equations and the momentum equation, jointly referred to as the shallow water equations. Salinity condition is calculated by solving the mass transport equation or the convective-diffusion equations.

The input data to the model consists of two parts. The first part includes the static physical properties including estuarine bathymetry, boundary conditions, and transport parameters such as dispersion and roughness coefficients. The second part includes the dynamic data (which changes with time) including river inflows, tides, wind, evaporation and precipitation. The model calculates salinity throughout the bay on a 30 minute time step and produces spatially explicit results at each node in the model domain. In this study these results are summarized as daily or monthly average values.

TxBLEND was originally developed in the early 1990s in response to mandates from the Texas Legislature (Senate Bill 137 (1975), House Bill 2 (1985) and Senate Bill 683 (1987)). A goal of these legislative initiatives was to determine the freshwater inflow needs necessary to maintain a sound ecological environment for Texas bays and estuaries. Over the years an approach has been developed that is now commonly referred to as the "State Methodology". Among the most important features of this approach has been the collection of perhaps the most comprehensive estuarine monitoring program ever created and the creation of a suite of modeling and analysis tools (TWDB 1990, TWDB 1992), including the TxBLEND model, to support development of freshwater inflow recommendations. The primary function of this model has been to compare salinity gradients predicted by the FINS recommended inflows with species abundance maps to verify that the salinity gradients produce by the FINS flows are consistent with the salinity preferences of these indicator species. The TWDB has now developed, calibrated, and applied the TxBLEND model for all of the major estuaries in Texas, including the estuary of San Antonio Bay. I have used that calibrated, validated computer model for this report.

While most of the literature on estuarine science continues to recognize the importance of freshwater inflow to estuarine health, development of simple regression equations that directly relate flows to biology, a fundamental component of the state methodology, has proven an elusive goal. This is perhaps not surprising given the complexity of the system, the relative paucity of the data (even in Texas where this data is more abundant than anywhere else in the world) and the simplicity of the statistical formulations that have been developed up to this time. Recent attempts to relate specific components of the inflow regime (e.g. spring freshets and or summer low flows) hold some promise for uncovering these relationships; however these approaches have thus far proven unsuccessful. Much of the recent literature on the management of flows to protect a sound environment, while recognizing the need to better explain direct causal relationships, has focused on more holistic approaches to protect ecosystems (Poff et al. 1997, Bunn and Arthington 2002). This has led to a focus on habitats, which in estuaries are significantly influenced by salinity conditions (BIO-WEST 2007).

Alber (2002) presents a conceptual model for estuarine freshwater inflow management that is summarized in Figure 1.

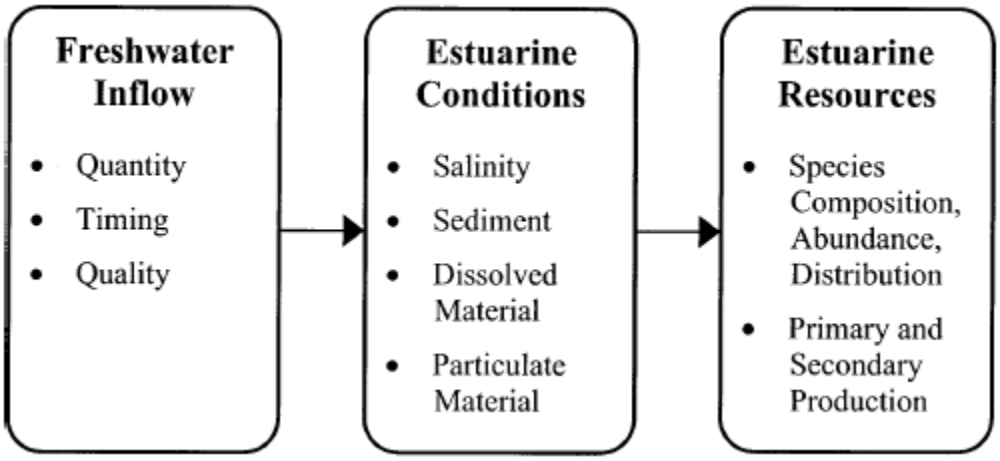



**Figure 1 Schematic diagram of the effects of freshwater inflow (from Alber 2002)**

The most recent legislative initiative in Texas related to freshwater inflows (Senate Bill 3, 2007) established the Texas Science Advisory Committee (SAC) for Environmental Flows. The SAC has produced a guidance document for the determination of freshwater inflows for Texas bays and estuaries. (SAC 2009). Acknowledging a range of approaches, the SAC recommended an approach that is between the simple flow-productivity model employed in earlier studies and the complexity of a more complete model. (SAC 2009) Figure 2 shows the SAC's inflow-salinity-biology paradigm.

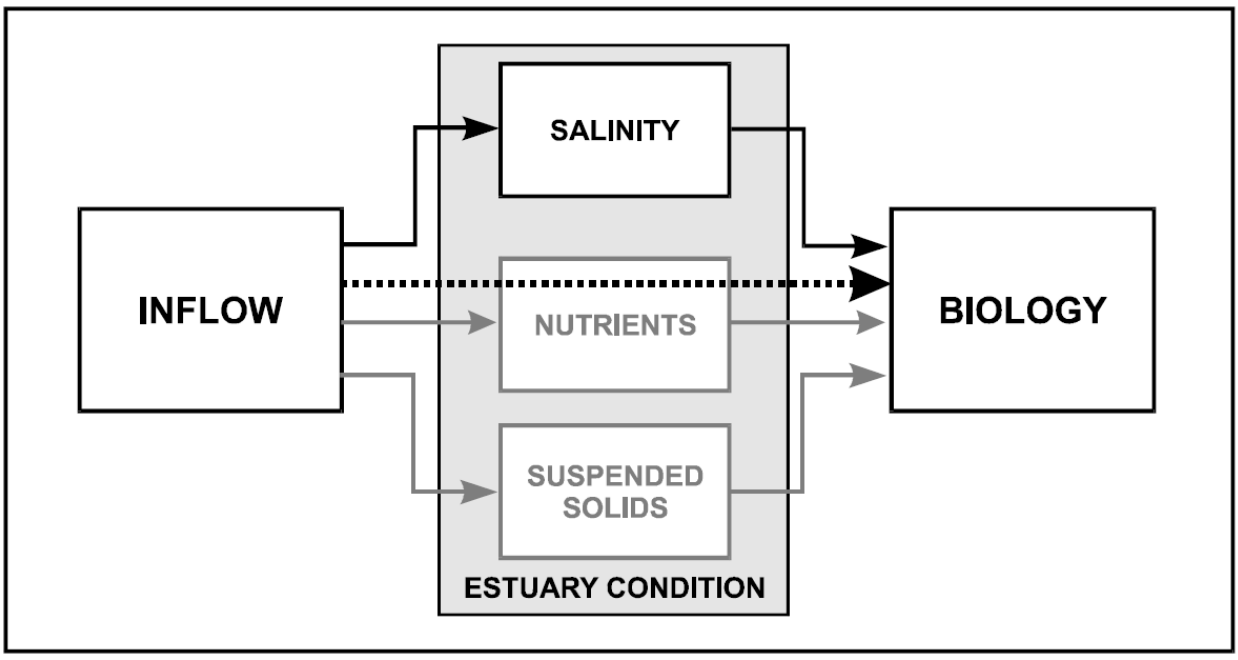



**Figure 2 Schematic of Relation of "Biology" to "Inflow" (from SAC 2009)**

This inflow-salinity-biology paradigm was employed by the Senate Bill 3 Bay and Basin Science Teams (BBEST) working on the Galveston Bay system (TSJ BBEST 2009) and the San Antonio Bay system (GSA BBEST 2010). These two groups employed approaches similar to the approach that is presented in this study. In support of both of those efforts the TWDB produced reports documenting the calibration and validation of the TxBLEND models for these bays (TWDB 2010a, 2010b).

The version of TxBLEND that is used for San Antonio Bay is referred to as the five bay model, because it is also used for Mission-Aransas and Copano Bays and includes the Matagorda and Nueces bays though the latter two are included primarily to define boundary conditions. Figure 3 shows the triangular elements that make up the five bay model. The green dots in Figure 3 show the locations (nodes) of the freshwater inflows used in the model. The only value that has been changed as part of the analysis conducted in this study was the estimate of freshwater inflow at the Guadalupe inflow node. This was adjusted for the simulations to evaluate the effect of diversions from the Guadalupe and San Antonio River basins (discussed in detail in section 1.5). The results of these simulations were then compared with results produced by official TWDB version of the model which includes recent historical diversions. Other than to calculate what would be the inflows from the Guadalupe without diversions and with some increased diversions, no adjustments have been made to the official calibrated and validated model developed by the TWDB.

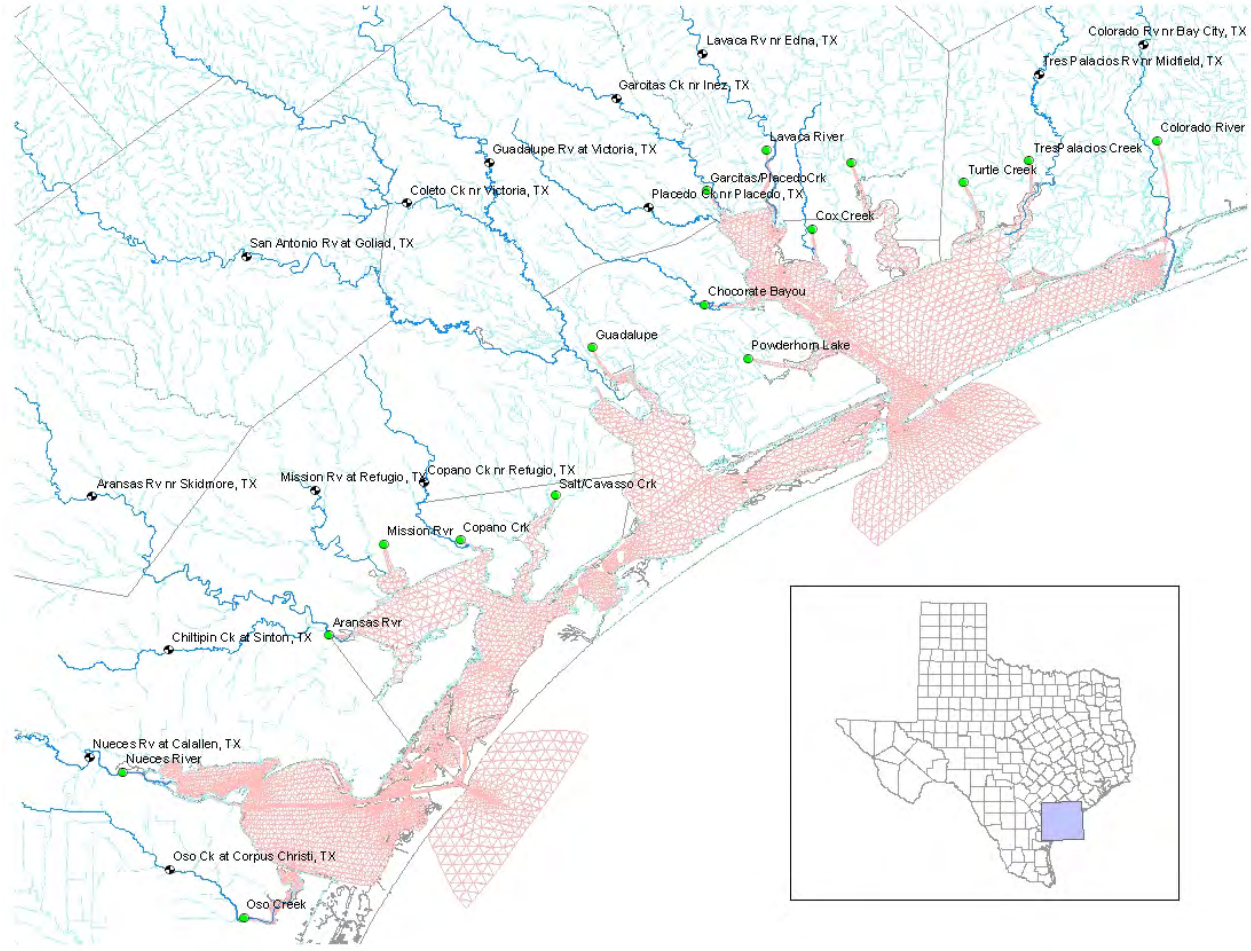



**Figure 3 TxBLEND Five Bay model**

### *1.2. Inflow dataset*

Coastal estuaries are very complex systems which respond to a variety of inputs chief among these is freshwater inflow; often referred to as the master variable. Freshwater inflow plays important roles in maintaining estuarine health by creating and preserving low salinity nurseries, transporting sediments, nutrients and organic matter downstream, and affecting estuarine movements and reproductive timing

(Longley 1994, Montagna et al. 2002: SAC 2004, SAC 2009). The coastal hydrology program at the TWDB provides estimates of historical freshwater inflows into Texas bays and estuaries to support environmental and water planning studies. The earliest freshwater inflow estimates were compiled in a series of reports published by the Texas Department of Water Resources between 1980 and 1983. Monthly inflows to the seven major estuaries in Texas for the period 1941-1976 were estimated in those studies. Inflow estimates subsequently were extended from 1977-1987 and provided in a daily format in support of further studies on Texas's estuaries (Longley 1994). Finally, inflow records for each of the major estuaries have been updated periodically since, in support of ongoing research and planning studies both within and external to TWDB. In response to requests made of the Senate Bill 3 BBEST teams, freshwater inflow estimates have recently been extended through 2009 for San Antonio Bay. Therefore, complete hydrology is available for this bay for 1941-2009, with daily estimates of inflows available only after 1977.

These inflow estimates are based on historical gage flow records collected by the USGS and include adjustments for diversions and return flows made downstream of the lowest gages. The gaged inflow at the Guadalupe River node in the five bay TxBLEND model is calculated based on the USGS gages listed in Table 1.

**Table 1 USGS stream gages used to develop the gaged inflow component of combined inflows to the Guadalupe Estuary. Gage number, location, and the period of record utilized in developing the combined inflows are shown.**

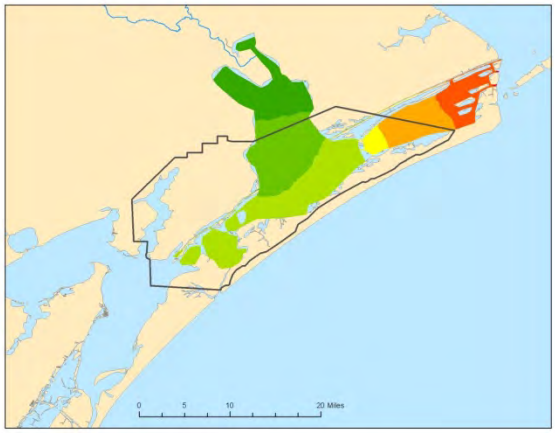
| Estuary | Gage Station Number | Gage Location | Utilized Period of Record |
|---|---|---|---|
| Guadalupe | 8177500 | Coleto Creek near Victoria | 1941-1952 & 1978-present |
| | 8177000 | Coleto Creek near Schroeder | 1953-1978 |
| | 8176500 | Guadalupe River at Victoria | 1941-present |
| | 8188500 | San Antonio River at Goliad | 1941-present |

Estuary inflows also include estimates ungaged flow calculated by the TWDB using a rainfall runoff model called TxRR. The process for the development of these inflow estimates has been documented (TWDB 2010c).

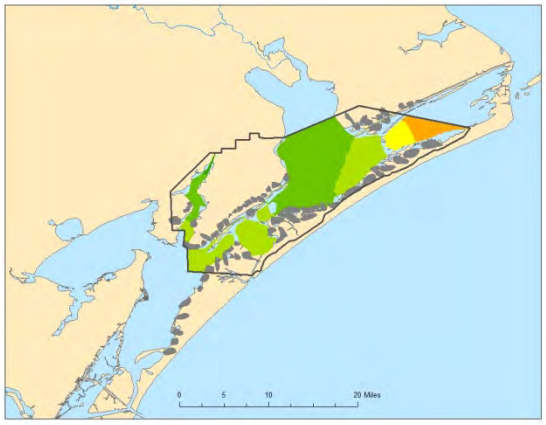
### *1.3. Geographic Scope of the Analysis.*

In order to evaluate the impact of the management of water diversions from the Guadalupe and San Antonio River Basins on bay salinity, an appropriate geographic scope containing an area responsive to changes in these freshwater inflows needed to be delineated. As shown in Figure 3, the TxBLEND five bay model domain extends from Matagorda Bay in the east to Corpus Christi Bay in the west. While salinity simulations were performed and results produced for all of the nodes within this area, it is a more limited area that is significantly influenced by inflows from the Guadalupe River (into which the San Antonio River merges above the bay). Potential geographic scopes range from the entire San Antonio and Mission Aransas Bay systems to very limited area near the Guadalupe River mouth. Also considered were the geographic scopes employed in other studies including the state's Freshwater Inflow Needs Study (Pulich et al 1998) and the oyster area selected by the GSA BBEST (GSA BBEST 2010). San Antonio Bay is also the winter home of federally endangered whooping crane. Recovery of this species depends in part on freshwater inflows from the Guadalupe River. A significant portion of the whooping crane diet is made up of blue crabs. Although blue crab response to salinity is complex, several studies suggest that years in which freshwater water inflows are low, the availability of blue crabs decreases, causing stress and possibly increased mortality for whooping cranes. (Pugesek et al. 2008, Stehn 2008, NWF 2004) The USFWS service has designated an area within San Antonito Bay as a

Critical Habitat Area and this area was also considered in determining the geographic scope of this study. Figure 4 depicts the areas that were considered.

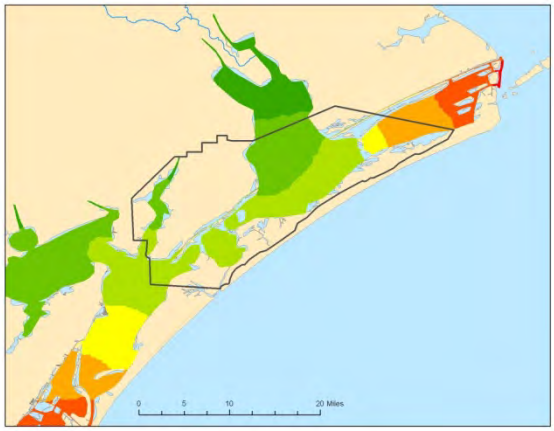


**TPWD Freshwater Inflows Needs Study (FINS) area (49K hectares)**



**Whooping Crane Designated Critical Habitat Area (DCHA) (35K hectares) includes winter territories**

**BBEST Oyster Area (10K hectares)**



**San Antonio-Mission Aransas Area (100K hectares) includes additional areas south not shown**

**Figure 4 Potential geographic scopes for conducting salinity zonation analysis**

The scope that was selected is a combination of the FINS area and the Designated Critical Habitat Area (DCHA) for the Whooping Crane. This area was selected because it includes (a) areas adjacent to the whooping crane winter territories, (b) up-Bay areas that may provide important nursery functions as well as (c) the mid-Bay areas which contain the majority of oyster beds in San Antonio bay. Based on alternative inflow simulations this area is very responsive to changes in freshwater inflows.

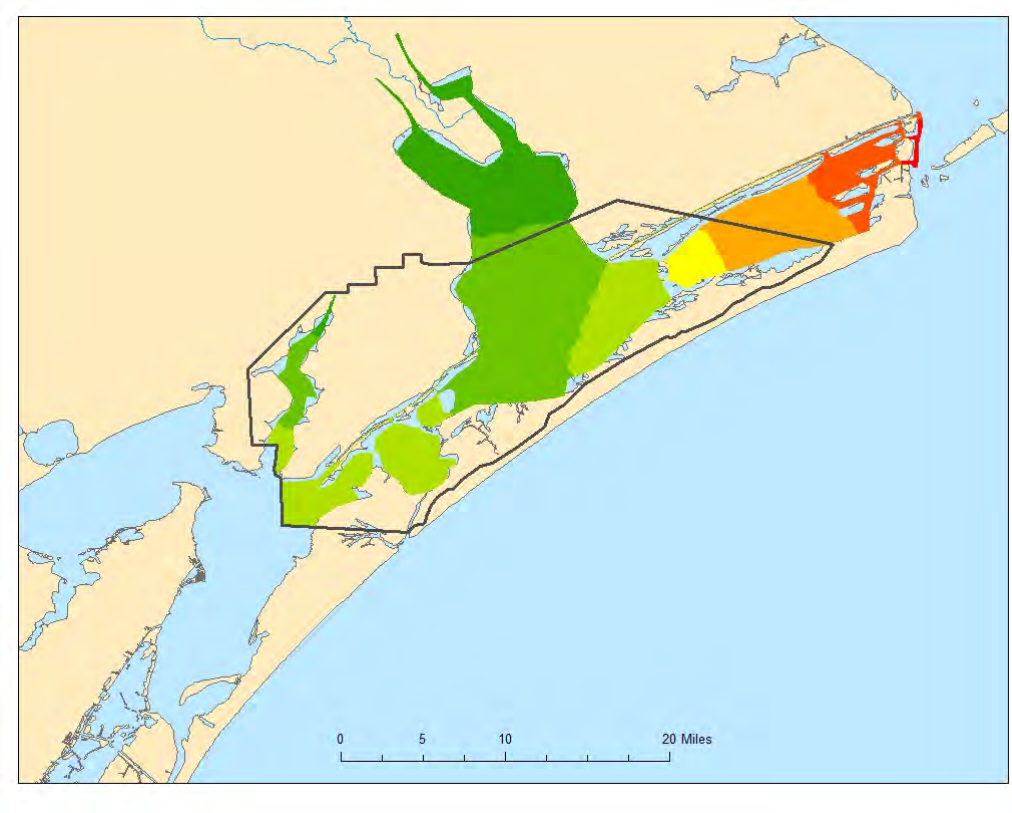



**Figure 5 TPWD FINS plus Designated Critical Habitat Area (DCHA) (54K hectares)**

### *1.4. Existing Salinity Data*

Direct measurements of salinity in San Antonio Bay are relatively limited both spatially and temporally (thus the need to calculate salinity response to freshwater inflow using a model). There are four fixed stations within the geographic scope of this study where salinity data has been collected over time (Figure 6). Table 2 shows the period of record for each of these stations. The first two stations are operated by the TWDB and data from these stations were used in calibrating the TxBLEND model. The second two are maintained by the Division of Near Shore Research (DNR) at Texas A&M in partnership with the Guadalupe Blanco River Authority (GBRA). Data from the GBRA1 site along with the data from the later period from the TWDB Seadrift site was used in validating the TxBLEND model. The process to calibrate and validate the TxBLEND model is described in Section 3 below.

**Table 2 Salinity monitoring stations**

| Operator | Name | Start Date | End Date |
|---|---|---|---|
| TWDB | Seadrift | 1986 | active |
| TWDB | Mesquit | 1986 | 1999 |
| DNR/GBRA | GRBA 1 | 2004 | active |
| DNR/GBRA | GBRA 2 | 2004 | 2004 |

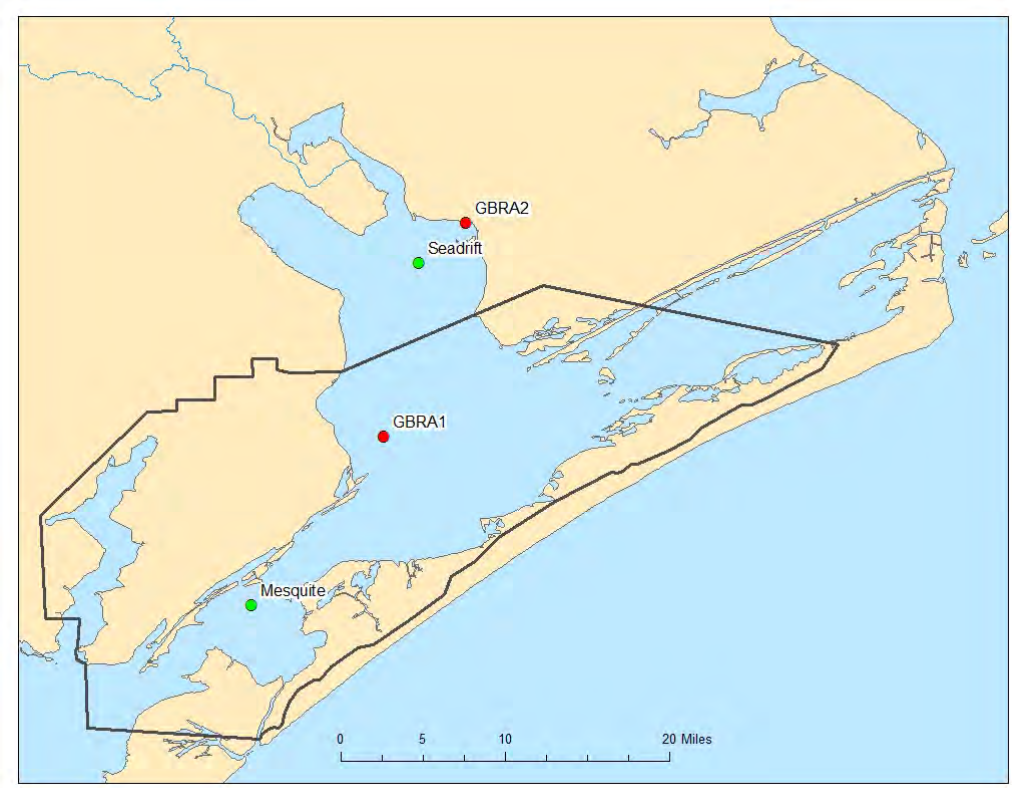



**Figure 6 Salinity monitoring stations.**

### *1.5. Diversion data*

The primary objective of this study is to evaluate the effect of water diversions from the Guadalupe and San Antonio Rivers on salinity conditions in San Antonio Bay. The estimates of freshwater inflow were adjusted to reflect the effect of upstream diversions. Water rights holders are required to report all diversions to the TCEQ South Texas Water Master and this data, for the period from 1991-2010, was obtained as part of this study.

Several steps were required to use this data to estimate changes in freshwater inflow that results from these water diversions. First, not all reported water diversions reported to the South Texas Water Master are consumptive. Consumptive diversions were identified based on the water right type. Water diversion reports were compared to the Texas Commission on Water Quality's (TCEQ) water rights database, which includes a code that identifies the type of use (Table 3).

**Table 3 Water right use types from TCEQ water rights database**

| Code | Use Type |
|---|---|
| 1 | Municipal/Domestic |
| 2 | Industrial |
| 3 | Irrigation |
| 4 | Mining |
| 5 | Hydroelectric |
| 6 | Navigation |
| 7 | Recreation |
| 8 | Other |
| 9 | Recharge |
| 11 | Domestic & Livestock Only |
| 13 | Storage |

Water rights with use codes greater than 4 were assumed to be non-consumptive and were excluded from the subsequent analysis.

Next, because streamflow in many segments of the Guadalupe and San Antonio Rivers experience significant channel losses due to evapotranspiration, evaporation and recharge, it is not appropriate to assume that diversions in the upper basin will result in a one to one loss of inflow at the bay. To account for these channel losses, channel loss factors for river segments of the Guadalupe and San Antonio Rivers have been developed for use in the Guadalupe San Antonio Water Availability Model (WAM). Changes in freshwater inflow as a result of diversions were estimated by applying these channel loss factors to the reported diversion amounts. For example, if 100 cubic feet per second ("cfs") is diverted in the upper basin but channel losses between the diversion point and the bay are estimated at 40 percent of stream flow, then that diversion of 100 cfs only results in a change to bay inflow of 60 cfs. The process for applying these channel loss corrections was to assign each diversion to a control point in the WAM based on its water right number and owner name. Figure 7 is a map showing the locations of the water rights in the Guadalupe and San Antonio River Basins.

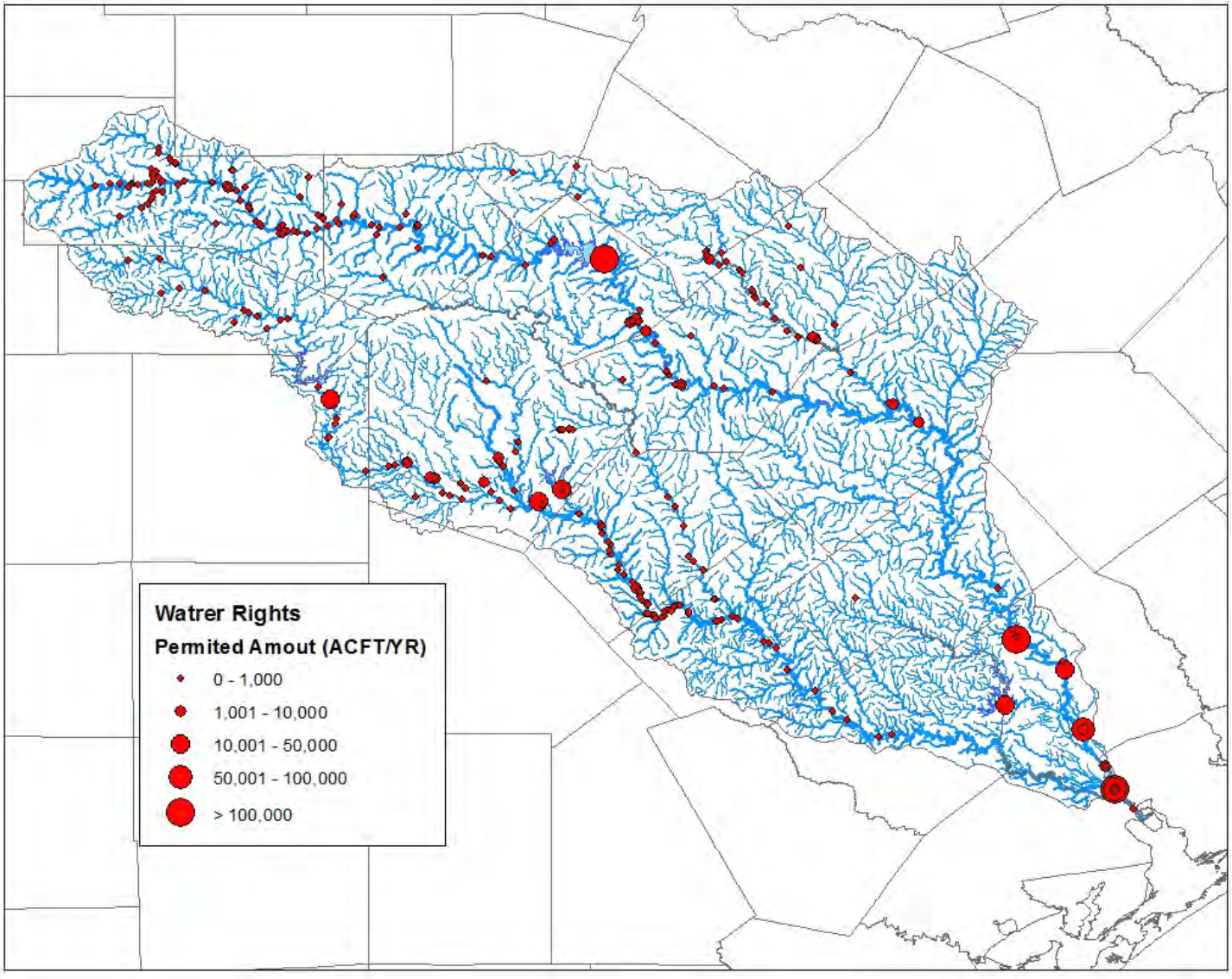



**Figure 7 Map of water rights in the Guadalupe and San Antonio River Basins**

Reported diversions were routed downstream though the various river segments defined in the WAM with channel losses applied in each segment. Once the diversion reached the lowest control point at the Guadalupe Estuary that amount was assumed to be the change in bay inflow from that individual diversion. Table 4 summarizes annual diversions from the Guadalupe and San Antonio River Basins. Red highlight indicates that the reported use was greater than average or the annual inflow was less than average; 2010 was excluded from the calculation of these statistics. It is notable that there appears to be an inverse relationship between consumptive use and inflow. Of the 10 years with consumptive use greater than average, all but 2 were in years with less than average annual inflow.

**Table 4 Diversions from the Guadalupe and San Antonio River Basins and total annual inflow in ACFT per year.**

| Year | Total | Consumptive | Adjusted for Channel Losses | Annual Inflow from TWDB TxBLEND |
|---|---|---|---|---|
| 1991 | 626,610 | 140,938 | 91,377 | 3,005,379 |
| 1992 | 480,316 | 138,641 | 101,070 | 7,694,054 |
| 1993 | 686,101 | 161,238 | 111,308 | 3,021,168 |
| 1994 | 2,724,744 | 173,605 | 122,500 | 1,879,053 |
| 1995 | 481,919 | 166,430 | 107,157 | 1,467,918 |
| 1996 | 1,407,917 | 206,235 | 126,373 | 643,349 |
| 1997 | 150,198 | 126,940 | 99,168 | 3,591,467 |
| 1998 | 2,761,733 | 240,146 | 176,368 | 5,031,448 |
| 1999 | 2,149,300 | 260,749 | 196,903 | 1,223,257 |
| 2000 | 1,773,652 | 236,325 | 172,435 | 1,523,130 |
| 2001 | 6,800,974 | 237,248 | 176,115 | 3,263,205 |
| 2002 | 2,873,149 | 205,727 | 163,596 | 6,145,470 |
| 2003 | 2,714,172 | 210,485 | 158,595 | 2,395,662 |
| 2004 | 3,516,283 | 191,209 | 142,696 | 5,503,331 |
| 2005 | 3,262,473 | 260,234 | 180,789 | 2,364,739 |
| 2006 | 1,673,135 | 290,314 | 202,683 | 1,007,027 |
| 2007 | 3,533,042 | 176,595 | 135,876 | 5,365,399 |
| 2008 | 2,039,007 | 236,269 | 169,186 | 844,429 |
| 2009 | 380,520 | 255,037 | 175,069 | 1,349,862 |
| 2010 | 552,310 | 182,985 | 128,825 | N/A |

Adjusted monthly diversions were distributed evenly to daily values and these daily amounts were added to the TxBLEND input file for the Guadalupe inflow.

This approach is intended to provide a reasonable estimate of the changes in freshwater inflows that have occurred as a consequence upstream diversions. This is the best estimate based on the information available to me. For example, reported diversions may include diversions from reservoir storage which probably represents some water that was captured in the reservoir on days prior to the period reported as the diversion period. Also, depending on the availability of alternative sources of water supply, changes in diversion amount could impact the amount of water that is returned from wastewater treatment plants. During the development of the GSA WAM, an attempt was made to estimate this relationship but this was unsuccessful. The GSA WAM generally assumes that alternative sources i.e. groundwater would be used to make up any reductions in surface water diversions. No attempt to make adjustment to return flows was included in this analysis. Nor was any attempt made to evaluate the effect of change in freshwater inflow resulting from changes in spring flow caused by groundwater pumping. Finally, this approach is based on reported diversions. The records include only one domestic

and livestock report. It seems reasonable to expect these records provide a lower bound on the total diversions that have occurred.

Another set of freshwater inflows were calculated to evaluate the effect of using water that has already been permitted but has not yet been fully used. For this study, these potential future diversions represent a very conservative estimate of the total potential future impacts because this study only includes full use for one set of relatively senior water rights located near the bay at the basin outlet. This approach was taken in part because the impacts of future diversions for more upstream and more junior water rights are more difficult to accurately estimate without the use of a water availability model. Unfortunately the existing WAM for the Guadalupe and San Antonio Basins includes a period of record that ends in 1989 while water use data available from the South Texas Water Master was only available after 1991. A WAM is needed because Texas water law is based on prior appropriation meaning that the most senior water right holders divert water first and during time of low flow can make calls on more junior water right holders to cease diversions if their diversion would impact the senior water right holder's ability to divert the amount that they are legal allowed. Without a WAM it is difficult to predict how prior appropriation would affect diversions under more junior water rights during the low flow periods of interest in this study. Also, while the overwhelming majority of water rights in Texas were granted without any requirements to leave any water in the stream to protect the environment, many more junior water rights include special conditions within their permit which may limit their right to divert subject to specified stream flow restrictions. A WAM is generally required to accurately estimate the effect of these restrictions on the amount of water diverted by these water rights holders. Finally diversions far upstream of the bay may have relatively lower impact as compared to the total diversion amount than diversions closer to the bays that are not subject to significant channel losses. For these reasons only a group of downstream, relatively senior water rights held by the GRBA (water right numbers 5172-5178) were included in this analysis.

As noted above, this analysis presents are very conservative estimate of expected future impacts of water diversions on freshwater inflows. Increased use of all existing water rights as well as any additional new water right will only further reduce inflows. For water right numbers 5172 - 5178, monthly reported use was compared to full permitted use, assuming the seasonal distributions defined in the WAM, and the difference between full permit amount and the report use (assuming it was positive in some cases the reported use exceed the monthly distributed estimate of the full permit amount in which case the adjustment was set to zero) was subtracted from the freshwater inflow into San Antonio Bay. In some cases the full exercise of these permits exceeded the flow in the river, in these cases the river would have been completely dewatered and thus the freshwater inflow was set equal to zero. Table 5 shows the total annual reported use for water right 5172 – 5178 compared to the full permitted amount and the expected future impact on freshwater inflow of full exercising these rights as currently permitted and proposed. Notably a comparison between Table 5 with Table 4 indicates that in some years the expected impact on freshwater inflows on these 7seven water rights permits would exceed the total impact of all existing diversions.

**Table 5 Diversions available under water right permits 5172 – 5178 in ACFT per year.**

| Year | WR Perm 5172 -5178 Reported Use | WR Perm 5172 -5178 Permited Use | WR Perm 5172 -5178 Additional Future Diversions |
|---|---|---|---|
| 1991 | 46,318 | 172,501 | 126,183 |
| 1992 | 55,939 | 172,501 | 116,562 |
| 1993 | 54,766 | 172,501 | 117,735 |
| 1994 | 64,209 | 172,501 | 108,292 |
| 1995 | 41,356 | 172,501 | 131,145 |
| 1996 | 36,501 | 172,501 | 136,000 |
| 1997 | 35,259 | 172,501 | 137,242 |
| 1998 | 100,850 | 172,501 | 71,651 |
| 1999 | 113,045 | 172,501 | 59,456 |
| 2000 | 90,660 | 172,501 | 81,841 |
| 2001 | 90,611 | 172,501 | 81,890 |
| 2002 | 83,174 | 172,501 | 89,327 |
| 2003 | 79,844 | 172,501 | 92,657 |
| 2004 | 75,528 | 172,501 | 96,973 |
| 2005 | 80,232 | 172,501 | 92,269 |
| 2006 | 78,032 | 172,501 | 94,469 |
| 2007 | 66,183 | 172,501 | 106,318 |
| 2008 | 63,957 | 172,501 | 108,544 |
| 2009 | 47,666 | 172,501 | 124,835 |
| 2010 | 31,362 | 172,501 | 141,139 |

**2. Inflows from the Guadalupe and San Antonio River Basins are the most important factor determining salinity in the San Antonio Bay**

Estuarine salinity patterns are primarily driven by river inflows resulting from surface water runoff (Solis and Powell 1999). This is especially true for estuaries along the mid-Texas coast that typically have low groundwater inflow and relatively low annual precipitation (Slack et al. 2009). The other dominant effect on estuarine salinity is tidal exchange but this impact is muted in lagoon type estuaries such as the San Antonio Bay which is protected from direct exchange with the Gulf of Mexico by the Matagorda and other barrier islands. Wind, evaporation and precipitation can also play a role, however they typically explain little of the variance in salinity conditions and have generally been treated as inconsequential noise in other recent studies (Bio-West 2008, Slack 2009). The relationship between salinity and freshwater inflow is not typically instantaneous and most studies report relationships based on cumulative antecedent flow conditions from 1 to 2 months. (Pulich et al. 1998, Bio-WEST 2007, Slack 2009, and GSA BBEST 2010). Figure 8 shows the relationship between salinity and the cumulative inflow for the previous 28 days. The $r^2$ for this relationship indicates that about 70% of the variance in salinity is explained by this antecedent inflow volume.

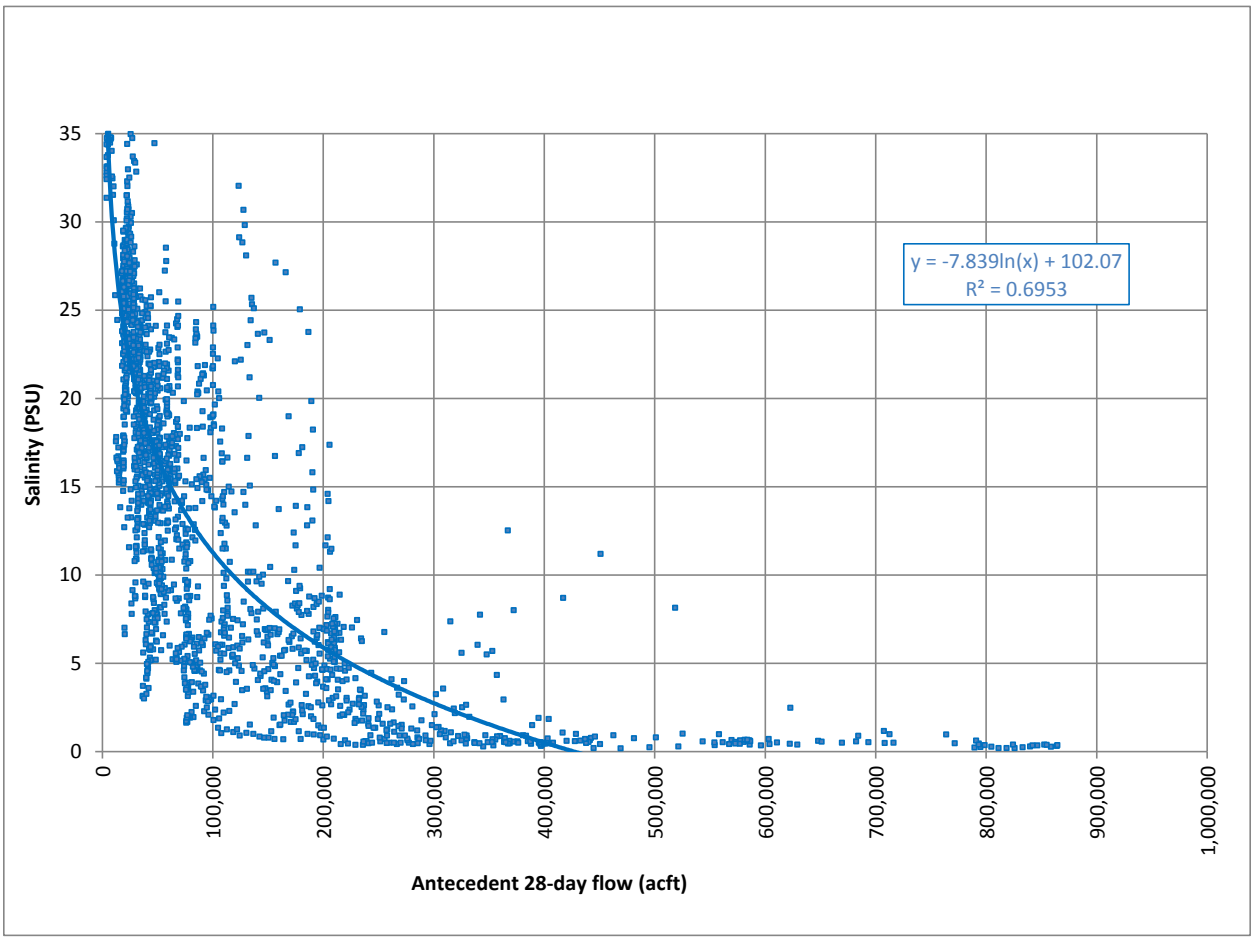



**Figure 8 Relationship between surface water salinity at GBRA 1 (PSU) and the 28-day cumulative inflow in ACFT from the Guadalupe and San Antonio Rivers.**

**3. The TxBLEND model used in this study represents the best available science and is the official model developed by the state of Texas for the purpose of simulating salinities in Texas Bays.**

The TxBLEND model used in this study represents the best available science for determining the salinity response to freshwater inflow for a range of flow conditions over a broad area of San Antonio Bay. The model has been the subject of some criticism in the past, the primary ones being that until recently the model had only been calibrated but had not been validated and the fact that it is a two-dimensional model while processes operating in estuaries are three dimensional.

The model has recently been validated and it has been demonstrated to produce an acceptable level of performance (GSA BBEST 2010) to conduct salinity zonation analyses comparable to the manner in which it is being employed in this study. Prior to the GSA BBEST study, TxBLEND model covered the period from 1987-1997. TWDB calibrated the model based on this period of record. Calibration is a process of adjusting model parameters, in this case dispersion coefficients and bottom roughness, to improve the model's performance at predicting hydrodynamic and circulation estimates. With the BBEST work, the period of record in the model was extended to 2009. This has allowed the TWDB to perform a model validation. In a model validation, the model is executed using a dataset that is independent from the set for which it was calibrated, in this case the period from 1998-2009. Results are compared with observed values without making any adjustments to model calibration parameters.

Based on this analysis, the TWDB concluded that "TxBLEND captures major salinity trends in the system reasonably, but high frequency fluctuations are more difficult to simulate. The model also performs better at mid and lower bay locations than in the upper estuary." (TWDB 2010a) While these caveats might raise concerns were the model employed to track hourly or daily fluctuations near the mouth of the Guadalupe River, it supports the way the model has been used in this study, namely to track course time step (monthly) changes in salinity over a broad area across the bay.

Figure 6, above, shows the location of salinity monitoring stations used in the calibration and validation analysis. The red sites were active in the early period and were used in both the validation and calibration analysis, the green site labeled GBRA 1 is relatively recent station deployed in 2004 and was used only in the validation analysis.

For both the sites within the Whooping Crane DCHA, Mesquite Bay and GBRA 1, the TxBLEND model explains a high degree of variance in the daily average salinity. TWDB reports an $r^2$ equal to 0.90 for Mesquite Bay for the calibration analysis and 0.86 for GBRA1 for the validation analysis. Figure 9 and Figure 10 from the calibration and validation report demonstrate how the model accurately tracks salinity at these two sites.

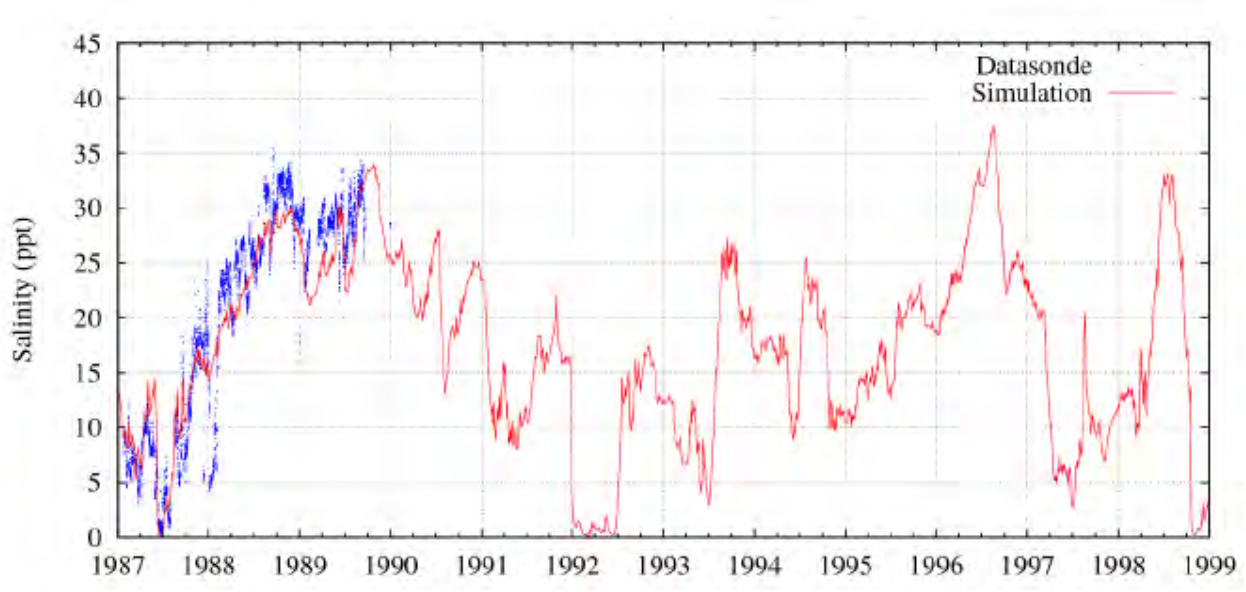



**Figure 9 Observed (blue) versus simulated (red) salinities in Mesquite Bay for a period including 1987 to 1990, with additional simulated salinities up to 1999. (From TWDB 2010)**

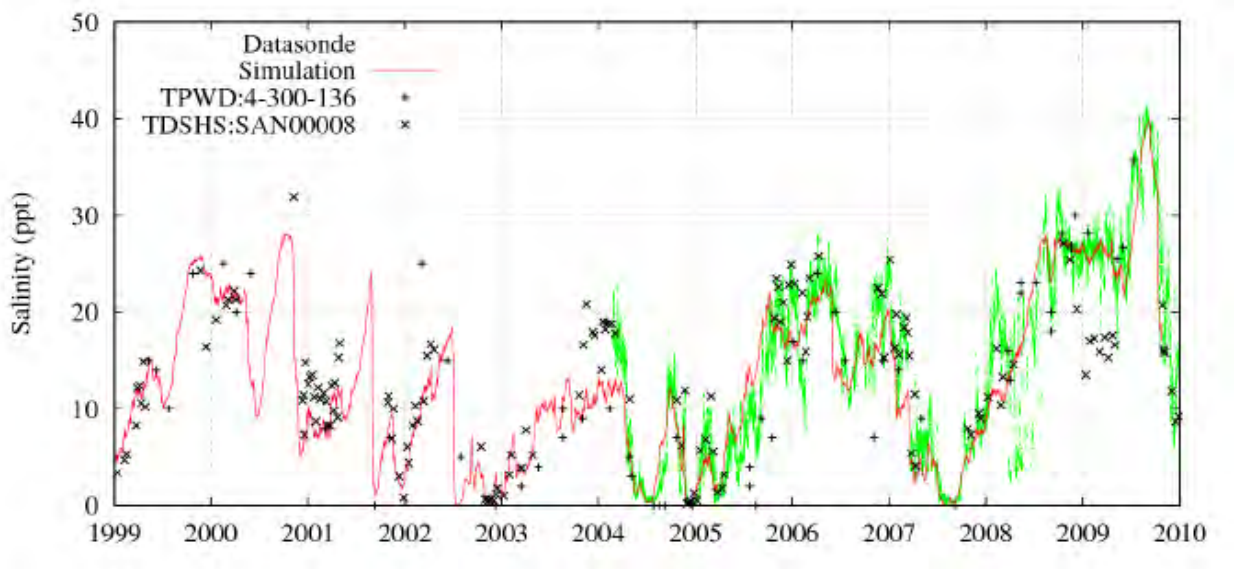



**Figure 10 Simulated (red) and observed (green, + or x) salinities at the GBRA-1 site in San Antonio Bay for the period 1999-2009. The GBRA-1 station (green) is located at 28.2597 N, -96.7736 W. Data collected by TPWD (+) was from grid cell 4-300-136 located at 28.2615 N, -96.7771 W. Data collected at TDSHS (x) SAN00008 site was located at 28.2464 N, -96.7692 W (From TWDB 2010).**

The criticism that the model is a two dimensional model is accurate; however this general criticism of two dimensional models is less germane to San Antonio Bay than it may be to other bay systems. The vertical dimension is of most significant concern in deeper bays or bays that include deep ship channels. In those settings, density gradients can have more significant effect on hydrodynamics. This is probably a less significant problem in the relatively shallow and homogeneous San Antonio Bay. Three dimensional models are used in other bay systems across the United States, however they are typically employed for rather spatially and temporally limited applications. For the purpose of predicting broad salinity responses over a wide range of inflow conditions and large areas, three dimensional models are somewhat less practical. The reality is that three dimensional models do not currently exist for San Antonio Bay, and that they also require very significant levels of investment in terms of data collection and computer programing to develop. In 2005, TWDB received an estimate "easily upwards of $1 million for each major estuary" to develop three dimensional models.

4. **TxBLEND inflow data for the Guadalupe available from the Texas Water Development Board and an alternative set prepared by the GSA BBEST produce almost identical salinity results; the analysis presented in this report is based on the TWDB dataset.**

The GSA BBEST identified several issues related primarily to how return flows were incorporated into the TWDB inflow estimates. There remains some controversy as the accuracy of the inflow estimates for the early part of the record in the 1940s and 50s, because documentation on what was included in these estimates has apparently been lost. However, for the period of record that is the focus of the analysis in this report (1991-2009), the BBEST corrections have generally been incorporated in into the official TWDB data sets (Carla G. Guthrie, Ph.D. TWDB, person comm.). Since the BBEST produced their report, TWDB has continued to incorporate additional information and now includes several return flow reports that were not available to the BBEST. The differences between the current official set and the data used by the BBEST are very small. Out of the 6,940 days between January 1, 1991 and December 31, 2009, only 133 days (<2% of all days) had differences in inflow of more than 1 percent. The largest percent difference occurs on June 28, 1991 on which data the BBEST inflow set reports freshwater

inflow of 982 cfs while the more recent TWDB dataset reports inflow of 1,021, or a difference of about 40 cfs out of about 1,000. Differences in freshwater inflow can have large cumulative effect on bay salinity; therefore in order to fully respond to concerns about which inflow dataset should be used, simulations were made using both sets. Figure 11 and Figure 12 show results from the salinity simulation model for the official TWDB inflow set and the inflow set that was used by the BBEST, respectively. These salinity zonation figures show the percent of the bay area that is within salinity ranges, each with bins of 5 PSU (Practical Salinity Units, which for this report is the same as parts per thousand, or ppt), based on monthly average salinity for the period from October 2007 to December 2009. The black line is an estimate of the average salinity across the geographic scope. This period of record was selected for this example simply to focus on short enough time frame to visually evaluate the salinity patterns produced by the two inflow datasets. Even at this scale it is difficult (perhaps impossible to visually) detect a difference. The two inflow sets produce results which differ by less than 1 tenth of 1 percent of the bay area within each bin. The conclusion from this analysis is that salinity gradients produced by these two data sets are essentially the same. Therefore for the remainder of this report, only results from simulations based on the official TWDB inflow set will be used.

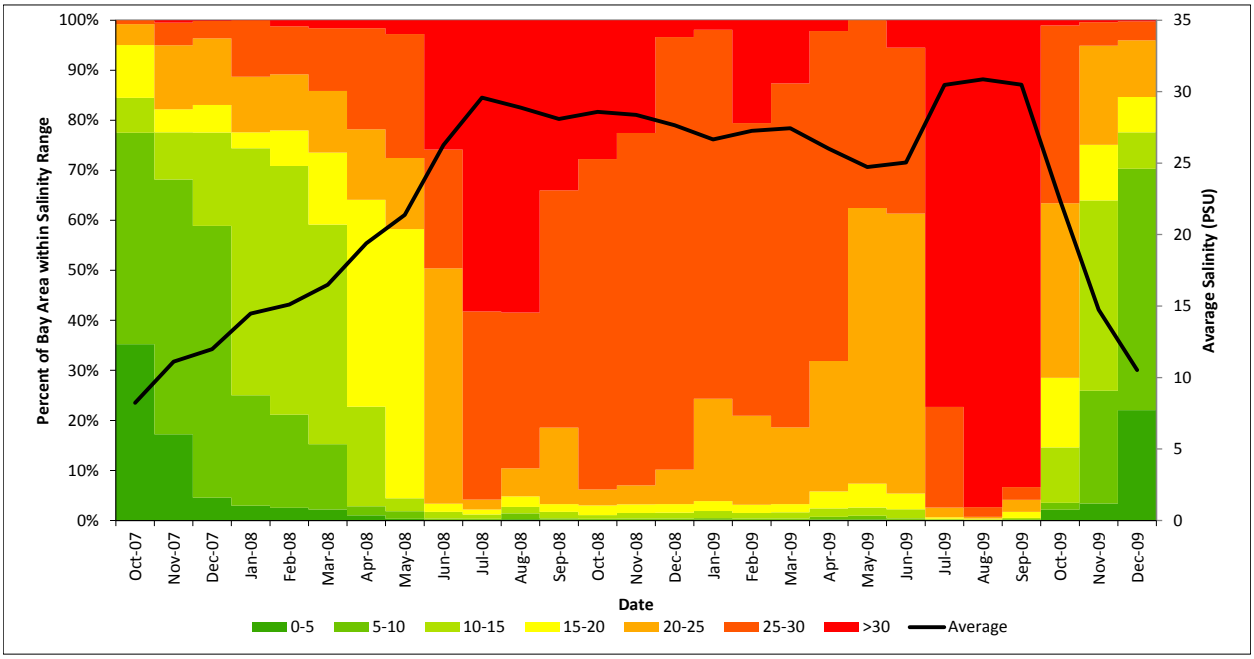



**Figure 11 Percent of bay area within salinity ranges based on TWDB inflow data.**

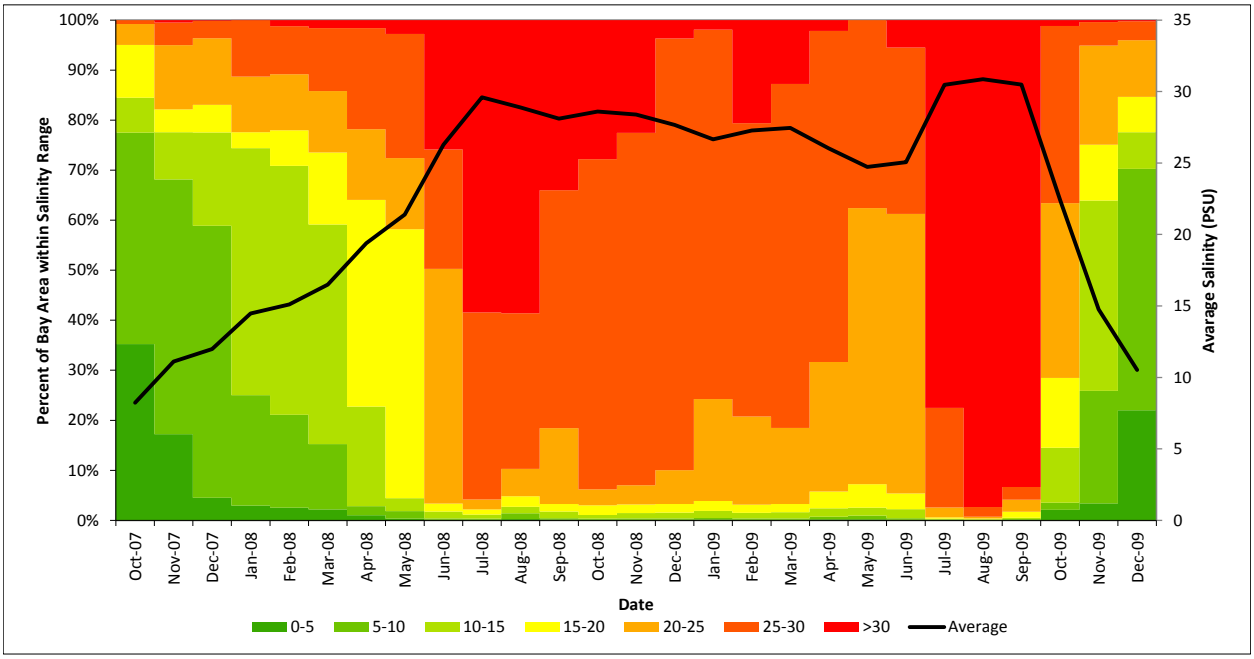



**Figure 12 Percent of bay area within salinity ranges based on BBEST inflow data.**

**5. Water diversions from the Guadalupe and San Antonio River Basins, by reducing freshwater inflows, have a significant impact on the resulting salinity conditions in San Antonio Bay**

The effect of water diversions on San Antonio Bay is evaluated in the context of the freshwater inflow and salinity gradients produced by three water use scenarios inflow. The scenarios are 1.) an assumption that water that was historically diverted is passed to the bay, 2.) the reported historical water diversions and 3.) an assumption full use of several large, senior downstream water rights permits in addition to other existing diversions. The freshwater inflow analysis is evaluated with reference to the flow recommendation determined by the state's FINS (Freshwater Inflow Needs Study) (Pulich et al 1998). The salinity gradient analysis is conducted by comparing the salinity calculated by the TxBLEND model assuming these three alternative inflow scenarios.

### *5.1. Analysis of Flows*

The flows analysis approach is based on findings of freshwater inflow needs for San Antonio Bay that was produced by TPWD and TWDB. (Pulich et al. 1998) This study is commonly referred to as the Freshwater Inflow Needs Study (FINS). In the FINS study, a team of estuarine ecologists "recommends MaxH (1.15 million ac-ft) inflows as the lowest target value to fulfill the biological needs of the Guadalupe Estuary on a seasonal basis." MaxH stands for maximum harvest and is the result of an optimization program developed by the TWDB to determine the flow that produces the greatest amount of fisheries biomass subject to a number of constraints and objectives. Similarly MinQ is another output from the optimization program which meets slightly different objectives. MaxH and MinQ were among the flows considered by TPWD in developing their target flows in FINS. The report goes on to state that

> "There have been, and will continue to occasionally be, times when nature does not provide the water to meet the recommended MinQ or MaxH inflows to San Antonio Bay. The biological effects of these reduced flows on the Guadalupe Estuary fisheries productivity and biodiversity are examined here. Maintenance of productivity of economically important and ecologically characteristic sport or commercial fish and shellfish species and the food webs that support

them are goals identified in the Texas Water Code Section 11.147(a). The freshwater inflow targets presented in this document are designed to meet the requirements for beneficial inflows as described in the Texas Water Code Section 11.147(a). A major concern of the TPWD is that an increase in the severity, frequency, or duration of drought flows will alter the ecosystem structure by either reducing overall fisheries production or by favoring one fisheries species production at the expense of others, thereby reducing biodiversity."

Time series analysis comparison of flows both with diversions as they actually occurred and with the adjustments to add back in an amount to reflect the effect of upstream diversions and adjustments to decrease inflow based on expected future use of some permitted but far unused water rights (described in section 1.5) demonstrates marked increase in the severity, frequency and duration of drought resulting from human alterations, that is, from the diversions.

Severity of drought is defined here as the shortfall or magnitude by which flows fall below the level that has been determined to be necessary to protect the sound ecological environment of the estuary. Table 6 shows the average and maximum shortfalls under the three water diversion scenarios. Although it varies widely by month, the average shortfalls with the current levels of diversions are more than 20% greater in about half of the months than they would be if water that was diverted were instead passed to the bay A similar increase in average severity would be observed if based on the full use of some large water rights in the lower basin.. From the maximum severity columns on the left, we see that current divisions reduced flows to less than 10,000 acre-feet ("acft") at times in July and August (MaxH minus Max Severity). This translates to daily average inflow of less than 200 cfs.

**Table 6 Severity of drought conditions assuming no diversions, under current conditions, and assuming full use of water right permits 5172 – 5178.**

| | | Avg Drought Severity | | | Max Drought Severity | | |
|---|---|---|---|---|---|---|---|
| Month | MaxH | Assume Reported Diversions Passed to Bay | Historical Inflows (which include effects of diversions) | Assume Additional diversions from full use of GBRA lower basin permits | Assume Reported Diversions Passed to Bay | Historical Inflows (which include effects of diversions) | Assume Additional diversions from full use of GBRA lower basin permits |
| Jan | 111,200 | 34,975 | 42,252 | 50,452 | 63,627 | 65,397 | 76,132 |
| Feb | 124,200 | 45,401 | 49,085 | 53,396 | 72,840 | 86,795 | 95,361 |
| Mar | 52,420 | 0 | 5,816 | 15,059 | 0 | 7,281 | 16,226 |
| Apr | 52,420 | 3,169 | 9,923 | 17,074 | 3,169 | 17,848 | 26,303 |
| May | 222,600 | 103,972 | 107,048 | 111,826 | 176,659 | 197,785 | 202,772 |
| Jun | 162,700 | 68,167 | 77,952 | 76,368 | 118,335 | 140,288 | 150,811 |
| Jul | 88,610 | 31,177 | 52,437 | 60,430 | 64,465 | 78,402 | 87,961 |
| Aug | 88,330 | 29,110 | 35,739 | 39,183 | 55,717 | 81,013 | 87,463 |
| Sep | 52,420 | 11,982 | 14,500 | 16,237 | 11,982 | 27,040 | 35,547 |
| Oct | 52,420 | 3,089 | 10,404 | 18,787 | 3,089 | 11,394 | 24,434 |
| Nov | 73,830 | 16,878 | 21,925 | 25,359 | 27,245 | 31,683 | 42,222 |
| Dec | 66,200 | 7,872 | 14,916 | 19,242 | 13,824 | 23,403 | 33,338 |
| All | | 47,409 | 51,045 | 53,502 | 176,659 | 197,785 | 202,772 |

Clearly there are many times when flows greatly exceed the target values from the FINS report, however according the TWDB estimates, flow from the Guadalupe and San Antonio Rivers fell less than 100 cfs on more than half of the days in July 2009. During that same month when salinities in the San Antonio Bay exceeded 30 PSU, diversions upstream caused, on a daily average, a 400 cfs decrease in flows at the bay. This clearly demonstrates an increase in the severity of drought conditions beyond those that would be expected under natural conditions. If GBRA would have fully exercised their lower basin water rights (5172-5178) the maximum severity would have essentially equaled the target flow for the months of May through August in 2009 which means that the river would have been completely dewatered.

Severity is important for a number of reasons. The first and most obvious being, that as flows decrease, habitat conditions in the bay become less and less suitable resulting in more negative impacts on the

marine community. The second related issue is that while there may be some uncertainty with the exact values in the target inflow recommendations, as flows continue to decrease further below these targets this uncertainty decreases as well; at some point when very little to no freshwater is entering the bay, there is little question that conditions will become stressful to the marine community.

The duration of drought events are also higher than they would be were so much water not diverted upstream. A drought event is defined here as the continuous period of time during which flows remain below recommended freshwater inflow targets. Table 7 shows the duration of individual drought events under the two scenarios. The duration of these drought events would be considerably shorter if the water historically diverted was passed to the bay. Three times in the 19 years from 1991-2010, the bay experienced droughts longer than 6 months, but none would last that long if the diverted water had been passed to the bay. Full use of GBRA lower basin water right would be expected to extend unacceptable drought conditions to almost a full continuous year. This persistence is important because the freshwater inflow targets were in part predicated on antecedent conditions. Consistently failing to meet the minimums for extended periods, will require longer periods of normal inflows before conditions become suitable again.

**Table 7 Duration of drought conditions assuming no diversions, under current conditions, and assuming full use of water right permits 5172 – 5178.**

| Duration (months) | Assume Reported Diversions Passed to Bay | Exisitng Diversions | Assume Additional diversions from full use of GBRA lower basin permits |
|---|---|---|---|
| 1 | 13 | 17 | 17 |
| 2 | 6 | 5 | 6 |
| 3 | 4 | 6 | 5 |
| 4 | 3 | 1 | 1 |
| 5 | 2 | 1 | 2 |
| 6 | | | |
| 7 | | 2 | 1 |
| 8 | | 1 | 1 |
| 9 | | | |
| 10 | | | |
| 11 | | | 1 |
| Total | 28 | 33 | 34 |

Finally, the frequency of drought conditions could be substantially decreased if some of the diverted water were passed to the bay. Frequency of drought conditions is defined here as the number of months in which the target flows are not met. These frequencies are presented in Figure 13 as the number of months over the 19 year period during which the flows would be expected to be below recommended levels. Clearly, as the FINS notes, there are times when even under natural conditions the targets would not be satisfied, however the current scenario with water diversions results in these failures considerably more often. Future use of existing but so far unused permits will only exacerbate this condition.

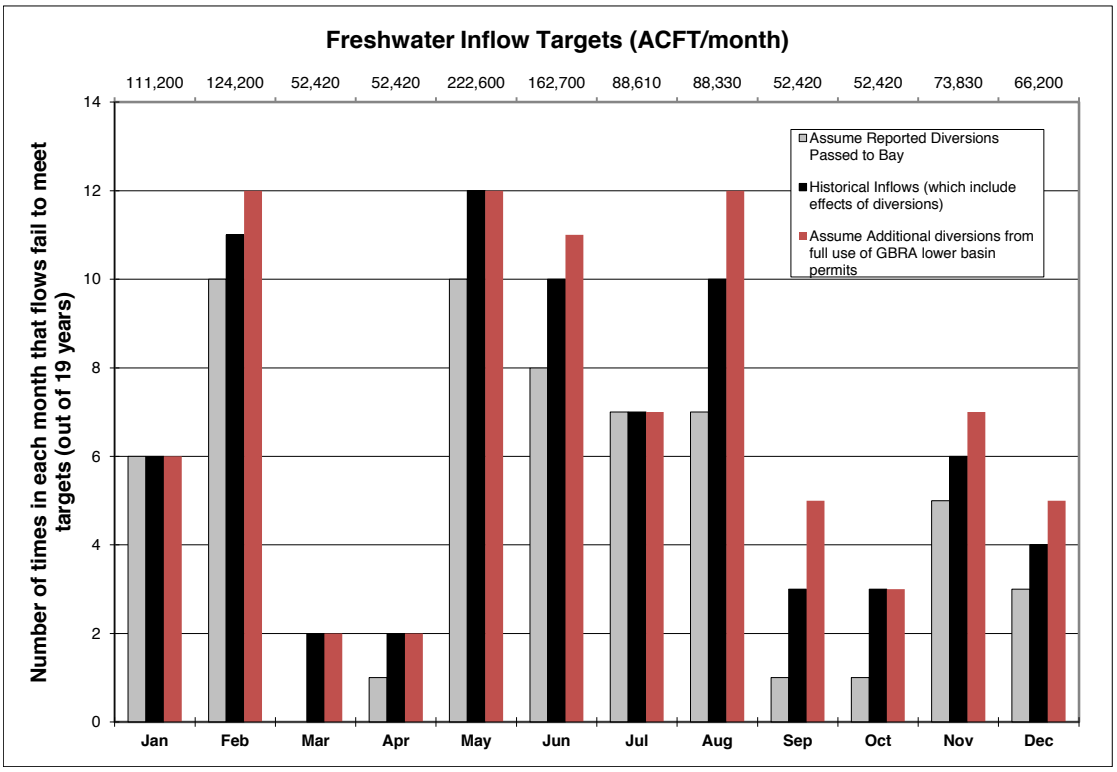



**Figure 13 Frequency of drought conditions assuming no diversions, under current conditions, and assuming full use of water right permits 5172 – 5178.**

### *5.2. Analysis of Salinity*

The second analysis of impacts from water diversions on San Antonio Bay is an evaluation of the changes to the salinity gradients that would result if water that is currently diverted were passed to the bay and the additional changes that can be expected from the full use of unperfected water rights. This analysis was conducted by simulating salinity conditions in the TxBLEND model first assuming historical diversions and next assuming the diversions historically diverted were instead passed to the bay and finally with inflows deceased as a result of full use of water right numbers 5172 – 5178.. The method for conducting this analysis is briefly described here. After running the TxBLEND model and deciding on a subset of the model domain for the geographic scope, the majority of the qualitative analysis was conducted in a GIS (Geographic Information System) and in a number spreadsheets.

For each inflow scenario, salinity at each node the model was imported into the GIS. An inverse weighted distance algorithm was used to convert these points into a continuous surface, or raster file, for each month in the period of record from 1987-2009. The raster data were then classified into 1 PSU bins to create polygons. At this stage graphics similar to Figure 5 showing areas of the bay within 5 PSU salinity ranges were produced for each month. The area of each polygon in hectares was then calculated and the tables containing results for each polygon, for each month in the record were imported into an Excel spreadsheet. In Excel, the areas were converted into percent of bay area based on a total area of approximately 54,000 hectares. Figure 14 shows the results of this analysis based on the freshwater inflow estimates provided by the TWDB. The vertical axis on the right shows the percent of the total bay area that is within the salinity ranges defined in the legend. For example the fall of 1989, only about 1 percent of the total bay area has monthly average salinities that are lower than 20 PSU, while in the spring of 1992 almost 100 percent of the bay has salinities less than 10 PSU. The black line

shows the actual monthly inflow from the Guadalupe River and the magnitude of those flows are shown on the left vertical axis. The conclusion is clear, and obvious, higher freshwater inflows produce lower salinities for larger portions of the bay. Appendix A includes close ups of Figure 14 for each year from 1987 to 2009.

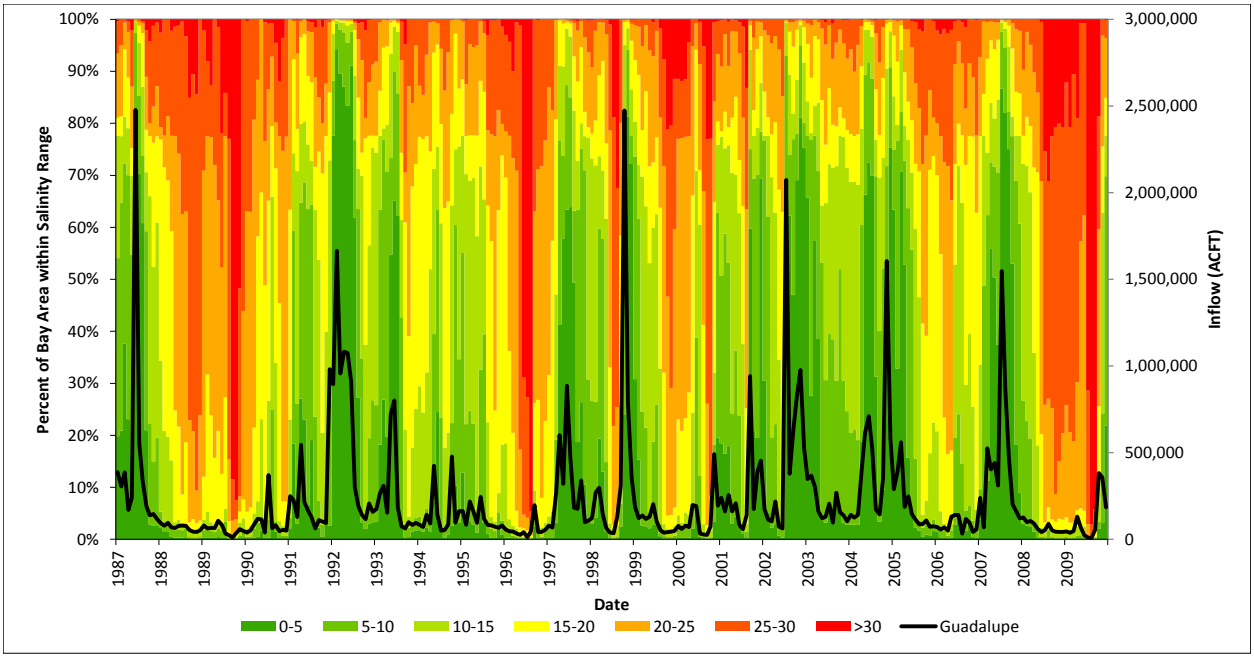



**Figure 14 Percent of bay area within salinity ranges based on TWBD inflow data for full period of record (1987-2009).**

Monthly average salinities for all nodes within the model domain were produced as part of this study. As an example, monthly average salinities are provided for node 2355 in Table 8.

**Table 8 Monthly average salinity from TxBLEND node number 2355**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1987 | 8.14 | 6.91 | 4.34 | 6.03 | 7.96 | 1.33 | 0.69 | 2.2 | 6.46 | 11.8 | 13.85 | 12.5 |
| 1988 | 14.77 | 17.62 | 17.45 | 18.01 | 21.1 | 22.08 | 23.78 | 22.84 | 26.33 | 26.57 | 27.5 | 26.11 |
| 1989 | 23.02 | 20.41 | 21.34 | 22.64 | 22.19 | 23.97 | 21.11 | 26.91 | 31.04 | 32.59 | 29.66 | 24.5 |
| 1990 | 23.81 | 23.73 | 21.84 | 19.01 | 16.84 | 19.6 | 16.84 | 10.95 | 14.84 | 19.42 | 23.1 | 23.06 |
| 1991 | 17.43 | 7.5 | 10.77 | 5.78 | 5.77 | 7.55 | 6.77 | 10.78 | 13.8 | 16.92 | 14.5 | 11.1 |
| 1992 | 0.77 | 0.1 | 0.11 | 0.23 | 0.27 | 0.06 | 2.32 | 5.4 | 9.6 | 14.51 | 13.49 | 10.86 |
| 1993 | 11.23 | 8.26 | 6.1 | 6.61 | 3.99 | 1.93 | 2.42 | 9.53 | 16.51 | 19.55 | 17.58 | 16.38 |
| 1994 | 15.54 | 16.25 | 15.4 | 14.17 | 9.37 | 5.65 | 11.5 | 16.71 | 16.88 | 12.31 | 7.34 | 9.68 |
| 1995 | 8.66 | 11.49 | 11.87 | 12.11 | 13.75 | 10.32 | 9.61 | 16.23 | 18.71 | 21.01 | 19.1 | 17.79 |
| 1996 | 17.38 | 19.83 | 21.62 | 23.56 | 26.62 | 30.35 | 30.75 | 34.46 | 22.62 | 20.56 | 22.29 | 21.34 |
| 1997 | 20.29 | 18.77 | 13.91 | 4.15 | 3.94 | 1.58 | 0.74 | 4.28 | 6.57 | 6.15 | 7.92 | 10.48 |
| 1998 | 10.85 | 11.1 | 7.46 | 7.98 | 12.3 | 20.56 | 26.87 | 26.73 | 17.63 | 6.27 | 0.34 | 1.92 |
| 1999 | 5.18 | 7.29 | 10.75 | 11.64 | 13.97 | 12.82 | 10.83 | 15.03 | 20.07 | 24.58 | 25.49 | 24.15 |
| 2000 | 21.96 | 22.05 | 21.83 | 20.77 | 17.62 | 9.89 | 12.75 | 19.61 | 25.55 | 27.83 | 15.45 | 7.1 |
| 2001 | 8.53 | 7.65 | 7.91 | 11.04 | 9.6 | 10.9 | 14.64 | 20.98 | 2.72 | 6.24 | 7.17 | 2.39 |
| 2002 | 5.06 | 8.42 | 11.85 | 12 | 14.98 | 17.77 | 3.43 | 1.89 | 3.98 | 3.09 | 0.39 | 2.01 |
| 2003 | 2.75 | 5.77 | 3.62 | 4.61 | 8.85 | 10.29 | 9.57 | 9.55 | 10.74 | 9.21 | 10.38 | 10.96 |
| 2004 | 12.2 | 12.18 | 12.3 | 8.16 | 2.34 | 1.33 | 0.61 | 4.89 | 9.4 | 8.94 | 3.84 | 0.5 |
| 2005 | 2.87 | 4.71 | 2.16 | 3.75 | 7.91 | 8.21 | 12.91 | 14.27 | 19.38 | 19.48 | 17.74 | 16.99 |
| 2006 | 16.98 | 18.79 | 21.15 | 22.14 | 22.91 | 13.7 | 11.76 | 12.06 | 15.63 | 14.6 | 15.83 | 18.97 |
| 2007 | 15.43 | 9.24 | 7.53 | 3.46 | 4.03 | 4.65 | 0.89 | 0.29 | 1.1 | 4.45 | 6.77 | 7.79 |
| 2008 | 10.84 | 11.43 | 11.91 | 14.69 | 16.78 | 21.42 | 25.76 | 26.4 | 26.06 | 27.29 | 27.03 | 26.75 |
| 2009 | 26.03 | 26.44 | 26.75 | 25.72 | 24.16 | 23.99 | 30.46 | 37.91 | 37.21 | 22.44 | 11.72 | 6.6 |

This is the node that is closest the GBRA1 salinity monitoring site as shown in Figure 15.

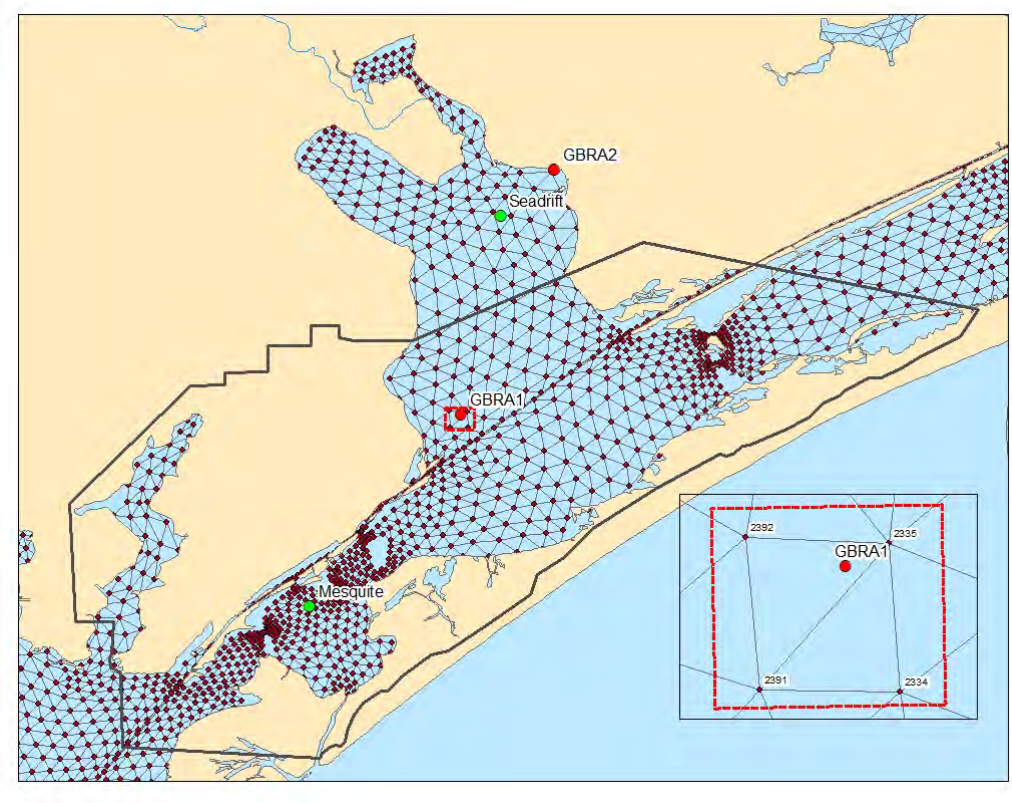



**Figure 15 Location of GBRA1 monitoring stations within TxBLEND model domain**

In order to assess the impact of water rights diversions on salinity conditions, inflows from the Guadalupe and San Antonio Rivers were adjusted based on the two alternative water diversion scenarios described above and the TxBLEND model was rerun to simulate salinity conditions based on the freshwater inflow estimates produced by these scenarios.

As noted above there are many times when inflows exceed the flows needed to produce moderate salinity conditions in the bay under either scenario. It is during the low flow periods when these diversions can have significant effect on bay salinities. (GSA BBEST 2011) The most recent drought in the Guadalupe and San Antonio River Basins occurred in 2008 – 2009. To isolate the impact of diversions in this period, the model was re-run for all three scenarios assuming the same starting conditions from October 2007 (a wet period just before the drought began) through December 2009 (a few months after the drought broke). This bracketing of the drought is depicted in Figure 20 which shows the whole bay salinity conditions within 5 PSU salinity bins. From Figure 20 we see that the bay begins this period with more than half of the bay having salinities less the 15 PSU and returns this condition in the fall of 2009.

Figure 16 through Figure 18 show the salinity gradients based on with 25 PSU isohaline thresholds for the months from May 2008 till April 2009. Notably, when assuming existing diversions, the model predicted that very little of the Designated Critical Habitat Area (DCHA) for Whooping Cranes would have had salinities less than 25 PSU. This is consistent with observed salinity measurements at the GBRA1 monitoring site. If the water diverted were instead passed down to the bay, the 25 PSU isohaline would have moved much farther into the Designated Critical Habitat Area.

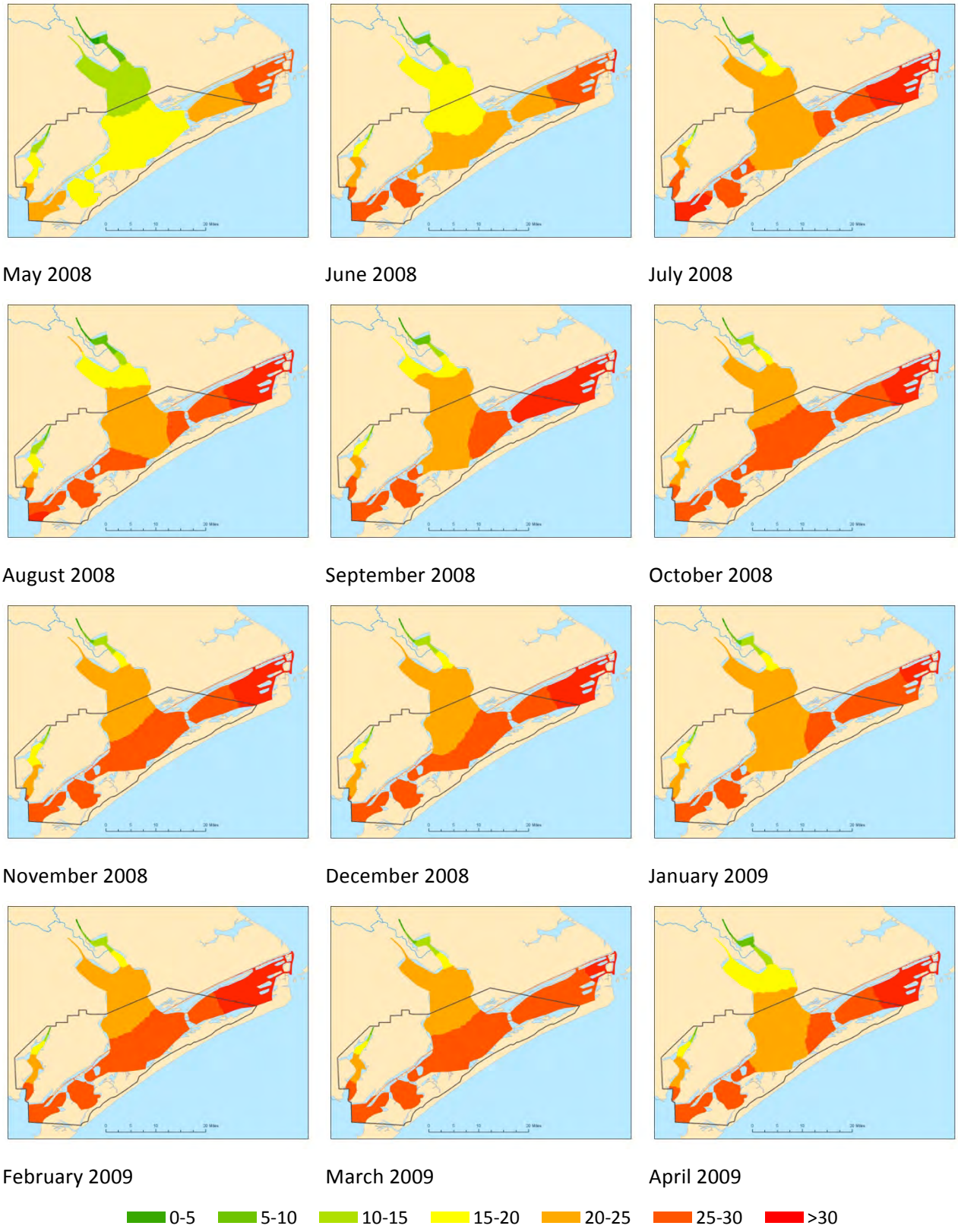



**Figure 16 Simulated salinities based on inflows increased based on the asusmption that reported diversions are passed to the bay.**

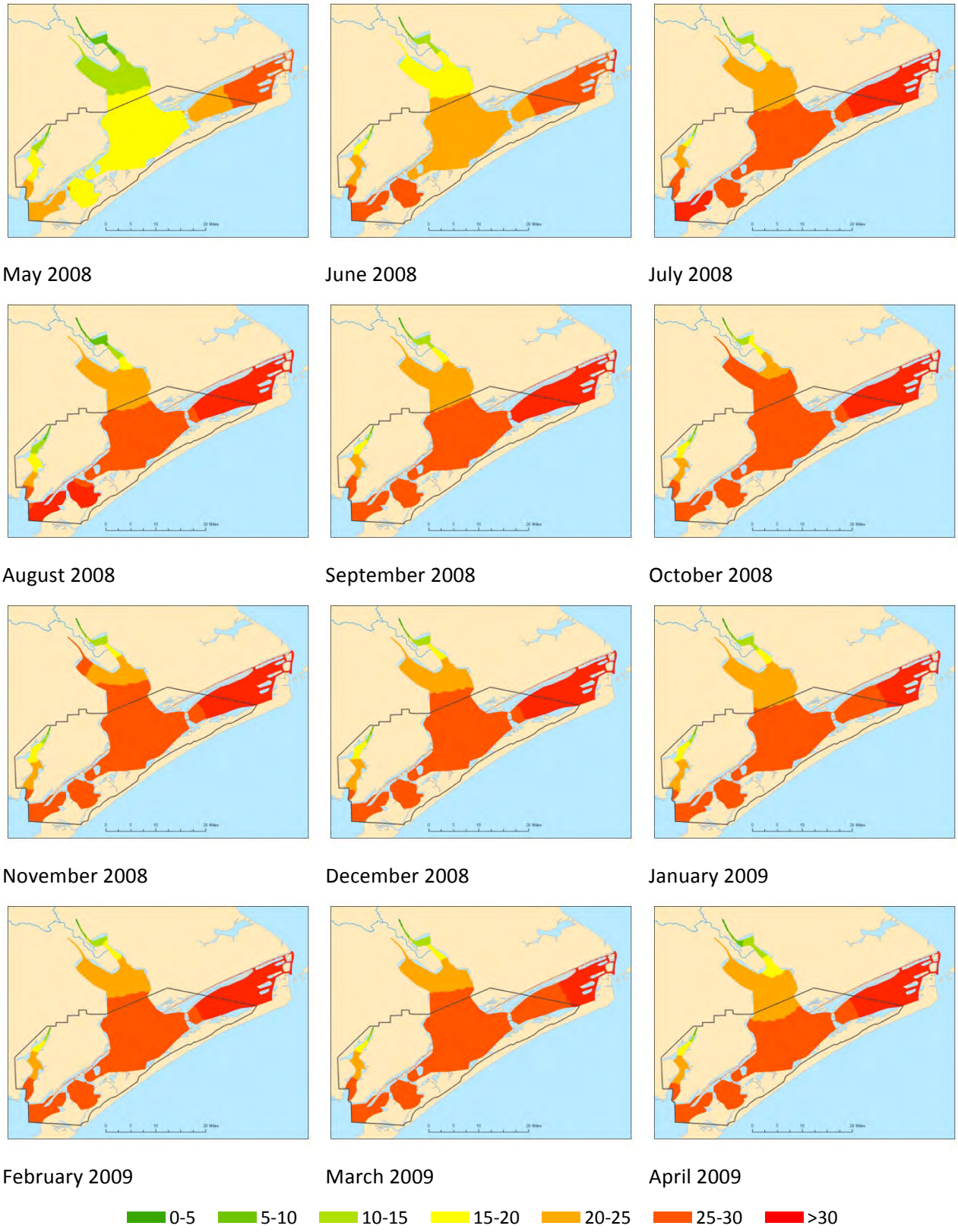



**Figure 17 Simulated salinities based on historical inflows, which were reduced dues to diversions.**

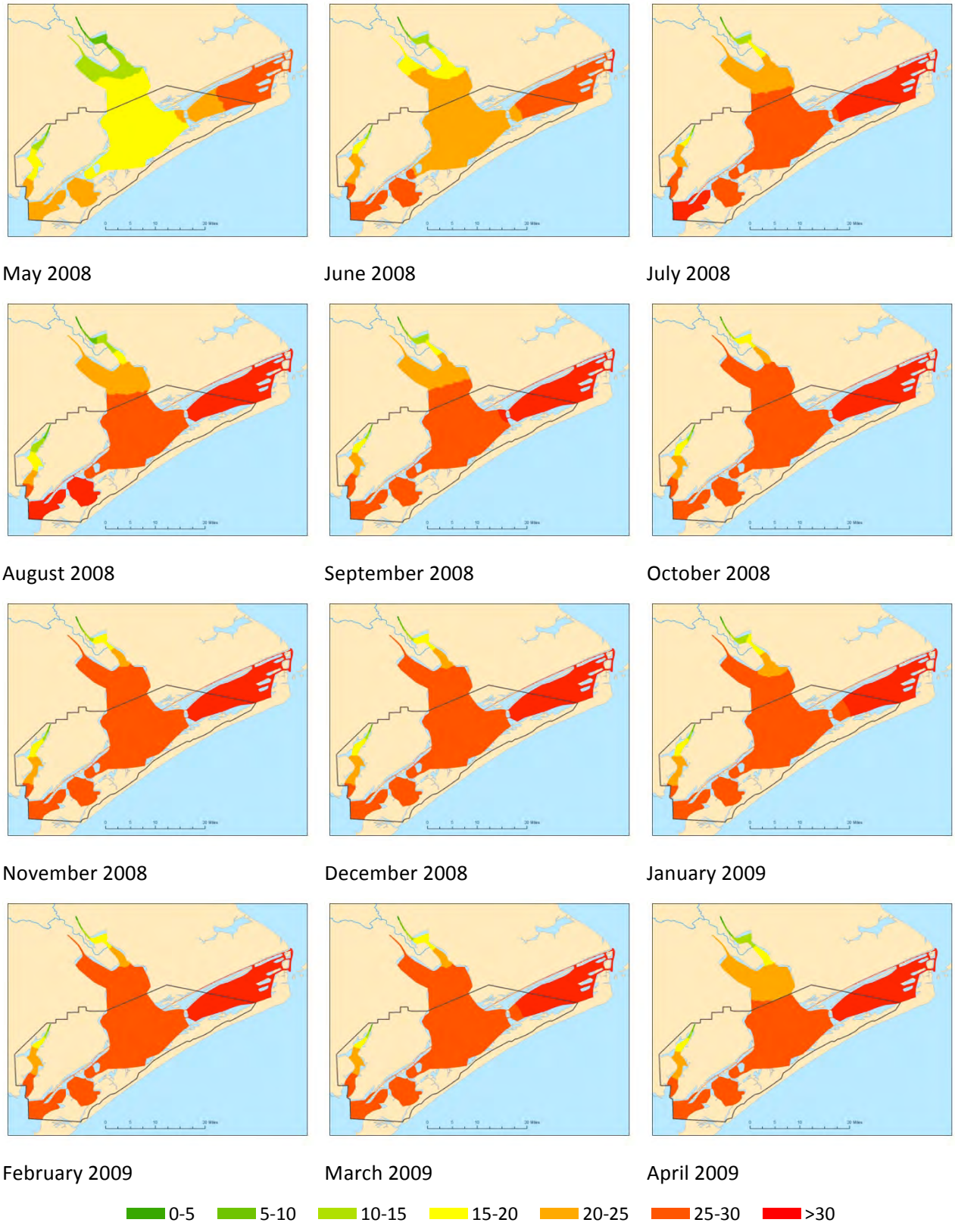



**Figure 18 Simulated salinities based on inflows assuming additional reductions based on the full permited use of water rights permits 5172-5178.**

Figure 19 through Figure 21 below present the same information in a different format.

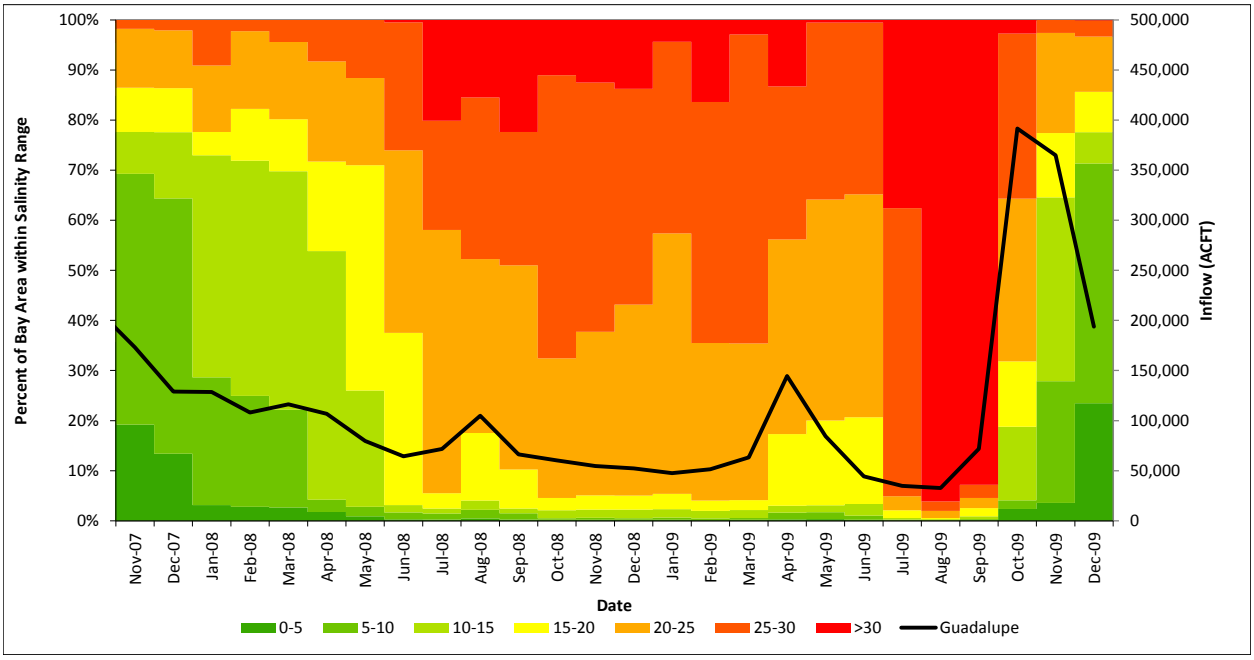



**Figure 19 Simulated salinities based on inflows increased based on the assumption that reported diversions are passed to the bay.**

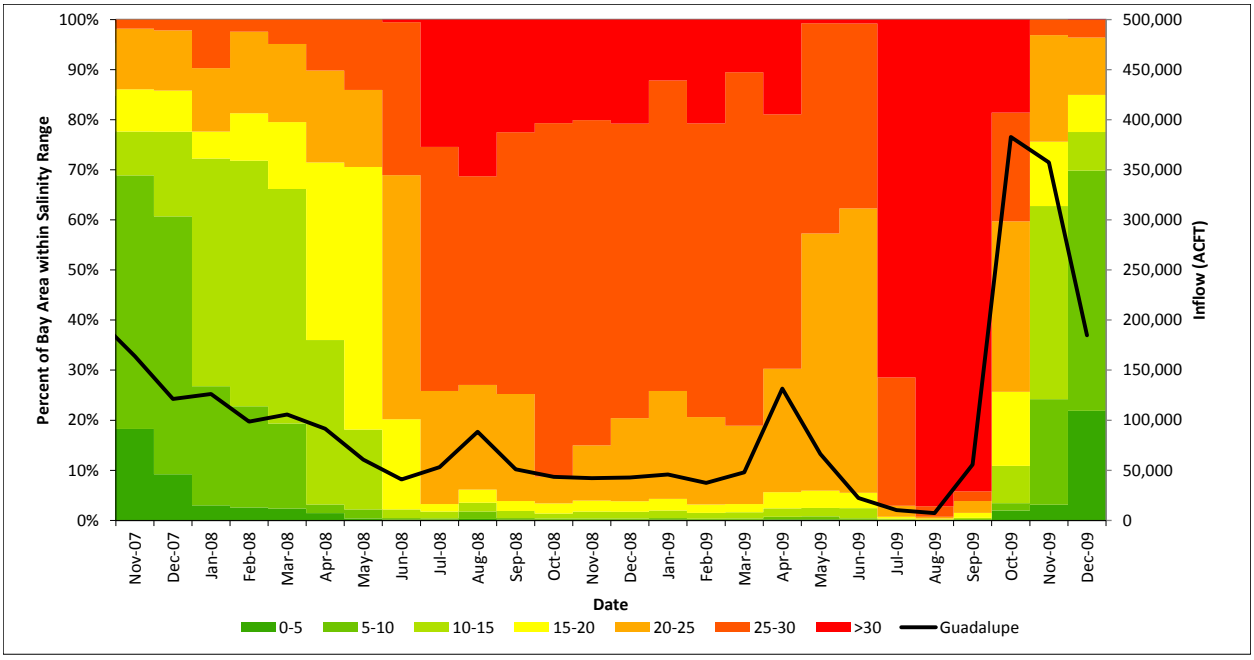



**Figure 20 Simulated salinities based on historical inflows which were reduced due to diversions.**

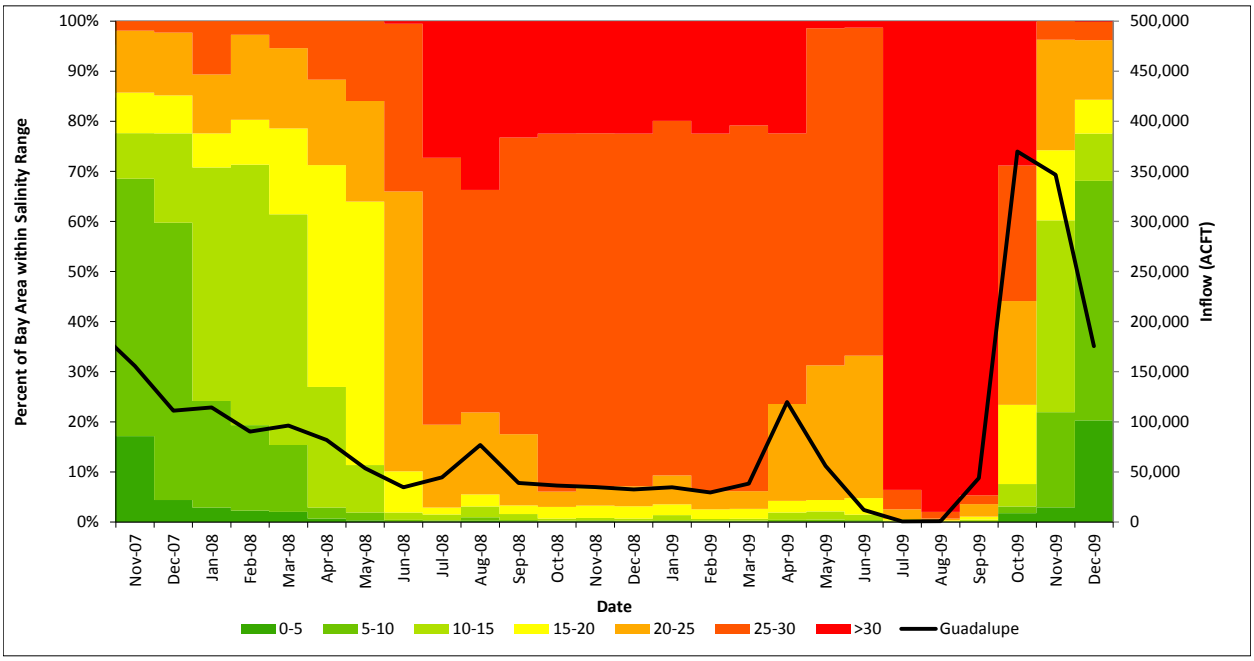



**Figure 21 Simulated salinities based on inflows assuming additional reductions based on the full permited use of water rights permits 5172-5178.**

Table 9 summarizes these results in Figure 16 through Figure 18, showing percent of the bay with salinities less than 25 PSU. Even assuming that all of the water diverted was passed to the bay, 2008-09 would be considered a severe drought, however much of the bay would still have experienced significant areas with salinities between 20 and 25 PSU. Historical water use resulted a situation where about half of that area was greater than 25 PSU. Full exercise of GBRA's lower basin water rights (5172 - 5178) would be expected to produce a prolonged period of salinities greater than 25 PSU more than 90 percent of the bay.

**Table 9 Percent of bay area with salinity less than 25 PSU.**

| Date | Add Effect of Exisitng Divers Back to Freshwater inflow | Historical Flows which Include Reported Diversions | Historical Flows which Include Reported Diversions Plus Full Use of LOWER GBRA Water rights (5172-5178) |
|---|---|---|---|
| May-08 | 88% | 86% | 84% |
| Jun-08 | 74% | 69% | 66% |
| Jul-08 | 58% | 26% | 19% |
| Aug-08 | 52% | 27% | 22% |
| Sep-08 | 51% | 25% | 18% |
| Oct-08 | 32% | 9% | 6% |
| Nov-08 | 38% | 15% | 7% |
| Dec-08 | 43% | 20% | 7% |
| Jan-09 | 57% | 26% | 9% |
| Feb-09 | 35% | 21% | 6% |
| Mar-09 | 35% | 19% | 6% |
| Apr-09 | 56% | 30% | 24% |
| May-09 | 64% | 57% | 31% |

**6. The Cumulative Salinity Departure (CSD) approach developed for the LCRA permit 5731 is a method that could be employed to protect the health of San Antonio Bay.**

While there has been considerable development in the estimation of the freshwater inflows needs for San Antonio Bay over the last several decades there has been less progress on developing the kinds water management strategies can be implemented to ensure that sufficient freshwater inflows are maintained so as to provide for a sound ecological environment into the future. One promising approach has recently been developed in the Colorado River Basin to help manage inflows for Matagorda Bay. This was the result of a settlement agreement between the Lower Colorado River Authority (LCRA) and the protestants opposing the issuance of water rights permit 5731. (SOAH Docket No. 582-08-0689). The terms of the settlement agreement were fully incorporated into the final permit issued by the TCEQ on April 29, 2011 (attached as Exhibit B).

Under the approach developed for this basin, freshwater inflows and salinity conditions will be monitored on a daily basis and a set of criteria, linked to these measurements, which will be used to inform water diversion decisions. The broad goal was to develop practical approach to identify what experts in the basin recognize as severe droughts. The approach they developed is called a Cumulative Salinity Departure (CSD). In the Colorado system it works as follows

1. When average daily salinity at the defined monitoring site exceeds 23 ppt, the absolute value of the difference between the salinity value and 23 ppt shall be added to a running total of CSD
2. When average daily salinity is below 23 ppt, the absolute value of the difference shall be subtracted.
3. If the resulting CSD would otherwise be a negative value it shall be set to zero
4. When CSD equals 2,200 the system is defined as being in a severe drought

The methodology also includes a number of additional criteria linked to either high freshwater inflows or low salinity that reset the CSD calculations.

Thresholds and criteria specific to San Antonio Bay would need to be developed and evaluated however this approach provides a reasonable, rational method for understanding when severe drought occurs and trigger appropriate management actions to respond to these conditions and potentially minimize the impacts of drought exacerbated by human alterations to freshwater inflows.

**CONCLUSIONS**

Salinities in San Antonio Bay were high during the 2008-09 period. This was period of drought and low flows but this report shows that if no one consumed any water, it would be less saline. If just GBRA used their full permitted rights in the lower basin, it would have been even more saline. Any new permits for diversions and impoundments will make the matter worse, as will full use of all other existing permits. Finally, the San Antonio Bay is 'quite' sensitive: Changes in inflow as a result of decreased or increased diversions can have a significant impact on salinities. i.e. this analysis shows that 100,000 acft difference over several months or a year, can make a difference and significantly raise or lower salinities over large parts of the bay.

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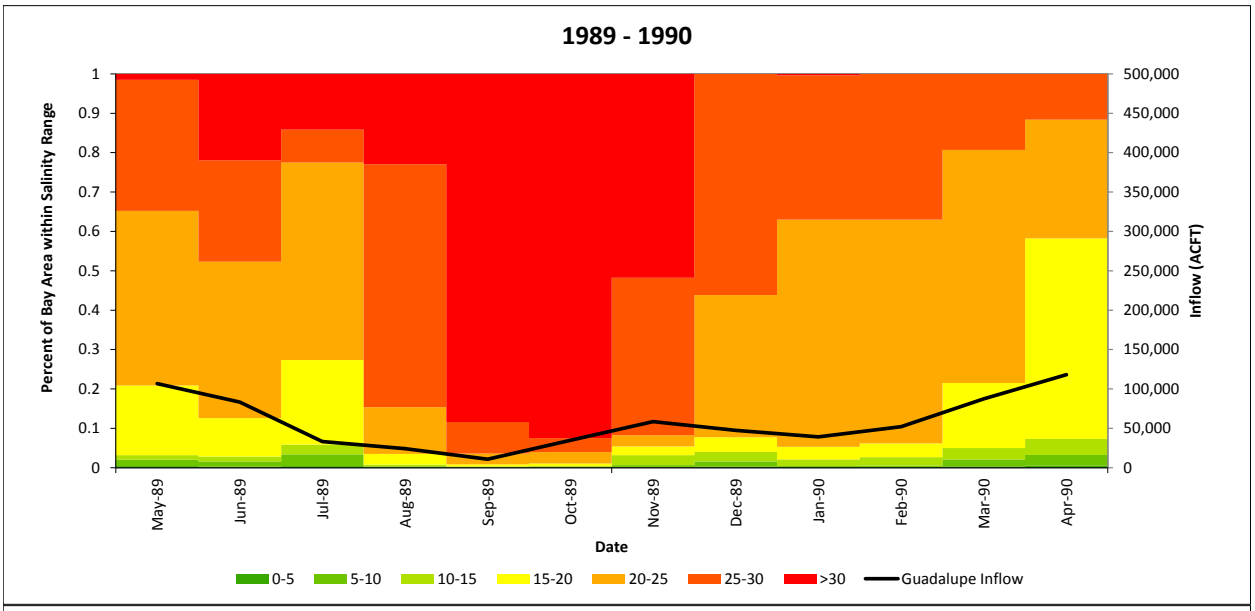
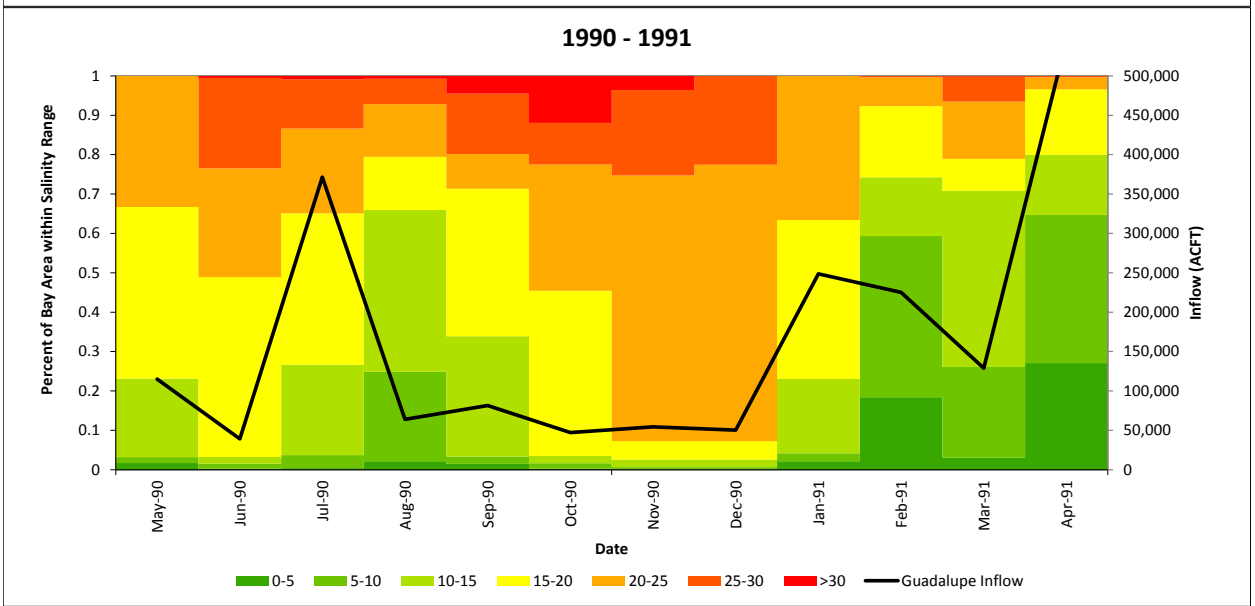
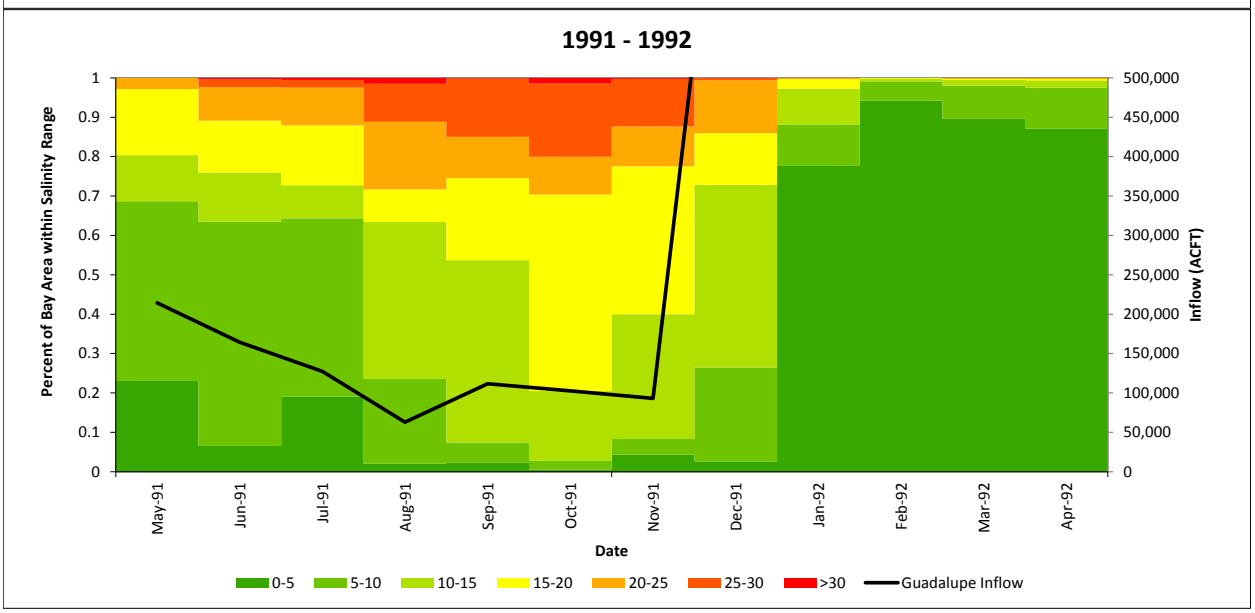
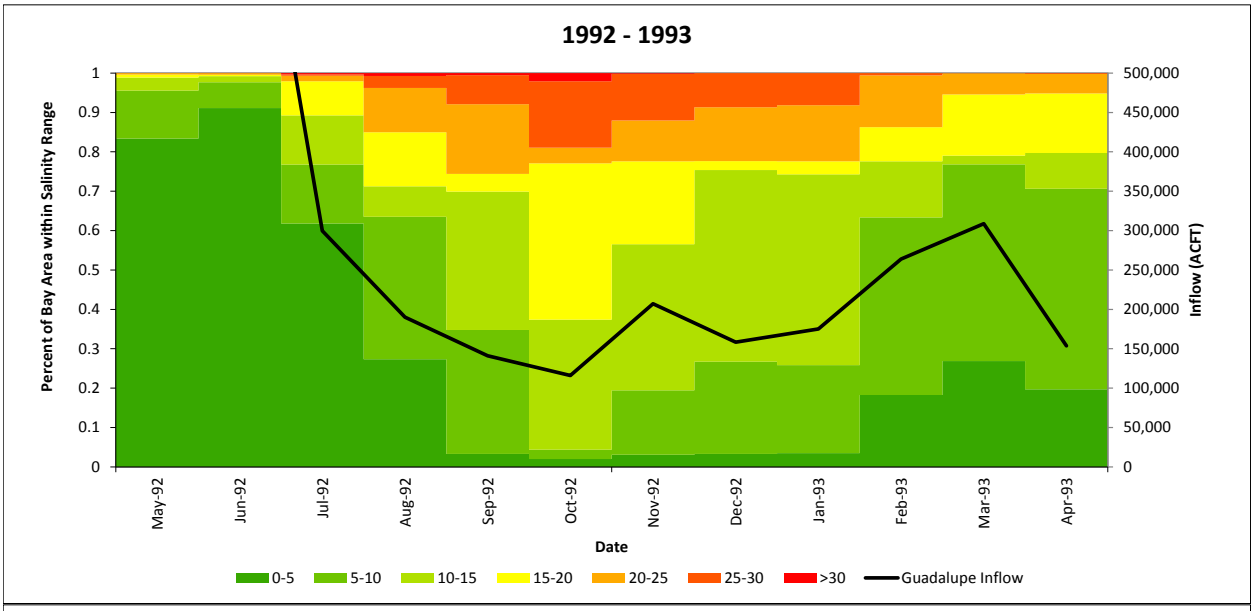
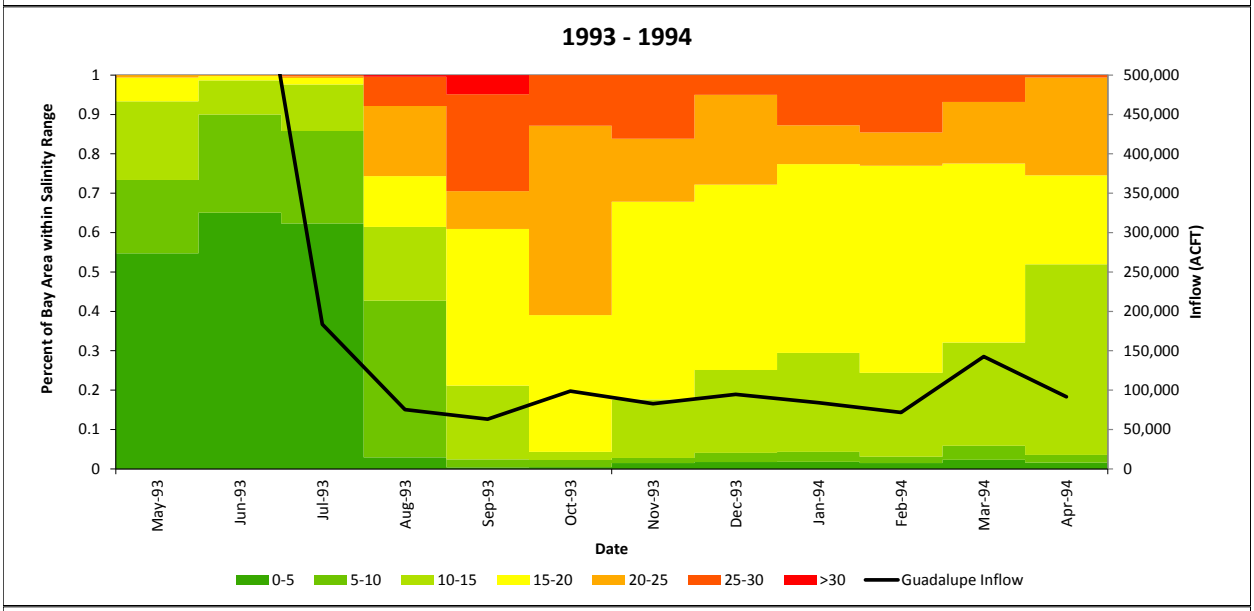
Appendix A - Salinity zonation- freshwater inflow figures.

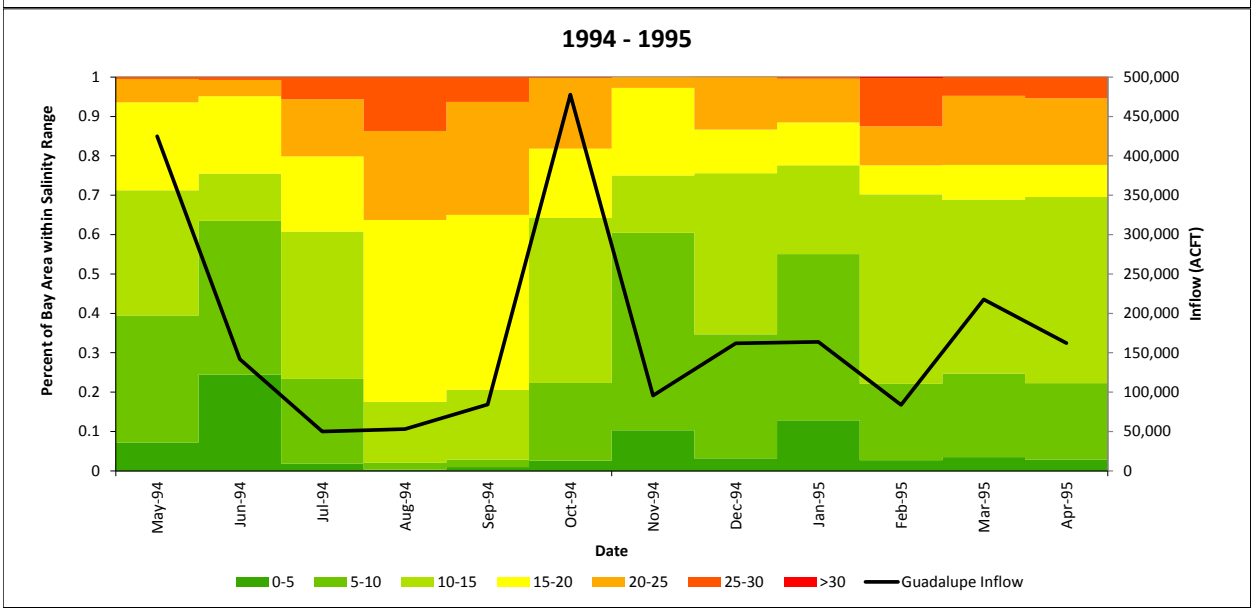


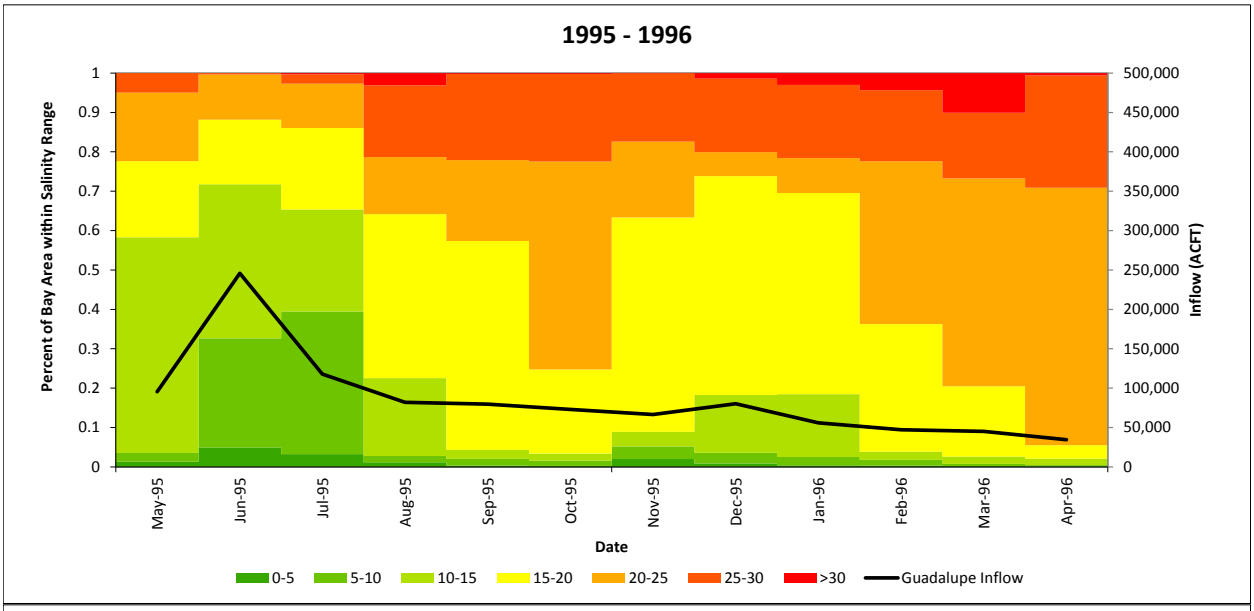



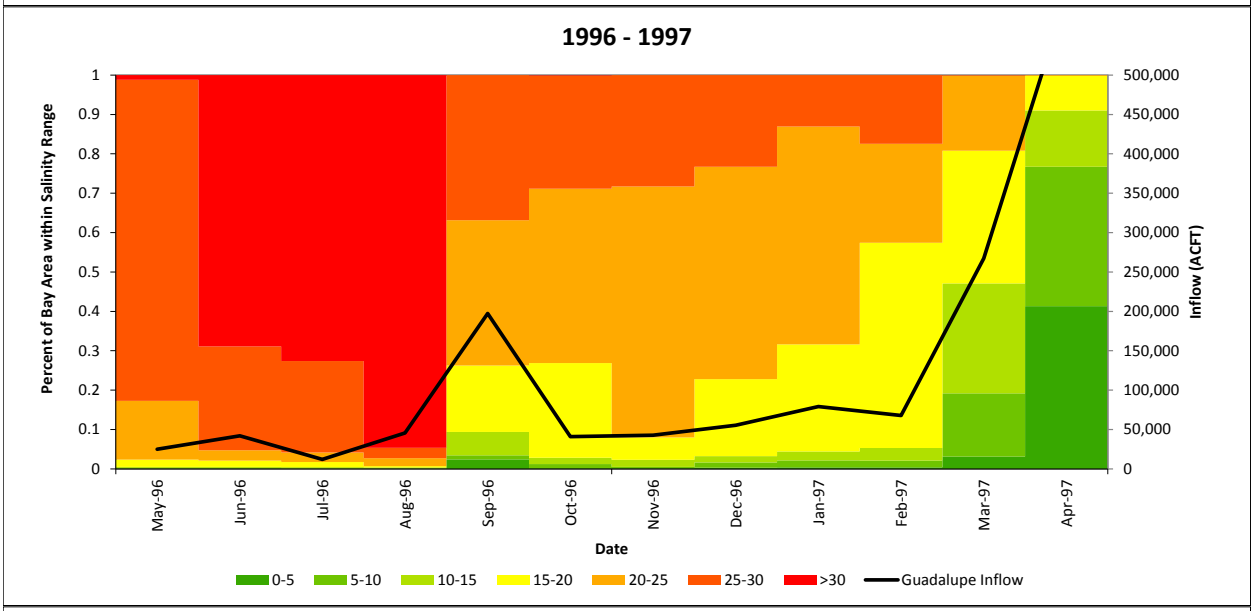



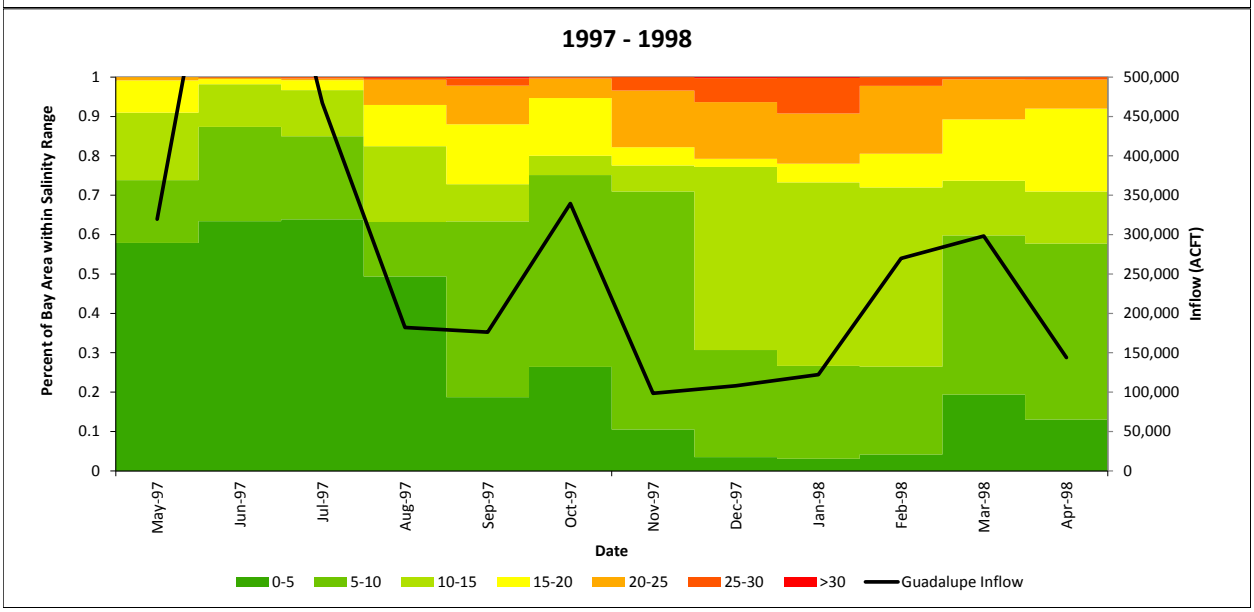

1992 - 1993
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-92
Jun-92
Jul-92
Aug-92
Sep-92
Oct-92
Nov-92
Dec-92
Jan-93
Feb-93
Mar-93
Apr-93
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow

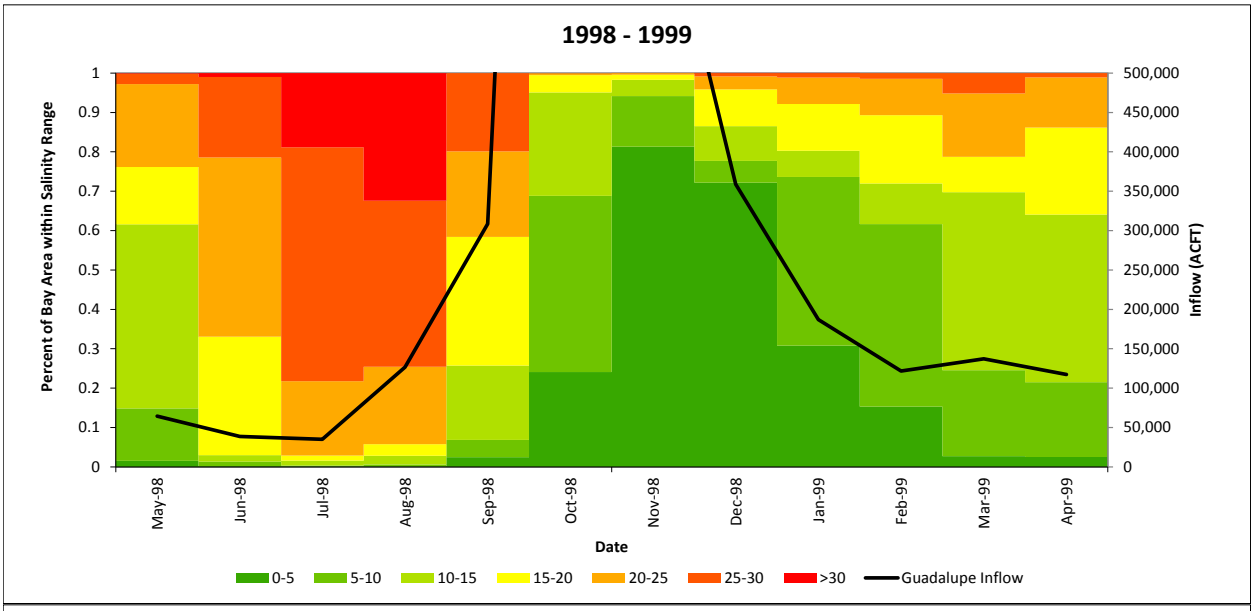

1993 - 1994
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-93
Jun-93
Jul-93
Aug-93
Sep-93
Oct-93
Nov-93
Dec-93
Jan-94
Feb-94
Mar-94
Apr-94
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow

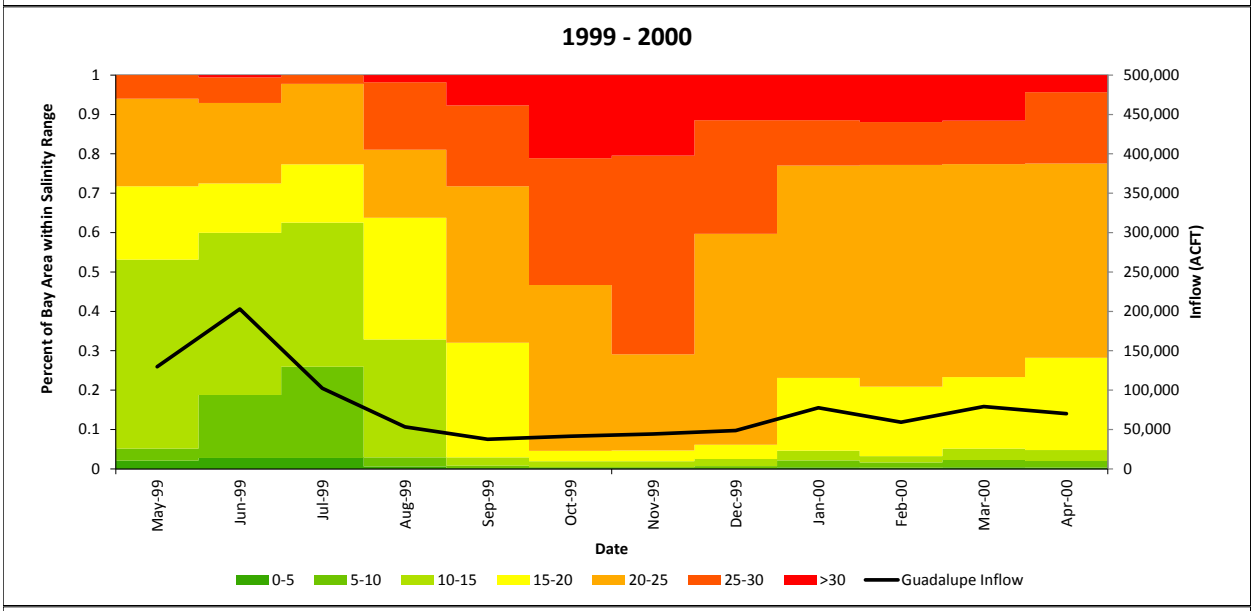

1994 - 1995
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-94
Jun-94
Jul-94
Aug-94
Sep-94
Oct-94
Nov-94
Dec-94
Jan-95
Feb-95
Mar-95
Apr-95
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow

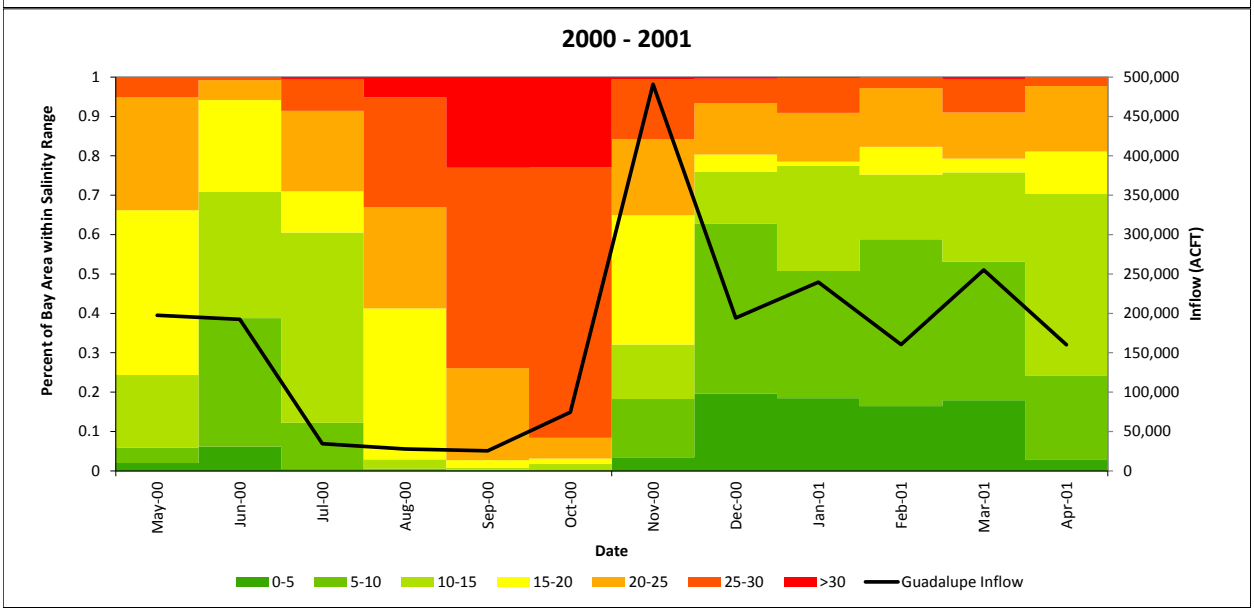

1995 - 1996
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-95
Jun-95
Jul-95
Aug-95
Sep-95
Oct-95
Nov-95
Dec-95
Jan-96
Feb-96
Mar-96
Apr-96
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow


1996 - 1997
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-96
Jun-96
Jul-96
Aug-96
Sep-96
Oct-96
Nov-96
Dec-96
Jan-97
Feb-97
Mar-97
Apr-97
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow


1997 - 1998
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-97
Jun-97
Jul-97
Aug-97
Sep-97
Oct-97
Nov-97
Dec-97
Jan-98
Feb-98
Mar-98
Apr-98
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow


1998 - 1999
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-98
Jun-98
Jul-98
Aug-98
Sep-98
Oct-98
Nov-98
Dec-98
Jan-99
Feb-99
Mar-99
Apr-99
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow


1999 - 2000
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-99
Jun-99
Jul-99
Aug-99
Sep-99
Oct-99
Nov-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow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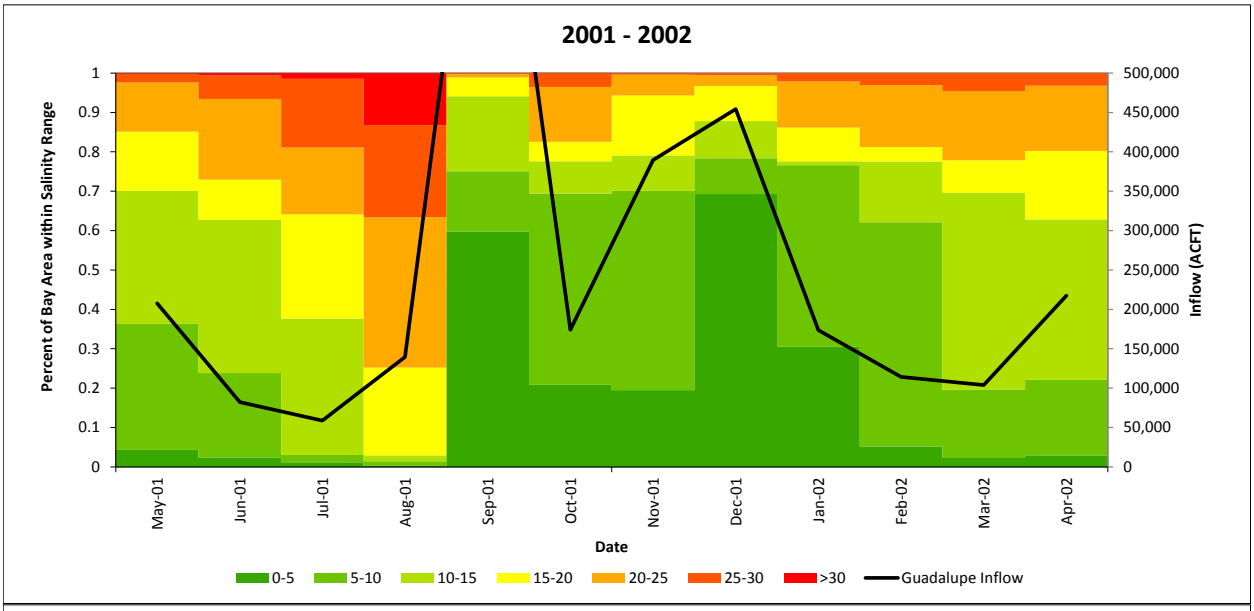
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00
Nov-00
Dec-00
Jan-01
Feb-01
Mar-01
Apr-01
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow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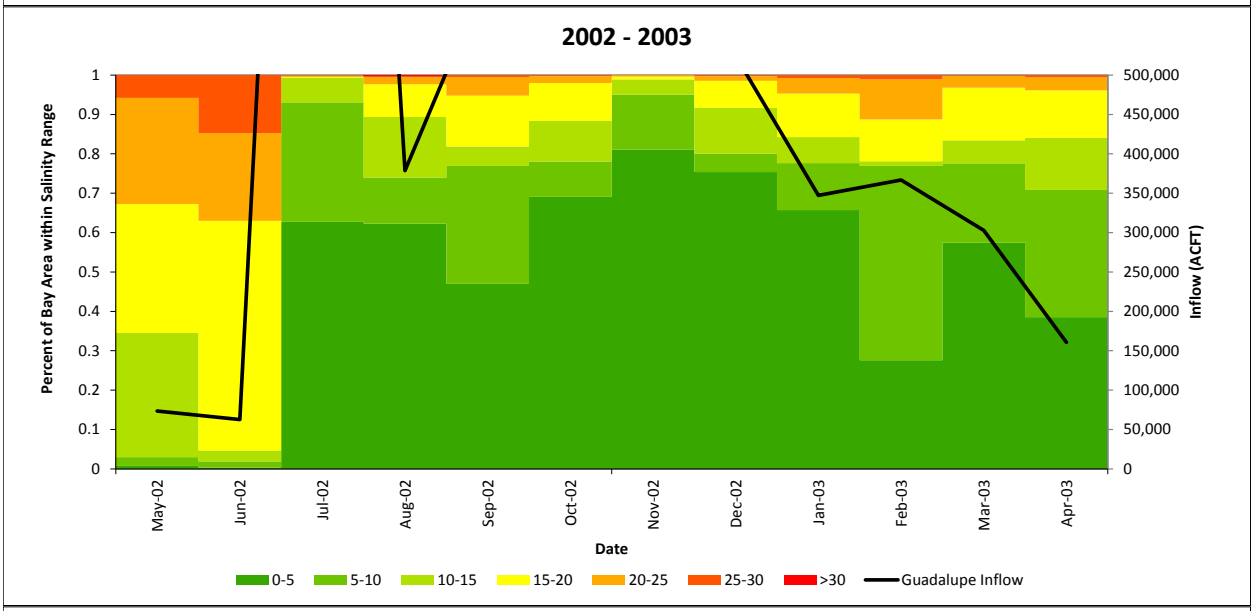
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-01
Jun-01
Jul-01
Aug-01
Sep-01
Oct-01
Nov-01
Dec-01
Jan-02
Feb-02
Mar-02
Apr-02
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow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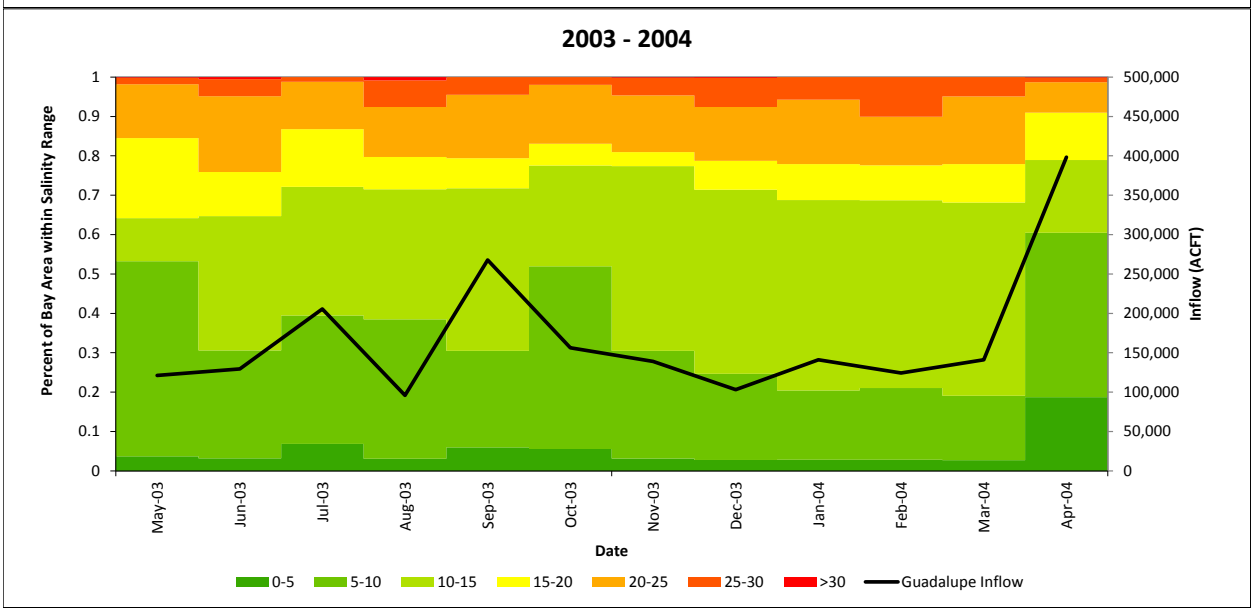
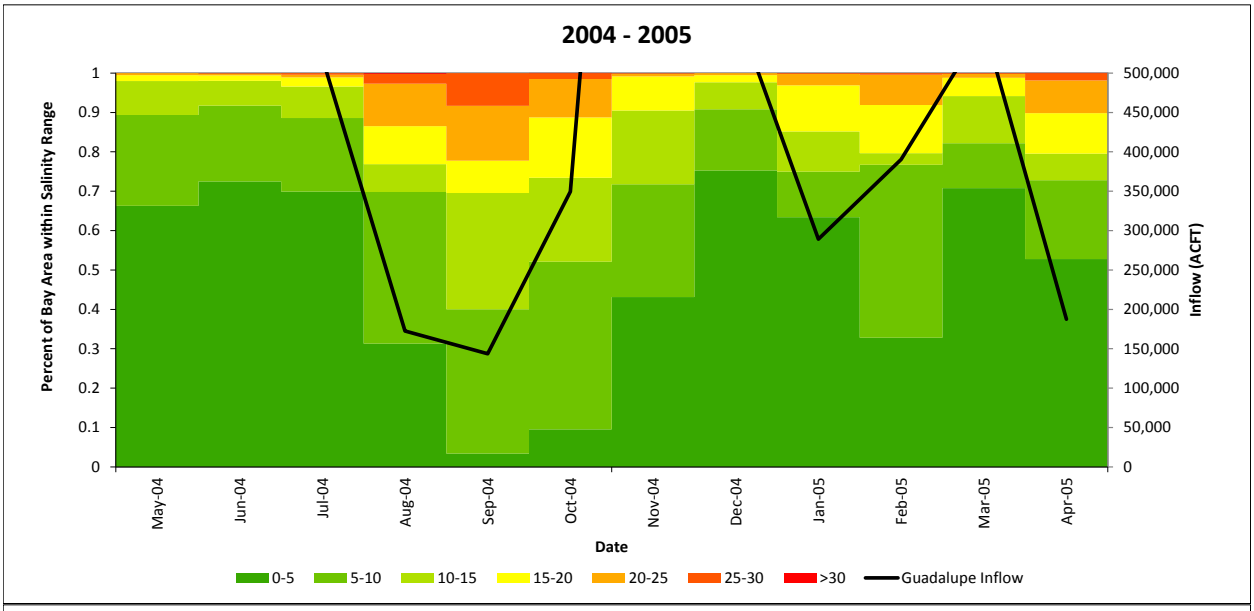
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-02
Jun-02
Jul-02
Aug-02
Sep-02
Oct-02
Nov-02
Dec-02
Jan-03
Feb-03
Mar-03
Apr-03
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow


2003 - 2004
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-03
Jun-03
Jul-03
Aug-03
Sep-03
Oct-03
Nov-03
Dec-03
Jan-04
Feb-04
Mar-04
Apr-04
0-5
5-10
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow


2004 - 2005
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-04
Jun-04
Jul-04
Aug-04
Sep-04
Oct-04
Nov-04
Dec-04
Jan-05
Feb-05
Mar-05
Apr-05
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10-15
15-20
20-25
25-30
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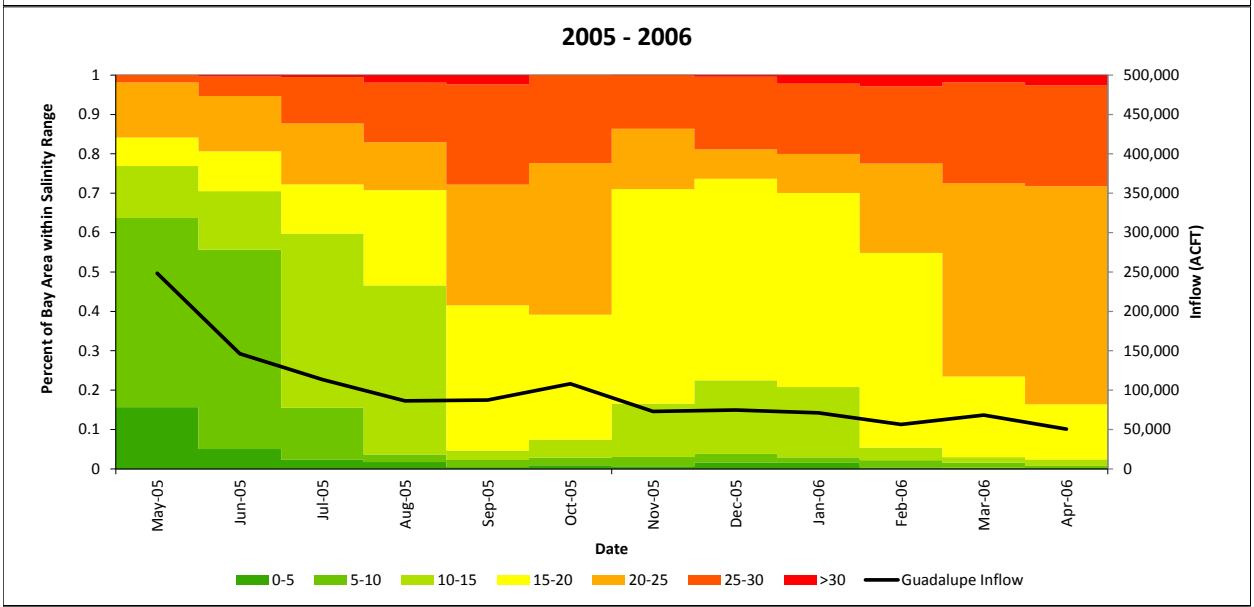
Guadalupe Inflow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Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-05
Jun-05
Jul-05
Aug-05
Sep-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
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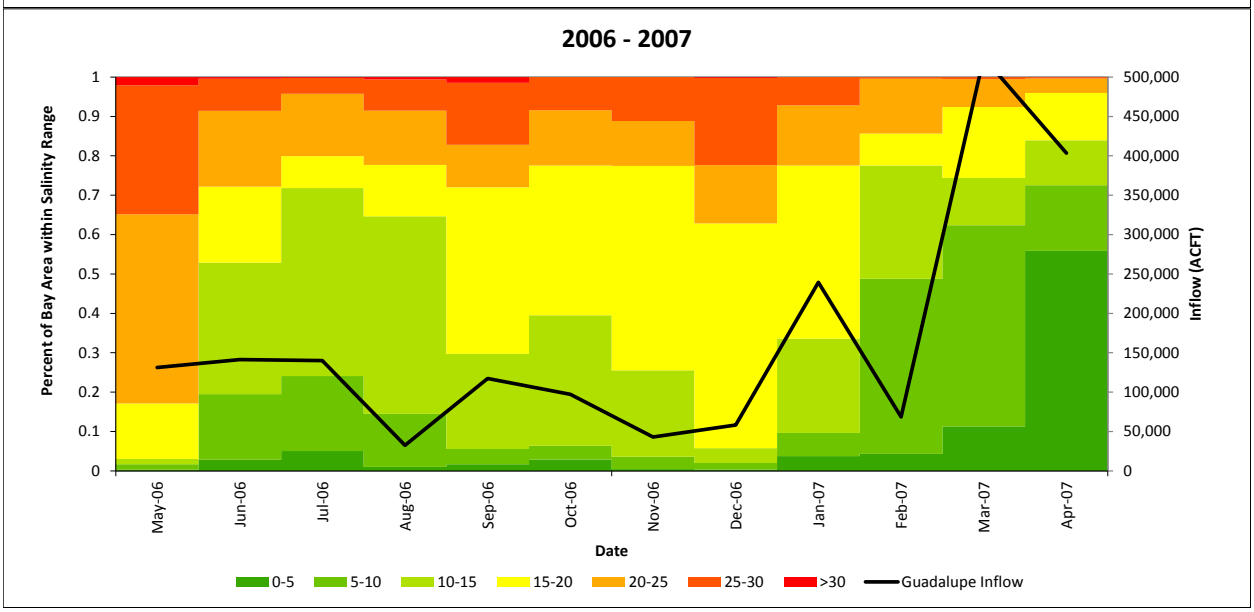
15-20
20-25
25-30
>30
Guadalupe Inflow


2006 - 2007
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-06
Jun-06
Jul-06
Aug-06
Sep-06
Oct-06
Nov-06
Dec-06
Jan-07
Feb-07
Mar-07
Apr-07
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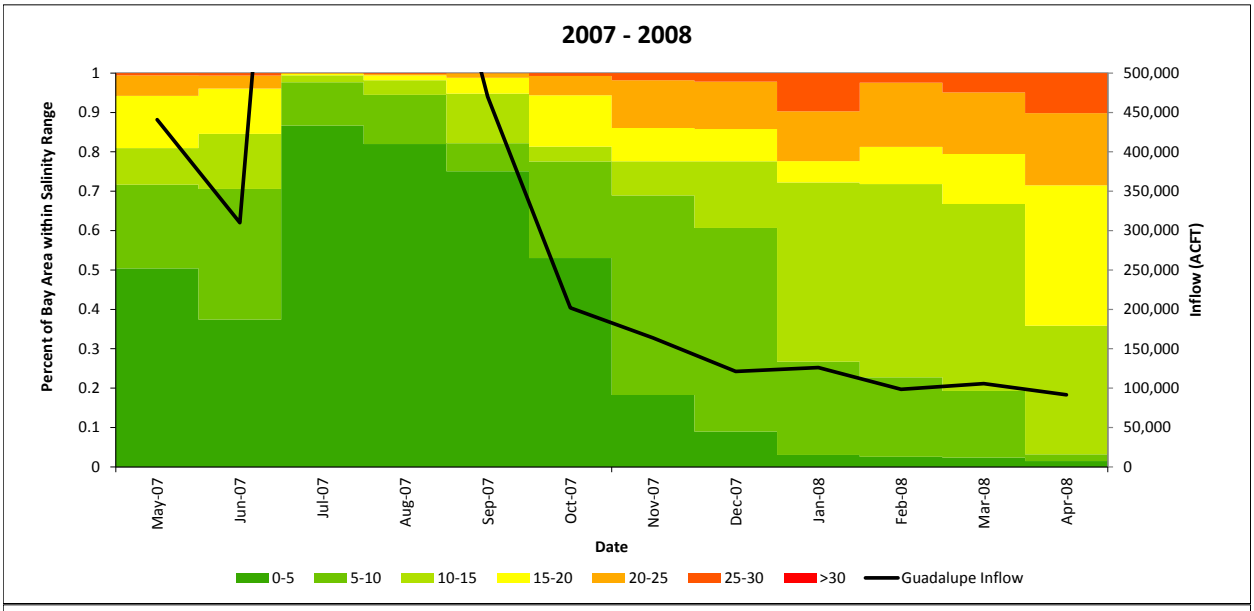
15-20
20-25
25-30
>30
Guadalupe Inflow


2007 - 2008
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-07
Jun-07
Jul-07
Aug-07
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
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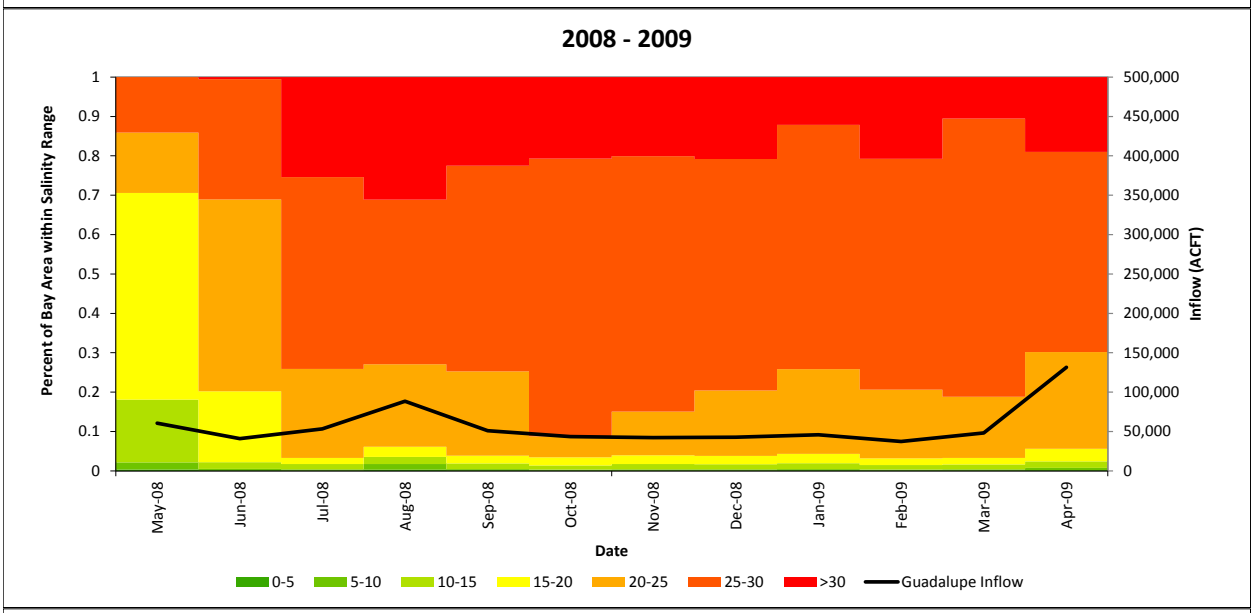
10-15
15-20
20-25
25-30
>30
Guadalupe Inflow


2008 - 2009
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
0-5
5-10
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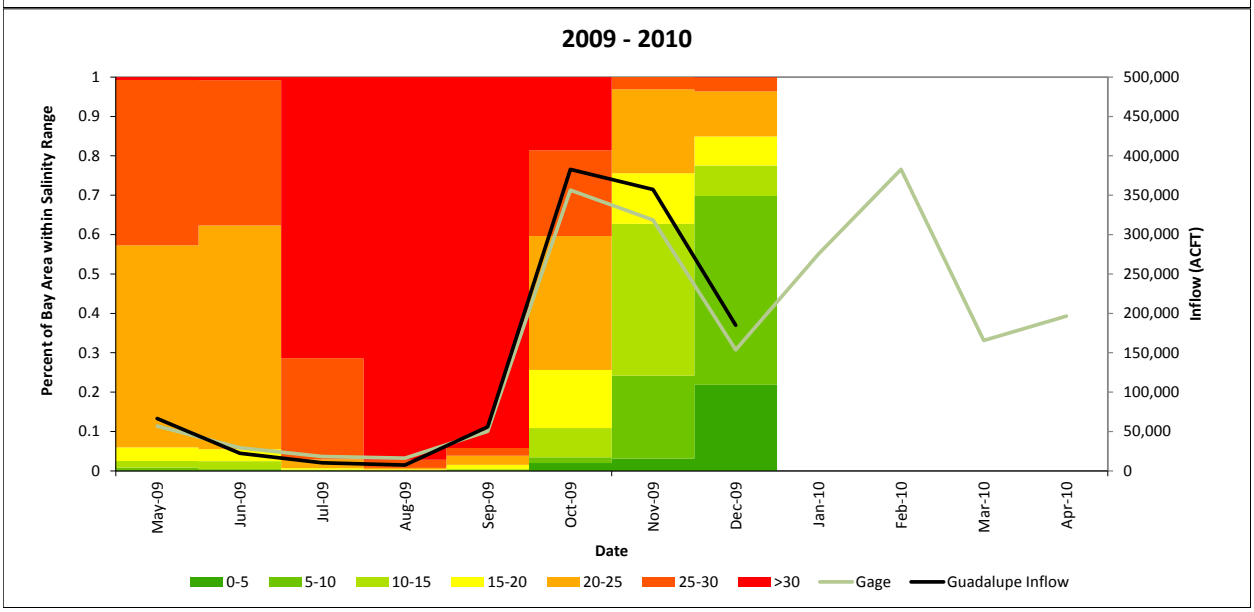
Guadalupe Inflow


2009 - 2010
Percent of Bay Area within Salinity Range
Inflow (ACFT)
Date
May-09
Jun-09
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# EXHIBIT D

IN THE UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
CORPUS CHRISTI DIVISION

| | | |
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| THE ARANSAS PROJECT, | * | CIVIL ACTION |
| PLAINTIFF, | * | CA-C-10-075 |
| VS. | * | |
| BRYAN SHAW, ET AL., | * | CORPUS CHRISTI, TEXAS<br>DECEMBER 8, 2011 |
| DEFENDANT. | * | 8:35 A.M. |

* * * * * * * * * * * * * * * * * * *

TRANSCRIPT OF BENCH TRIAL - DAY 4

BEFORE THE HONORABLE JANIS GRAHAM JACK
SENIOR UNITED STATES DISTRICT JUDGE

APPEARANCES:

FOR THE PLAINTIFF: MR. JAMES B. BLACKBURN, JR.
MR. CHARLES IRVINE
MS. MARY CONNER
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| ALSO PRESENT: | MR. TODD CHENOWETH<br>MR. BILL WEST<br>MS. SUZANNE SCOTT |

THE COURT: Okay.

(Witness sworn.)

THE COURT: What's wrong? Has he got fresh water?

MR. MUNDY: That's what I was checking.

ALBERT JOHNSON, PLAINTIFF'S WITNESS NO. 12, SWORN

DIRECT EXAMINATION

BY MR. IRVINE:

Q. Please state your name for the record.

A. Albert Johnson.

Q. And could you tell me what town you live in?

A. I currently live in Rockport.

Q. And are you a member of The Aransas Project, the Plaintiff in this case?

A. Yes, I am.

Q. When did you join The Aransas Project?

A. Shortly after they started rolling.

Q. Okay.

THE COURT: After they started what?

THE WITNESS: After they organized.

THE COURT: Oh, okay.

THE WITNESS: Yes, ma'am.

BY MR. IRVINE:

Q. Do you recall roughly what year that was?

A. No, I became aware from one of the Commissioners, and the judge that was here earlier is my cousin, so he and I talked

about it, so -- the County was going to support them, and I thought that it would be good to also be there.

Q. Thank you. So you own a place in Rockport. Do you also own another property?

A. Yes. We own a small ranch on the Lamar Peninsula.

Q. Can you tell me the name of that ranch?

A. It's known as the Johnson Ranch.

Q. And can you describe roughly where on Lamar the Johnson Ranch is?

A. It's adjacent to the wildlife refuge. It would be a shoebox or rectangular piece of land that would be adjacent on their south fence line.

Q. So you're neighbors with the refuge?

A. Yes. We share a common fence.

Q. You share a common fence with the refuge?

A. Yes.

Q. And do you know the name of that part of the refuge? Because each of the refuges have different names, units.

THE COURT: Lamar Peninsula?

THE WITNESS: Cow Chip would be that --

THE COURT: Cow Chip?

THE WITNESS: -- water feature.

THE COURT: Okay. Just like it sounds?

THE WITNESS: Yes.

THE COURT: Okay.

BY MR. IRVINE:

Q. Is that part of the Lamar unit perhaps?

A. Yes.

Q. Okay. And can you describe to the Judge, after you bought the property, what happened to certain portions of that property?

A. We bought the property in 1999, and I believe there was around 850 acres. We conveyed 245 acres more or less that were wetlands to The Nature Conservancy. It later took about two years, and it went forward to the U.S. Fish and Wildlife. We retained 545 acres of upland, and we put a conservation easement on that a couple of years after we sold the wetlands, maybe in about '04, with Carter Smith. And we retained a 10 acre tract in the middle of that to build our homestead on.

Q. So you've conveyed a portion of the wetland to Nature Conservancy, and then you put a conservation easement on a significant portion of the remainder of the upland property?

A. Yes. And they did in fact purchase the wetland.

Q. Who purchased the wetland?

A. The Nature Conservancy, with GLO money, and I believe we got, seems like about 96,000.

Q. Okay. And do you know what date that portion of wetland that you passed on to Nature Conservancy was then passed on to the refuge?

A. Late in the year in '04, I believe.

Q. Okay.
A. '03 or '04.
THE COURT: All of it? Okay. You're saying "yes"?
THE WITNESS: Yes.
THE COURT: You have to say it out loud. I'm sorry.
THE WITNESS: Sorry, Your Honor.
THE COURT: You're not used to this.
THE WITNESS: I'm very nervous.
THE COURT: Don't be. I mean, you know, all the -- you should look around, the wall, the chairs, you all paid for this. This is your courthouse.
BY MR. IRVINE:
Q. Can you explain to the Judge why you sold a portion of your land to Nature Conservancy and why then it was acquired by the refuge? What was on that piece of land?
A. When we first bought the land, we were unaware of the significant whooping crane habitat that was there, and we were shocked at the number of cranes and the activity. We were surprised. It was a bonus. But I immediately recognized that I was not in a position to police or control that properly, and that was why my thinking went in the direction of conveying it.
Q. And so when you conveyed it, was there a whooping crane territory on that portion of wetland that you sold?
A. Yes.
Q. How many cranes there?

A. There's a pair of cranes there that I've had a love affair with since '99, and they've been very, very prolific. It's been a wonderful 12 years.
Q. Are these the cranes that Mr. Stehn's report sometimes refer to as the Johnson Ranch pair?
A. That's correct.
Q. And so that wetland that you conveyed is now part of the refuge, but it is adjoining to your remaining property?
A. That's correct.
Q. And you watched over the years many juveniles come and be raised on that territory?
A. Many pairs actually.
Q. Many pairs?
A. Yes.
Q. Is it not true that that pair of Johnson Ranch cranes is one of the most productive in the flock?
A. They're very near the top, I would believe.
Q. And are the cranes, when they're in the territory, are they visible from your property?
A. Often.
Q. So you can look out onto the wetland and see the cranes. Can you describe for the Judge the business that you operate on the Johnson Ranch?
A. We bought the ranch, we built a small efficient two-bedroom house, and it was for a personal retreat. It was

on borrowed money. We soon began to think about cash flow, and so we began to lease that, and we put a deer feeder up to feed the wildlife, and very shortly the cranes arrived. So I immediately called Tom Stehn, and it's been an evolution, I guess you would say, over a ten or twelve-year period.

Q. And what is the name of that business?

A. Crane House.

Q. And you rent it out to what kind of people?

A. Tourists, photographers, naturalists. We try to support any crane research. We're friendly with all the researchers. They have the run of our land.

Q. Okay. So can you name any well-known photographers that have come down to your ranch?

A. We published a book with A&M, Klaus Nigge, National Geographic. Some people, John Martel in Rockport, various others. Some wish to remain somewhat anonymous. I don't understand that.

Q. And other guests at your Crane House there are bird watchers, nature enthusiasts?

A. Yes. We have our guest, they're currently in the audience today.

Q. He's getting an eye full. Is the ability to see whooping cranes the reason many guests visit the Crane House?

A. Without a doubt. It's phenomenal.

Q. And do you and your wife receive income from renting the

Crane House?
A. I think we may have grossed around 40,000 on the operation last year, and it's kind of a way to own a small ranch and pay your taxes, I guess you might say. We're probably still a little negative cash flow on the deal.
Q. And can you tell the Judge what your occupancy rate is at the Crane House?
A. During crane season, about 101 percent.
Q. 101 percent. Are there people who call months and months in advance of the crane season, trying to get bookings?
A. My wife is with me today, and she's the manager, and she has the worst job in the world, because people fight over certain dates and times. And we're terrified of a double booking, if you will. It doesn't, doesn't happen, but we try to be very attentive to our guests.
Q. So from the start of the crane season, which is roughly October, sometime mid October through to --
A. November.
Q. November?
A. November, early November.
Q. Through to about April?
A. Yes, sir.
Q. You are booked solid every single night?
A. Yes.
Q. Do you think you would be booked solid if there weren't

any cranes to be able to be seen from the Crane House?
A. Mosquitoes are bad a lot of the times, so we would not.
THE COURT: There's no market for the mosquitoes.
THE WITNESS: No, Judge.
BY MR. IRVINE:
Q. It wouldn't be as effective going to stay at the Mosquito House, would it?
A. That's right.
Q. Can you tell me where you will be living from next year onwards?
A. We've built a house on that ten-acre tract, and we're 95 percent complete. We'll probably move after the 1st.
Q. And so that is just around the corner from the Crane House?
A. It's about 1500 feet north of Crane House.
Q. And from your house, from the new home that you'll be building -- congratulations, by the way -- you will be able to see the crane territory and the cranes, the Johnson Ranch cranes out there in the marsh?
A. That's correct.
Q. And do you, did you design the house in any particular way so you would be able to watch the cranes?
A. We actually got assistance from Tom Stehn to come up with a design to build a house in the understory to where we would not create a disturbance. He said, "It's my goal to allow you

to live on the land without being a negative influence," if you will.

Q. And do you derive a great deal of pleasure from seeing those cranes out there?

A. Very much so.

Q. And seeing the subadults come around and go?

A. I feel like I've given back, in trying to -- my family is, Judge, or Burt Mills' family, we have the same grandfather, so I feel like I'm giving back to that ecosystem, trying to perpetuate it, if you will.

MR. IRVINE: Thank you very much. Pass the witness.

THE COURT: Ms. Snapka.

CROSS-EXAMINATION

BY MS. SNAPKA:

Q. Mr. Johnson, you indicated that you're a member of TAP?

A. Yes.

Q. When did you join TAP?

A. Shortly after they organized, I believe.

Q. And --

A. I'm not sure of the date.

Q. And did you pay any dues to TAP?

A. Yes, ma'am, I did.

Q. How much did you pay?

A. Whatever the normal dues might be. I'm a home builder and have two ladies that take care of me and write my checks, and

I'm -- often a lot of stuff goes on I don't know all the total details.

Q. And you have feeders on your property. Is that correct?

A. Yes, ma'am, I do.

Q. And that's one of the places that the cranes come to feed?

A. Yes, ma'am.

Q. Do they actively feed?

A. In some instances.

Q. And in '08-'09, you actually saw some juveniles at the feeder. Correct?

A. Yes.

Q. And they were there by themselves acting independent. Right?

A. At times, we have currently seven subadults, and they're much like teenagers. They bounce around, and who knows where they're going to be when.

Q. But particularly with these juveniles that you saw, they were there by themselves. Is that right?

A. At times.

Q. And they were, they had plenty to eat because they had the feeder there. Correct?

MR. IRVINE: Excuse me, Your Honor. I just wanted to clarify. Are we talking about juveniles or subadults? I think there's a bit of a communication gap there.

THE COURT: Yes. Are you talking about subadults or

juveniles?

THE WITNESS: The subadults would be a white bird that might be one to three years old. A juvenile would be brown or auburn color.

MS. SNAPKA: And he, there was a sighting in '08-'09 is the one I'm talking about specifically where the juveniles, the brown ones, were there independently.

BY MS. SNAPKA:

Q. Do you recall that?

A. There may have been one or two occasions. The parents roost maybe 150 yards from there in the marsh. And as the offspring get older, sometimes it looks like to me like it's the first time that mother's going to let the child go to the store by themselves.

THE COURT: Is this late in the season?

THE WITNESS: Later on in the season normally. I would say, my observation in the '08-'09 indicated that the birds were starving to death. And they did things to get food that it was not normal.

BY MS. SNAPKA:

Q. You have a, but you have a feeder there. Correct?

A. Yes, ma'am.

Q. So they were there feeding on your property. Right?

A. Yes, ma'am.

Q. So those weren't starving to death, were they?

A. Well, I'm not sure what they get from the feeder is an adequate nutrition stream for their needs.
Q. Did you see any of the birds die?
A. No.
Q. You certainly didn't report that, did you?
A. No. I would report anything, if a bird was sick or stressed.
Q. So what reports did you make in '08-'09?
A. I communicated occasionally with Tom Stehn. And a State Game Warden lives near my gate and has a feeder under a big, overstory of big oaks. The birds actually flew and went under the tree tops to go eat there, which is a high risk maneuver for a big bird.
Q. And they were doing that because the supplemental feeders were providing them nutrition. Correct?
A. I think they were very hungry that year.
Q. Do you have any e-mails to that effect?
A. I turned in all the e-mails I had when I was deposed, and my laptop crashed and we lost a lot of what we had.
Q. With regard to the Crane House, your income ever since you started operating that has increased every year. Is that right?
A. Not really. I think we're charging 250 a night now, and we may have raised the rates two or three years ago, $25 a night. But it's been fairly stable.

Q. Okay. So the -- in other words, the occupancy has been pretty much fully booked for the last several years?
A. Yes, ma'am, about half a year, and in the hot summer months when the mosquitoes are bad, it's not as attractive.
Q. I should have clarified that. During the whooping crane season, it's booked 100 percent every year. Is that correct?
A. Yes, ma'am.
Q. Give me one moment, please.
MS. SNAPKA: Pass the witness, Your Honor.
THE COURT: Thank you. Anything further?
MR. IRVINE: Nothing, Your Honor.
THE COURT: You may stand down. Thank you very much for coming.
THE WITNESS: Thank you, Judge.
MR. BLACKBURN: Your Honor, we call Mark Vickery.

MARK VICKERY, PLAINTIFF'S WITNESS NO. 13, SWORN

DIRECT EXAMINATION

BY MR. BLACKBURN:
Q. Good afternoon, Mr. Vickery. And I'm going to call you "Mr. Vickery," although we've known each other for some time.
A. Yes.
Q. Would you introduce yourself to Judge Jack, please.
A. I'm Mark Vickery. I'm the Executive Director at the Commission on Environmental Quality.
Q. And I'm just going to ask you, if you would, to tell us a

# EXHIBIT E

Aransas CAD

Property Search | Map Search | Map Administration | Login

Property Search Results > Property ID 61963 JOHNSON ALBERT H ETUX for Year 2015

New Search

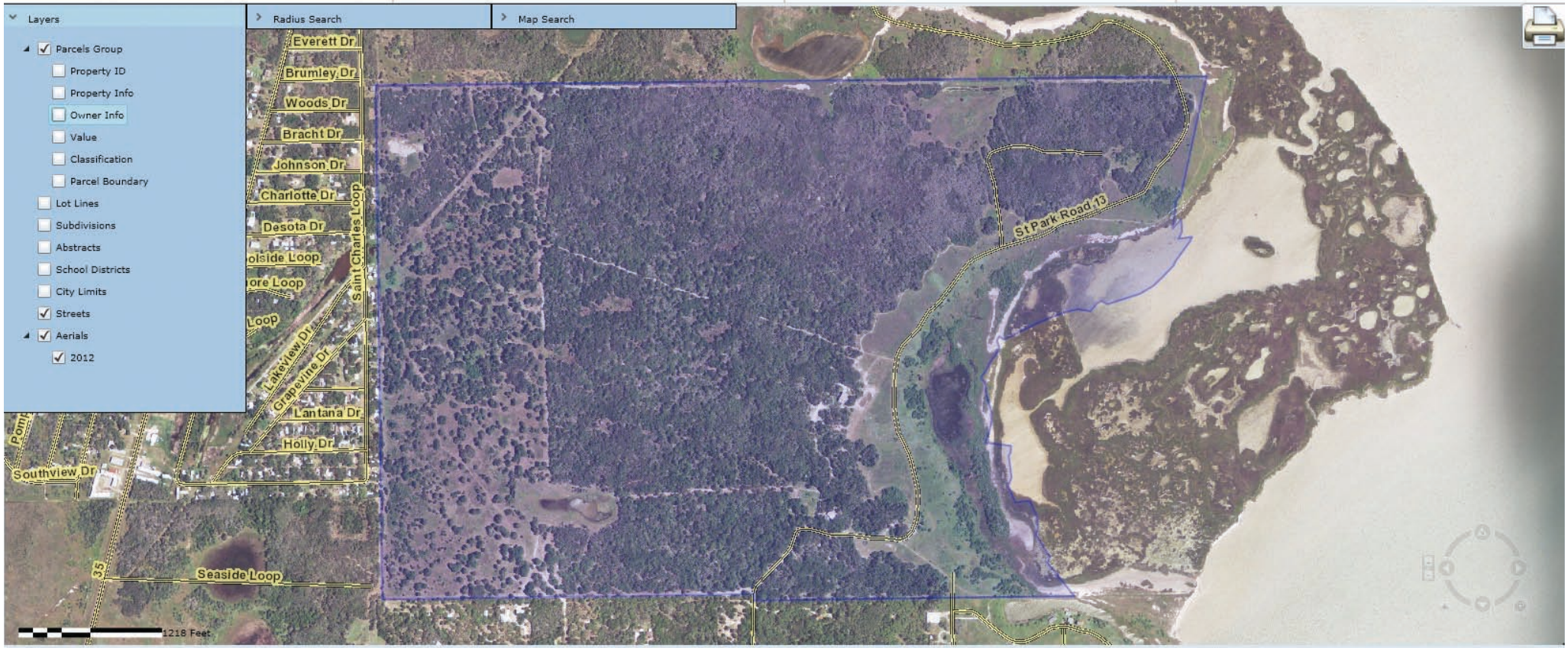
Details | Map | Help

**Account**
**Property ID:** 61963
**Geo. ID:** 3525-000-096-014
**Type:** Real
**Legal Description:** A96 WILLIAM LEWIS SURVEY, ACRES 583.67

**Location**
**Situs Address:** 501 N PALMETTO ST Rockport (Lamar), TX 78382
**Neighborhood:** NULL
**Mapsco:** NULL
**Jurisdictions:** CAD, GAR, NVD, SAR, XSP

**Owner**
**Owner Name:** JOHNSON ALBERT H ETUX
**Mailing Address:** NULL , 602 E
MARKET ST ,
NULL ,
ROCKPORT , TX

**Property**
**Appraised Value:** N/A




DISCLAIMER

# EXHIBIT F

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
CORPUS CHRISTI DIVISION

| | | |
|---|---|---|
| THE ARANSAS PROJECT,<br>Plaintiff, | §<br>§<br>§ | |
| VS. | § | Case No. 2:10-cv-075 |
| BRYAN SHAW, et al.,<br>Defendants. | §<br>§ | |

**MEMORANDUM OPINION AND VERDICT OF THE COURT**

This case was tried to the Court over an eight-day period on December 5, 6, 7, 8, 9, 13, 14, and 15, 2011.[1] As required by Rule 52(a) of the Federal Rules of Civil Procedure, the Court makes the following findings of fact and conclusions of law thereon.[2]

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[1]Defendants and intervenors moved to reopen the case to introduce new evidence. (D.E. 328). As discussed herein, the Court considered the new evidence but found it flawed and preliminary, and not persuasive, and consequently, on December 6, 2012, denied the motion to reopen as moot.

[2]Any finding of fact made herein that also constitutes a conclusion of law is adopted as a conclusion of law. Any conclusion of law made herein that also constitutes a finding of fact is adopted as a finding of fact. All findings of fact and conclusions are made by a preponderance of the evidence.

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minimize the potential take of an endangered species. Here, TAP is asking the Court to order the TCEQ defendants to apply for an ITP, thus acknowledging that their permit process and water enforcement actions, especially in times of drought, alter the critical habitat of the AWB cranes and can lead to a "take" of these endangered birds. Once the ITP is filed, ESA § 10 requires TCEQ defendants to work with the USFWS to formulate a Habitat Conservation Plan based on the best science available.

## III. FINDINGS ON STANDING AND JURISDICTION.

### A. Standing.

The ESA expressly authorizes citizen suits against any "person" alleged to be responsible for a "take." The ESA provides that any person may commence a civil suit on his own behalf– (A) to enjoin any person, including the United States and its agencies, who is alleged to be in violation of ESA provisions or regulations; (B) to compel the Secretary to enforce the provisions concerning the taking of any resident endangered species or threatened species within any State; or (C) against the Secretary where there is an alleged failure of the Secretary to perform any nondiscretionary act or duty. 16 U.S.C. § 1540(g)(1); see also Tennessee Valley Auth., 437 U.S. at 184; Defenders of Wildlife v. Bernal, 204 F.3d 920, 925 (9th Cir. 2000). The district courts shall have jurisdiction, without regard to the amount in controversy or the citizenship of the parties, to enforce any ESA provision or regulation, or to order the Secretary to perform such act or duty, as the case may be. 16 U.S. C. § 1540(g). Although the ESA provides for citizens suits, the ESA plaintiff must satisfy the jurisdictional requirements of standing. Bennett v. Spear, 520 U.S. 152, 162 (1997). To satisfy the "case" or "controversy" requirement of Article III, which is the "irreducible constitutional minimum" of standing, a plaintiff must, demonstrate that he has

suffered: injury in fact; that the injury is "fairly traceable" to the actions of the defendant, and that the injury will likely be redressed by a favorable decision. Lujan v. Defenders of Wildlife, 504 U.S. 555, 560-561 (1992).

**1. Injury in fact.**

In this case, the TCEQ defendants, GBRA, and SARA, have consistently challenged TAP's standing to sue. (See D.E. 213, 214, 215). In its December 5, 2011 Order denying TCEQ defendants' and intervenor's motion for partial summary judgment (D.E. 270), the Court found that TAP had satisfied the standing elements of injury in fact and redressability. Id. at 7-9. As to the injury requirement, the Court noted that many of the TAP members reside and work in the Aransas area and, for some, their livelihood depends in large part on the AWB cranes. (D.E. 270 at 7). Indeed, the tourism economy of the area relies on the annual migration of the Whooping Cranes to the nearby Refuge. This finding was reinforced by testimony at trial. For example, TAP member Albert Johnson is the proprietor of *The Crane House*, a small home that is rented to tourists, photographers, and naturalists that come specifically to observe the Whooping Cranes.[15] (Johnson, Day 4, Tr 182-183). TAP member Ray Kirkwood works as the narrator on the *Wharf Cat*, a boat that tours the Aransas Refuge, allowing visitors to observe a healthy, active estuarial system, and the AWB Whooping Cranes in their winter home. (Kirkwod, Day 4, Tr 136, 141, 146-148). Aransas County Judge Burt Mills testified that the AWB flock has always been an important aspect of the tourist industry for Aransas County. (Mills, Day 4, Tr 108, 117).

In addition, the Court found that many of TAP's members are active birders and devote substantial time and effort to observing Whooping Cranes and other birds in their natural habitat.

[15] See PX-106, Mission statement of *The Crane House Bed & Breakfast.*

(D.E. 270 at 7). At trial, Deborah Corpora, a Rockport birder, testified as to the pleasures of watching the Whooping Cranes at the Aransas Refuge. (Corpora, Day 3, Tr 154-170). The evidence was uncontested that TAP members had aesthetic, recreational, economic, professional, and other interests in photographing, studying, protecting and otherwise enjoying the AWB cranes in their natural environment. (D.E. 270 at 7-8).

The Supreme Court has recognized that "environmental plaintiffs adequately allege injury in fact when they aver that they use the affected area and are persons "for whom the aesthetic and recreational values of the area will be lessened by the challenged activity." Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), 528 U.S. 167, 183 (2000). Fewer AWB cranes would adversely affect the tourism, visual observation, and recreational enjoyment of TAP members. Thus, TAP successfully demonstrated that its members were "among the injured" for purposes of standing. Lujan, 504 U.S. at 562-63.

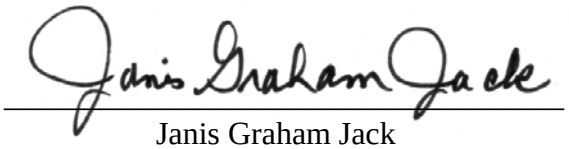
**2. Redressability.**

In denying TCEQ defendants' and GBRA's motion for partial summary judgment, the Court previously found that TAP had also established redressability. (D.E. 270 at 9-12). To establish redressability, it must be "likely, as opposed to merely speculative, that the injury will be redressed by a favorable decision." Friends of the Earth, Inc., 528 U.S. at 181. The relevant question is simply, "whether a plaintiff personally would benefit in a tangible way from the court's intervention." Steel Co. v. Citizens for a Better Environment, 523 U.S. 83, 103 n.5 (1998) (internal quotation marks omitted). "When . . . a plaintiff's asserted injury arises from the government's allegedly unlawful regulation (or lack of regulation) of someone else . . . causation and redressability ordinarily hinge on the response of the regulated (or regulable) third party to

The Court will retain jurisdiction over this action during the formulation of the HCP process.

The Court finds that Plaintiff TAP is the prevailing party in this matter, and is entitled to an award of its reasonable attorney's fees and costs, as well as expert witness fees, incurred in this action. See 16 U.S.C. § 1540(g)(4).

SIGNED and ORDERED this 11th day of March, 2013.



Janis Graham Jack
Senior United States District Judge