



## **MEETING MATERIALS**

**February 4, 2015**

**San Jacinto River Authority**

**Region H Water Planning Group**  
**10:00 AM Wednesday**  
**February 4, 2015**  
**San Jacinto River Authority Office**  
**1577 Dam Site Rd, Conroe, Texas 77304**

**NOTICE TO PUBLIC**

**Notice of Amendments to the 2011 Region H Regional Water Plan**

The Region H Water Planning Group will consider adoption of amendments to the 2011 Region H Water Plan as included in items 4 through 7 of the attached agenda. The first amendment will account for the expansion of existing off-channel reservoir and pump station infrastructure by Dow Chemical Company. A public hearing was held on December 10, 2014 to allow for public comment to this amendment, followed by a 30-day comment period. Written comments were accepted through January 12, 2015. The second amendment is deemed minor and will account for the addition of a reclaimed water supply for use by the customers of the Gulf Coast Water Authority. The proposed amendments to the Plan will be discussed and acted upon during a public meeting of the RHWPG.

Copies of the proposed amendments to the Regional Water Plan are available on the Region H website at <http://www.regionhwater.org/>. Oral comments on the proposed amendments may be received at the public meeting. Written comments from the public must be submitted to SJRA by February 18, 2015 for inclusion with the submitted amendment package. Comments can be submitted to SJRA as follows:

Jace Houston, General Manager  
San Jacinto River Authority  
Administrative Agent for Region H  
P. O. Box 329  
Conroe, Texas 77305-0329

For additional information, please contact:

- Region H, c/o Jace Houston, General Manager, SJRA, P. O. Box 329, Conroe, Texas 77305-0329, telephone 936-588-3111, and email [info@regionhwater.org](mailto:info@regionhwater.org).

**AGENDA**

1. Introductions.
2. Review and approve minutes of November 5, 2014 meeting.
3. **Receive public comments on specific issues related to agenda items 4 through 18.** (Public comments limited to 3 minutes per speaker)
4. Receive presentation on and discuss proposal to amend the 2011 Region H Regional Water Plan related to proposed expansion of an off-channel reservoir and pump station by Dow Chemical Company.
5. Consider action to amend the 2011 Region H Regional Water Plan to revise water management strategies related to proposed expansion of an off-channel reservoir and pump station by Dow Chemical Company.
6. Receive presentation on and discuss proposal to amend the 2011 Region H Regional Water Plan related to proposed development of a system by Gulf Coast Water Authority to utilize reclaimed wastewater effluent from the City of Houston.

7. Consider action to amend the 2011 Region H Regional Water Plan to include water management strategies related to proposed development of a system by Gulf Coast Water Authority to utilize reclaimed wastewater effluent from the City of Houston.
8. Consider authorizing the San Jacinto River Authority to use funds from the Region H Local Contribution Account to pay for a single audit report on 2014 Region H expenses.
9. Consider authorizing the San Jacinto River Authority to use funds from the Region H Local Contribution Account to pay for renewal of Directors and Officers Liability Insurance for Region H Planning Group members.
10. Receive update from Consultant Team regarding the schedule and milestones for the development of the 2016 Region H Regional Water Plan.
11. Receive update from Consultant Team and Water Management Strategies Committee regarding status of the identification of needs and potential strategies for the 2016 Region H Regional Water Plan.
12. Receive presentation from Consultant Team on the status of ecologically unique stream segments, unique reservoir sites, and legislative recommendations
13. Receive presentation from Consultant Team on recommendations for the schedule of public meetings for presentation of the Initially Prepared Plan.
14. Consider and take action on approval of public meeting schedule for presentation of the Initially Prepared Plan.
15. Receive presentation from Consultant Team and Texas Water Development Board regarding the process for and preparation of an application for a Regional Water Planning Grant from the Texas Water Development Board for funding of the fifth round of regional water planning for Region H.
16. Discussion and possible action to authorize the San Jacinto River Authority to provide public notice and submit a grant application to TWDB on behalf of Region H for funding the fifth round of regional water planning.
17. Receive report regarding recent and upcoming activities related to communications and outreach efforts on behalf of the Region H Planning Group.
18. Agency communications and general information.
19. **Receive public comments.** (Public comments limited to 3 minutes per speaker)
20. Next Meeting: March 4, 2015.
21. Adjourn

Persons with disabilities who plan to attend this meeting and would like to request auxiliary aids or services are requested to contact Jodi Chaney at (936) 588-3111 at least three business days prior to the meeting so that appropriate arrangements can be made.

## Agenda Item 2

Review and approve minutes of November 5<sup>th</sup>, 2014 meeting.

## Agenda Item 4

Receive presentation on and discuss proposal to amend the 2011 Region H Regional Water Plan related to proposed expansion of an off-channel reservoir and pump station by Dow Chemical Company.

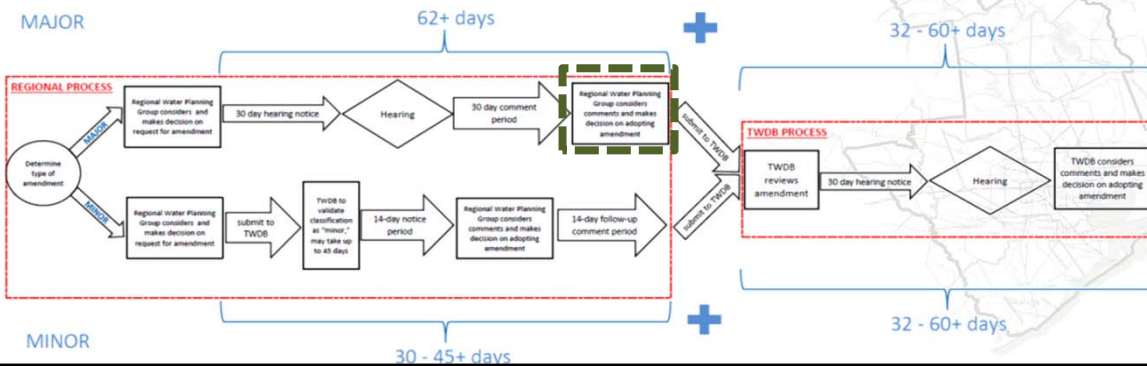
## Agenda Item 4 Dow Amendment

Receive presentation on and discuss proposal to amend the 2011 Region H Regional Water Plan related to proposed expansion of an off-channel reservoir and pump station by Dow Chemical Company.



## Agenda Item 4 Dow Amendment

- Since November
  - Held public hearing (12/10)
  - Held public comment period (comments through 01/12)
  - Posted revised amendment package (Includes BWA amendment)



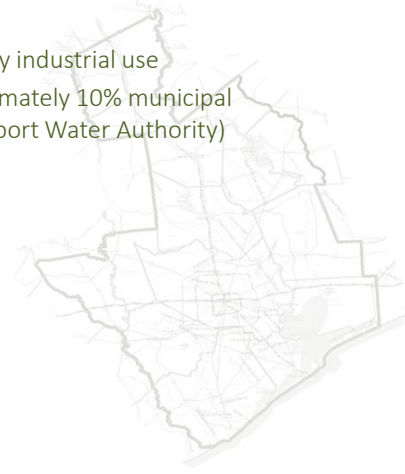
## Agenda Item 4 Dow Amendment

- Amendment process
  - TODAY: Review proposed amendment and comments
  - TODAY: Consider action on amending 2011 RWP
  - Submit amendment package and comments to TWDB



## Agenda Item 4 Dow Amendment

- Dow water supplies
  - Brazos River
    - 238,156 acre-feet per year
  - Harris and Brazoria Reservoirs
    - 31,900 acre-feet of storage authorized
  - Brazos River Authority Contract
    - 16,000 acre-feet per year (3-yr average)
    - 48,000 acre-feet per year (1-yr maximum)
- Dow water demands
  - Approximately 145,000 acre-feet per year
    - Primarily industrial use
    - Approximately 10% municipal (Brazosport Water Authority)

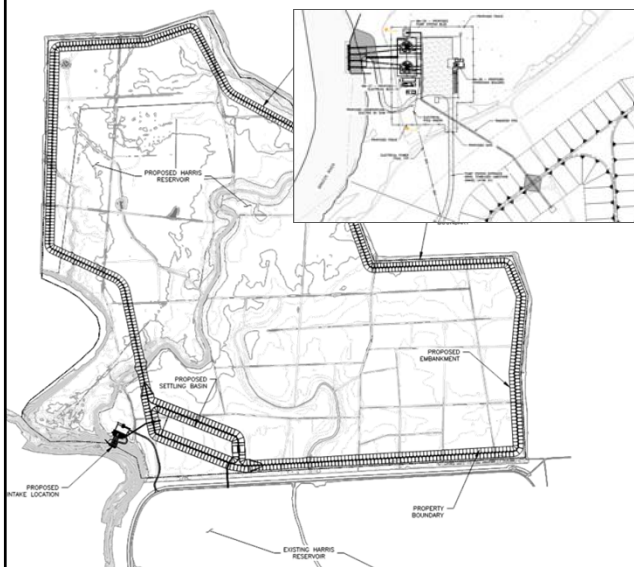


## Agenda Item 4 Dow Amendment

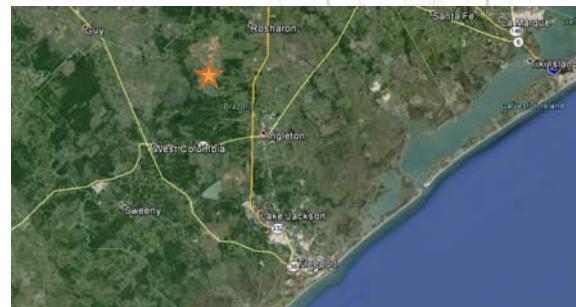
- Issues affecting availability
  - Upstream diversions by junior rights
  - Seawater intrusion
  - Insufficient pump station capacity
  - Insufficient storage



## Agenda Item 4 Dow Amendment



- Project status
  - 2012 – Land purchased from State of Texas
  - 2014 – Preliminary design completed
  - Permitting activities initiated





## Agenda Item 4 Dow Amendment

	2011 Region H Plan	Proposed Amendment
Reservoir Capacity (ac-ft)	44,000	56,760
Pump Station Capacity (gpm)	201,000	200,000
Supply Benefit (ac-ft/yr)	21,800	80,000
Entities Supplied	Manufacturing	Manufacturing, Municipal
Total Cost	\$124.47 million	\$226.84 million
Annual Cost	\$10.49 million	\$20.48 million
Annual Unit Cost (\$/ac-ft)	\$481	\$256



## Agenda Item 4 Dow Amendment

- 2011 RWP amendment package
  - Revisions to Executive Summary
  - Revisions to Chapter 4
    - Appendix 4A supply allocation tables
    - Appendix 4C cost tables
  - Revised technical memorandum
    - Dow Off-Channel Reservoir and Pump Station Expansion
  - DB12 database entries
  - Summary of comments received
    - None





## REGION H WATER PLANNING GROUP

*Senate Bill 1 - Texas Water Development Board*

c/o San Jacinto River Authority

P. O. Box 329, Conroe, Texas 77305

Telephone 936-588-3111

TO:

- Each mayor of a municipality with a population of 1,000 or more or which is a county seat that is located in whole or in part in the Region H water planning area;
- Each county judge of a county located in whole or in part in the Region H water planning area;
- Each special or general law district or river authority with responsibility to manage or supply water in the Region H water planning area based upon lists of such water districts and river authorities obtained from Texas Commission on Environmental Quality;
- Each retail public utility, defined as a community water system, that serves any part of the Region H water planning area or receives water from the Region H water planning area based upon lists of such entities obtained from Texas Commission on Environmental Quality; and
- Each holder of record of a water right for the use of surface water the diversion of which occurs in the Region H water planning area based upon lists of such water rights holders obtained from Texas Commission on Environmental Quality.
- RHWPG Members, alternates, and interested parties.

RE: **Public Notice of an Amendment to the 2011 Region H Water Plan**

DATE: November 9, 2014

### PUBLIC NOTICE

To All Interested Parties:

The Region H Water Planning Group area includes all or part of the following counties: Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Leon, Liberty, Madison, Montgomery, Polk, San Jacinto, Trinity, Walker, and Waller.

Notice is hereby given that the Region H Water Planning Group (RHWPG) is requesting public review and comment on an Amendment to the 2011 Region H Water Plan.

**A summary of the content of the Proposed Amendment to the Plan:** The Proposed Amendment changes a water management strategy that was included in the 2011 Region H Water Plan. Dow Chemical Company proposes to expand a reservoir and pump station that services its facility in Brazoria County. This proposed reservoir expansion creates 80,000 acre-feet per year in firm supply by increasing the storage associated with an existing Dow water right in the Brazos River.

**Public Comment:** A public hearing to receive public comments on the proposed amendment will be held at **2:00 p.m. on December 10, 2014** at the San Jacinto River Authority, 1577 Dam Site Road, Conroe, Texas 77304. Persons with disabilities who plan to attend this meeting and would like to

request auxiliary aids or services are requested to contact Jodi Chaney at (936) 588-3111 at least three business days prior to the meeting so that appropriate arrangements can be made.

The RHWPG will accept written comments until 5:00 p.m. January 12, 2015. Written comments should be provided to:

Hon. Mark Evans  
Chair, RHWPG  
c/o San Jacinto River Authority  
P.O. Box 329  
Conroe, Texas 77305-0329

**Questions or requests for additional information may be submitted to:** Jace Houston, General Manager, San Jacinto River Authority, P.O. Box 329, Conroe, TX 77305-0329, telephone 936-588-3111 or by email to [info@regionHwater.org](mailto:info@regionHwater.org). The San Jacinto River Authority is the Administrator for the RHWPG.

**A copy of the Proposed Amendment to the 2011 Plan is available** at the County Clerk's Office and at a depository library in each county in Region H. A list of depositories is attached. A copy also is available on the RHWPG website at [www.regionhwater.org](http://www.regionhwater.org).

## REGION H DEPOSITORY LIBRARIES AND COUNTY CLERKS

### AUSTIN COUNTY

Gordon Library  
917 Circle Drive  
Sealy, TX 77474

### BRAZORIA COUNTY

Angleton Public Library  
401 East Cedar  
Angleton, TX 77515

### CHAMBERS COUNTY

Chambers County Library  
– Main Branch  
202 Cummings  
Anahuac, TX 77514

### FORT BEND COUNTY

George Memorial Library  
1001 Golfview  
Richmond, TX 77469

### GALVESTON COUNTY

Rosenberg Library  
2310 Sealy  
Galveston, TX 77550

### HARRIS COUNTY

Houston Public Library – Central  
1<sup>st</sup> Floor, Bibliographic Information Center  
500 McKinney  
Houston, TX 77002

### LEON COUNTY

Ward Memorial Library  
207 East St. Mary's  
Centerville, TX 75833

### LIBERTY COUNTY

Sam Houston Regional Library  
and Research Center  
650 FM1011  
Liberty, TX 77575

### AUSTIN COUNTY

County Clerk  
County Courthouse  
1 East Main  
Bellville, TX 77418

### BRAZORIA COUNTY

County Clerk  
County Courthouse  
1524 East Mulberry (Highway 35)  
Room 152  
Angleton, TX 77515

### CHAMBERS COUNTY

County Clerk  
County Courthouse  
404 Washington Avenue  
Anahuac, TX 77514

### FORT BEND COUNTY

County Clerk  
301 Jackson (corner Jackson and 3<sup>rd</sup>)  
Richmond, TX 77469

### GALVESTON COUNTY

County Clerk  
600 59<sup>th</sup> Street, Suite 2001 (2<sup>nd</sup> floor)  
Galveston, TX 77550

### HARRIS COUNTY

County Clerk  
County Civil Courthouse  
201 Caroline, Suite 330  
Houston, TX 77002

### LEON COUNTY

County Clerk  
Leon County Courthouse  
155 North Cass  
Centerville, TX 75833

### LIBERTY COUNTY

County Clerk  
County Courthouse  
1923 Sam Houston, Room 209  
Liberty, TX 77575

**MADISON COUNTY**  
Madison County Library  
605 South May  
Madisonville, TX 77864

**MONTGOMERY COUNTY**  
Montgomery County Central Library  
104 Interstate 45 North  
Conroe, TX 77301

**POLK COUNTY**  
Murphy Memorial Library  
601 West Church  
Livingston, TX 77351

**SAN JACINTO COUNTY**  
Coldspring Area Public Library  
14221 State Highway 150 West  
Coldspring, TX 77331

**TRINITY COUNTY**  
Blanche K. Werner Library  
203 Prospect Drive  
Trinity, TX 75862

**WALKER COUNTY**  
Huntsville Public Library  
1216 – 14th Street  
Huntsville, TX 77340

**WALLER COUNTY**  
Waller County Library -  
Brookshire/Pattison  
3815 Sixth Street  
Brookshire, TX 77423

**MADISON COUNTY**  
County Clerk  
101 West Main, Room 102  
Madisonville, TX 77864

**MONTGOMERY COUNTY**  
County Clerk  
210 West Davis (Highway 105), Suite 103  
Conroe, TX 77301

**POLK COUNTY**  
County Clerk  
County Courthouse  
101 West Church, Suite 100  
Livingston, TX 77351

**SAN JACINTO COUNTY**  
County Clerk  
County Courthouse  
#1 Highway 150, Room 2  
Coldspring, TX 77331

**TRINITY COUNTY**  
County Clerk  
109 South Main  
(across from County Courthouse)  
Groveton, TX 75845

**WALKER COUNTY**  
County Clerk  
County Courthouse  
1100 University Avenue, Room 201  
Huntsville, TX 77340

**WALLER COUNTY**  
County Clerk  
County Courthouse  
836 Austin Street, Room 217  
Hempstead, TX 77445



**MAJOR AMENDMENT TO THE  
2011 REGION H REGIONAL  
WATER PLAN**

**Dow Chemical Company**



Attachment	Description
A	Amended excerpts from Executive Summary including Tables ES-7 and ES-8.
B	Amended excerpts from Chapter 4: Identification, Evaluation and Selection of Water Management Strategies Based on Needs
C	Amended Table 4A-3: Water Management Strategy Screening
D	Amended Table 4A-4: Water Management Strategy Environmental Impacts
E	Amended Table 4A-5: Recommended WMS by County
F	Amended Table 4A-6: Decadal WMS Summary
G	Amended Table 4A-7: WMS Supply Allocations by WUG
H	Amended Table 4A-8: WUG-Level Contracts
I	Revised Technical Memorandum 4B-47 (Dow Off-Channel Reservoir and Pump Station Expansion)
J	Amended Table 4C-1: WWP-Level Project Costs
K	Amended Table 4C-2: WUG-Level Project Costs
L	Summary of database entries anticipated for DB12
M	Comments received regarding proposed amendment





**Attachment A:**

Amended excerpts from Executive Summary including Tables ES-7 and ES-8



- **River Plantation MUD**
- **San Jacinto River Authority WRAP**
- **Sugar Land**
- **West Harris County Regional Water Authority**

### **Reservoir Strategies**

- **Allen's Creek Reservoir** – This proposed reservoir creates 99,650 ac-ft/yr of supplies for the City of Houston and the Brazos River Authority.
- **Brazoria County Off-Channel Reservoir** – This proposed reservoir creates 24,000 ac-ft/yr of firm supply for manufacturing demands in Brazoria County.
- **Dow Off-Channel Reservoir and Pump Station Expansion** – This proposed reservoir expansion creates 80,000 ac-ft/yr in firm supply by increasing the storage associated with an existing Dow water right.
- **Fort Bend Off-Channel Reservoir** – This proposed reservoir creates 46,000 ac-ft/yr of firm supply for municipal and industrial demands in Fort Bend County
- **GCWA Off-Channel Reservoir** – This proposed reservoir creates 39,500 ac-ft/yr of firm supply for manufacturing use served by GCWA. This reservoir uses existing water rights with surplus interruptible supply to produce this firm yield.

### **Reuse Strategies**

- **Fulshear Reuse** – Development of a direct reuse project for the City of Fulshear and surrounding utilities.
- **Houston Indirect Wastewater Reuse**—The City of Houston has applied for a water right permit to indirectly reuse up to 580,900 ac-ft/yr of wastewater discharges. A portion of that is recommended for direct reuse to industry.
- **Montgomery County MUD 8/9 Reuse** – Indirect reuse project for potable water by districts along Lake Conroe in Montgomery County.
- **NHCRWA Indirect Wastewater Reuse** –The North Harris County Regional Water Authority has the potential to indirectly reuse up to 126,000 ac-ft/yr of wastewater discharges.
- **Wastewater Reclamation for Industry** –This strategy proposes that 67,200 ac-ft/yr of Houston's municipal wastewater be treated and directly reused by industries along the Houston Ship Channel.
- **Wastewater Reclamation for Municipal Irrigation** – This strategy anticipates the development of direct reuse project incorporated into new community growth in the rapidly-developing counties of Region H.

### **Permit Strategies**

- **Brazos River Authority System Operations** –The Brazos River Authority has applied for a water right that permits existing additional yield within their reservoirs, and new yield that can be achieved through operation of their reservoirs as a basin-wide system. Approximately 25,350 ac-ft/yr of this water will be available for customers in Region H.

NFBWA Internal Distribution	106,402	\$225,000,000	N/A	2020
NFBWA Shared Transmission Line	71,876	\$213,000,000	N/A	2020
NHCRWA Internal 2010 Distribution	34,714	\$153,149,640	N/A	2010
NHCRWA Internal 2020 Distribution	91,167	\$345,292,192	N/A	2020
NHCRWA Internal 2030 Distribution	117,755	\$37,439,584	N/A	2030
NHCRWA Transmission 2010	34,714	\$80,690,624	N/A	2010
NHCRWA Transmission 2020	91,167	\$172,558,512	N/A	2020
NHCRWA Transmission 2030	117,755	\$0	N/A	2030
Pearland SWTP	13,420	\$0	\$265,000,000	TBD
Sealy GW Treatment Expansion	888	\$0	\$6,450,000	2020
WHCRWA Internal Distribution	78,839	\$552,472,000	N/A	2010
WHCRWA Transmission Line	78,839	\$290,084,193	N/A	2010

**Reservoir Strategies:**

Allens Creek Reservoir	99,650	\$222,752,400	See Contracts	2020
Brazoria County Off-channel Reservoir	24,100	\$173,898,602	See Contracts	2060
Dow Off-channel Reservoir and Pump Station Expansion	80,000	\$226,837,000	See Contracts	2020
Fort Bend County Off-channel Reservoir	46,000	\$202,514,788	See Contracts	2050
GCWA Off-channel Reservoir	39,500	\$197,448,012	See Contracts	2030

**Reuse Strategies:**

Fulshear Reuse	430	\$0	\$566,625	TBD
Houston Indirect Reuse	128,801	\$0	\$721,822,850	2040
Montgomery MUD 8/9 Indirect Reuse	1,120	\$0	\$12,245,687	2016
NHCRWA Indirect Reuse	16,300	\$0	\$66,778,694	2040
Wastewater Reuse for Industry	67,200	\$332,051,761	\$0	2060
Wastewater Reclamation for Mun. Irrigation	36,388	\$0	\$48,043,249	2030

**Permit Strategies:**

BRA System Operations Permit	25,400	TBD	See Contracts	2020
Houston Bayous Permit*	0	\$20,956,000	\$0	2020

**Other Strategies:**

Brazoria Co. Interruptible Supplies for Irr.	104,977	\$0	\$0	2010
Freeport Desalination Plant	33,600	\$255,699,000	See Contracts	2050
Brazos Saltwater Barrier	N/A	\$44,470,739	\$0	2030

1. WUG-level costs for a number of WMS are indicated as "See Contracts". The WUG-level costs for these strategies will be infrastructure costs associated with implementing *future* contracts from WWPs. For simplification, these costs are collectively represented under the "WUG-Level Contracts" WMS, as common infrastructure from a WUG may treat or transmit water from multiple WMS.
2. Yield value includes surface water transmission volume and is therefore not additional yield.
3. Includes supply volume of TRA to SJRA Contract
4. The Houston Bayous Permit has not yet been approved by TCEQ.

**Table ES-8  
Recommended Water Management Strategies by County (in ac-ft/yr)**

	2010	2020	2030	2040	2050	2060
<b>Austin</b>						
Initial Shortage	0	-739	-1,240	-1,496	-1,635	-1,865
Expanded GW	0	739	1,240	1,496	1,635	1,865
Municipal Conservation	0	223	251	265	273	285
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>223</b>	<b>251</b>	<b>265</b>	<b>273</b>	<b>285</b>
<b>Brazoria</b>						
Initial Shortage	-150,907	-186,760	-211,634	-238,588	-266,405	-299,199
Expanded GW	0	4,049	12,988	13,515	15,658	16,209
Municipal Conservation	1,476	2,610	2,978	3,249	3,567	3,918
Contract Expansions	7,750	7,750	7,750	7,750	7,750	7,750
<b>Net Shortage</b>	<b>-141,681</b>	<b>-172,351</b>	<b>-187,918</b>	<b>-214,074</b>	<b>-239,430</b>	<b>-271,322</b>
Irrigation Conservation	18,792	18,792	18,792	18,792	18,792	18,792
Wastewater Reclamation for Mun. Irrigation	0	0	116	227	344	465
Brazoria Co. Interruptible Supplies for Irr.	98,189	86,759	64,000	64,000	64,000	64,000
Reallocate Existing Supply	13,694	13,694	13,895	13,988	14,019	13,694
Interim Strategies	24,916	0	0	0	0	0
GCWA Offchannel Reservoir	0	0	39,500	39,500	39,500	39,500
Allens Creek Lake/Reservoir	0	45,277	41,779	66,665	58,092	66,196
BRA System Operations Permit	0	3,010	3,010	3,010	3,010	3,010
Brazoria OCR	0	0	0	0	0	24,000
Freeport Desalination Plant	0	0	0	0	33,600	33,600
Dow Off-channel Reservoir and Pump Station Expansion	0	80,000	80,000	80,000	80,000	80,000
New Groundwater Wells for Livestock	0	27	27	27	27	27
BWA Brackish Groundwater	0	3,136	3,136	3,136	3,136	3,136
<b>Total after Recommendations</b>	<b>13,910</b>	<b>78,344</b>	<b>76,337</b>	<b>75,271</b>	<b>75,090</b>	<b>75,098</b>
<b>Chambers</b>						
Initial Shortage	-42,520	-47,412	-50,831	-54,251	-57,612	-61,065
Expanded GW	0	577	681	796	905	1,010
Municipal Conservation	137	195	219	239	263	291
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-42,383</b>	<b>-46,640</b>	<b>-49,931</b>	<b>-53,216</b>	<b>-56,444</b>	<b>-59,764</b>
Irrigation Conservation	24,018	24,018	24,018	24,018	24,018	24,018
CLCND W Chambers System	0	1,691	1,978	2,235	2,511	2,804
Reallocate Existing Supply	21,010	21,264	21,389	21,509	21,627	21,725
Interim Strategies	903	0	0	0	0	0
New Contract from Existing Supply	13,823	17,083	19,972	22,888	25,732	28,672
<b>Total after Recommendations<sup>1</sup></b>	<b>17,371</b>	<b>17,416</b>	<b>17,426</b>	<b>17,434</b>	<b>17,444</b>	<b>17,455</b>
<b>Fort Bend</b>						
Initial Shortage	-86	-11,410	-52,608	-84,380	-123,623	-178,948
Expanded GW	0	6,886	3,423	3,813	4,378	5,052
Municipal Conservation	1,435	7,077	10,277	12,253	14,678	17,497
Contract Expansions	0	367	1,295	1,226	1,225	1,016
<b>Net Shortage</b>	<b>1,349</b>	<b>2,920</b>	<b>-37,613</b>	<b>-67,088</b>	<b>-103,342</b>	<b>-155,383</b>
Irrigation Conservation	5,197	5,197	5,197	5,197	5,197	5,197
WHCRWA GRP	0	0	0	0	0	0



**Attachment B:**

Amended excerpts from Chapter 4: Identification, Evaluation and Selection of Water Management Strategies Based on Needs





- WWP Contracts

#### Groundwater Strategies

- Expanded Use of Groundwater
- Interim Strategies
- New Groundwater Wells for Livestock

#### Groundwater Reduction Plans

- CHCRWA GRP (see CHCRWA Transmission)
- City of Houston GRP (see COH Treatment Expansion)
- City of Missouri City GRP
- Fort Bend MUD 25 GRP
- Fort Bend WCID 2 GRP
- NFBWA GRP (see NFBWA Transmission)
- NHCRWA GRP (see NHCRWA Transmission)
- Pecan Grove GRP
- Richmond/Rosenberg GRP
- River Plantation GRP
- SJRA WRAP
- Sugar Land GRP
- WHCRWA GRP (see WHCRWA Transmission)

#### Reservoir Strategies:

- Allens Creek Reservoir
- Brazoria County Off-Channel Reservoir
- Dow Off-Channel Reservoir and Pump Station Expansion
- Fort Bend County Off-Channel Reservoir
- GCWA Off-channel Reservoir
- Millican Reservoir
- Little River Off-Channel Reservoir
- Other Potential Reservoirs

#### Reuse Strategies:

- Fulshear Reuse
- Houston Indirect Reuse
- Montgomery County MUD 8/9 Indirect Reuse

Huntsville WTP	11,200	\$61,023,906	\$0	2010
LLWSSSC Surface Water Project	954	\$0	\$3,087,974	2010
Luce Bayou Transfer	450,000	\$253,916,914	\$0	2020
NFBWA Internal Distribution	106,402	\$225,000,000	N/A	2020
NFBWA Shared Transmission Line	71,876	\$213,000,000	N/A	2020
NHCRWA Internal 2010 Distribution	34,714	\$153,149,640	N/A	2010
NHCRWA Internal 2020 Distribution	91,167	\$345,292,192	N/A	2020
NHCRWA Internal 2030 Distribution	117,755	\$37,439,584	N/A	2030
NHCRWA Transmission 2010	34,714	\$80,690,624	N/A	2010
NHCRWA Transmission 2020	91,167	\$172,558,512	N/A	2020
NHCRWA Transmission 2030	117,755	\$0	N/A	2030
Pearland SWTP	13,420	\$0	\$265,000,000	TBD
Sealy GW Treatment Expansion	888	\$0	\$6,450,000	2020
WHCRWA Internal Distribution	78,839	\$552,472,000	N/A	2010
WHCRWA Transmission Line	78,839	\$290,084,193	N/A	2010

**Reservoir Strategies:**

Allens Creek Reservoir	99,650	\$222,752,400	See Contracts	2020
Brazoria County Off-channel Reservoir Dow Off-channel Reservoir and Pump Station Expansion	24,100	\$173,898,602	See Contracts	2060
Fort Bend County Off-channel Reservoir	80,000	\$226,837,000	See Contracts	2020
Fort Bend County Off-channel Reservoir	46,000	\$202,514,788	See Contracts	2050
GCWA Off-channel Reservoir	39,500	\$197,448,012	See Contracts	2030

**Reuse Strategies:**

Fulshear Reuse	430	\$0	\$566,625	TBD
Houston Indirect Reuse	128,801	\$0	\$721,822,850	2040
Montgomery MUD 8/9 Indirect Reuse	1,120	\$0	\$12,245,687	2016
NHCRWA Indirect Reuse	16,300	\$0	\$66,778,694	2040
Wastewater Reuse for Industry	67,200	\$332,051,761	\$0	2060
Wastewater Reclamation for Mun. Irrigation	36,388	\$0	\$48,043,249	2030

**Permit Strategies:**

BRA System Operations Permit	25,400	TBD	See Contracts	2020
Houston Bayous Permit*	0	\$20,956,000	\$0	2020

**Other Strategies:**

Brazoria Co. Interruptible Supplies for Irr.	104,977	\$0	\$0	2010
Freeport Desalination Plant	33,600	\$255,699,000	See Contracts	2050
Brazos Saltwater Barrier	N/A	\$44,470,739	\$0	2030

1. WUG-level costs for a number of WMS are indicated as "See Contracts". The WUG-level costs for these strategies will be infrastructure costs associated with implementing *future* contracts from WWPs. For simplification, these costs are collectively represented under the "WUG-Level Contracts" WMS, as common infrastructure from a WUG may treat or transmit water from multiple WMS.
2. Yield value includes surface water transmission volume and is therefore not additional yield.
3. Includes supply volume of TRA to SJRA Contract
4. The Houston Bayous Permit has not yet been approved by TCEQ.

**Attachment C:**

Amended Table 4A-3: Water Management Strategy Screening



Region H  
Table 4A-3: Water Management Strategy Screening

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Strategy Capital Cost (\$)	Average Annual Cost of Water (\$/ac-ft)	Major WMS	Earliest Potential Starting Decade	Firm Yield (ac-ft/yr)	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Decision Matrix Factors (High, Medium, Low)										Total of Screening Factors	Selected as Part of 2001 Plan	Selected as Part of 2006 Plan					
												Cost	Yield	Location	Water Quality	Environment	Local Preference	Institutional Constraints / Risk of Implementation	Impacts on Water Resources / Other Management Strategies										
<b>Conservation Strategies</b>																													
Industrial Conservation	Manufacturing	Reduce water demand through selected BMPs	TBD	TBD		2010	TBD	All	No	No impact	None	0	0	1	0	0	0	1	0	1						3	No	No	
Irrigation Conservation																													
Brazoria County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	\$1,850,200 annual cost, on-farm methods \$198,200 capital cost, canal lining	\$99		2010	18,792	Brazos, Brazos-Colorado	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1							5	Yes	Yes
Chambers County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	\$2,336,300 annual cost, on-farm methods \$279,200 capital cost, canal lining	\$98		2010	24,018	Trinity	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1							5	Yes	Yes
Fort Bend County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	\$509,900 annual cost, on-farm methods \$56,500 capital cost, canal lining	\$99		2010	5,198	Brazos, Brazos-Colorado, San Jacinto-Brazos	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1							5	Yes	Yes
Galveston County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	\$231,100 annual cost, on-farm methods \$29,400 capital cost, canal lining	\$98		2010	2,392	San Jacinto - Brazos	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1							5	Yes	Yes
Liberty County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	\$2,089,800 annual cost, on-farm methods \$188,700 capital cost, canal lining	\$100		2010	20,877	Trinity	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1							5	Yes	Yes
Waller County	Irrigation	Reduce irrigation losses through land leveling, point irrigation	\$726,700 annual cost, on-farm methods	\$110		2050	6,606	San Jacinto	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1							5	Yes	Yes
Municipal Conservation	Multiple	Reduce demand through various methods	From \$9.9 to \$22.8 million for all WUGs collectively	\$202 (Sm Sys) \$311 (Med Sys) \$213 (Lg Sys)		2010	From 45,605 to 105,494	All	No	No impact	None	0	1	1	0	0	1	1	0	1							5	Yes	Yes
<b>Contractual Strategies</b>																													
Expand/ Increase Current Contracts	Multiple	Increase existing contracts to meet customer demands	At WUG level	System Rate		2010	Varies by contract. No new supply created	Multiple	Yes	Reduced streamflows due to use of currently unused supplies	None	1	0	1	0	0	1	1	0	1							5	Yes	Yes
New Contracts from Existing Supply	Multiple	Create new contracts from existing unallocated supplies	At WUG level	System Rate		2010	Varies by contract. No new supply created	Multiple	Yes	Reduced streamflows due to use of currently unused supplies	None	1	0	1	0	0	1	1	0	1							5		Yes
Reallocation of Existing Supply	Multiple	Reallocate surplus water to WUGs with shortages	At WUG level	System Rate		2010	Varies by contract. No new supply created	Multiple	Yes	Altered location of return flows	None	1	0	1	0	0	1	1	0	1							5	No	No
TRA to SJRA contract	TRA / SJRA	Sell uncommitted supply to SJRA	\$302,781,597	\$687	None - Infrastructure cost already reflected under Luce Bayou WMS	Y	2040	76,476	Trinity to San Jacinto	Yes	Potential introduction of invasive species	Requires construction of new conveyance	0	1	0	0	0	0	-1	0							0	No	Yes
TRA to Houston Contract	TRA / Houston	Sell uncommitted supply to Houston			None - Infrastructure cost already reflected under Luce Bayou WMS	Y	2030	123,524	Trinity to San Jacinto	Yes	Potential introduction of invasive species via Luce Bayou conveyance.	Unknown	1	1	0	0	0	1	1	-1	0						3	Yes	Yes
WUG Level Contracts	Multiple WUGs	Contracts from WWPs to WUGs. Includes contracts for volumes created under other yield-producing WMS	WUG-specific infrastructure	Contract Rate		2010	Varies by contract. No new supply created	All	Yes (source-dependent)	None - impacts associated with yield-creating WMS or infrastructure	None	NA	NA	NA	NA	NA	NA	NA	NA	NA							NA	NA	NA
WWP Contracts	Multiple WWPs	Contracts between WWPs. Includes contracts for volumes created under other yield-producing WMS	NA - cost associated with WWP infrastructure projects	Contract Rate		2010	Varies by contract. No new supply created	All	Yes (source-dependent)	None - impacts associated with yield-creating WMS or infrastructure	None	NA	NA	NA	NA	NA	NA	NA	NA	NA							NA	NA	NA
<b>Groundwater Strategies</b>																													
Expanded Use of Groundwater	Multiple	Increase groundwater use, to the sustainable or permitted yield.	\$589,500 per 1 mgd well. \$165,928,999 total capital cost for WUG infrastructure	\$205		2010	90,617	All	No	Uses existing supply, return flows remain in basin of origin.	New wells may require some land clearing.	0	1	1	1	0	1	0	0								4	Yes	
Interim Strategies	Brazoria, Chambers, Galveston, Harris, and Montgomery Counties	Temporary groundwater use in excess of available supply	\$86,701,535 total capital cost for WUG infrastructure	\$788	Y	2010	NA - temporary use of 45,512 ac-ft/yr	Multiple	No	Potential for subsidence and excess drawdown	New wells may require some land clearing.	1	1	1	0	-1	1	0	1	0							4	No	No
New Groundwater Wells for Livestock	Multiple	Added well capacity to facilitate expanded pumping or interim groundwater use	\$18,635	\$37		2010	41	San Jacinto-Brazos, Neches-Trinity	No	None - impacts associated with yield-creating WMS or infrastructure	New wells may require some land clearing.	0	NA	1	1	0	1	0	0	0							3	No	Yes
<b>Groundwater Reduction Plans</b>																													
CHCRWA GRP	CHCRWA	Conversion of CHCRWA to surface water.	TBD	TBD		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	1	0	0	1	0	0	0								2	No	No

Region H  
Table 4A-3: Water Management Strategy Screening

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Strategy Capital Cost (\$)	Average Annual Cost of Water (\$/ac-ft)	Major WMS	Earliest Potential Starting Decade	Firm Yield (ac-ft/yr)	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Decision Matrix Factors (High, Medium, Low)										Total of Screening Factors	Selected as Part of 2001 Plan	Selected as Part of 2006 Plan			
												Cost	Yield	Location	Water Quality	Environment	Local Preference	Institutional Constraints / Risk of Implementation	Impacts on Water Resources / Other Management Strategies								
COH GRP	COH	Conversion of portions of COH service area to surface water	See COH Treatment Expansion and Distribution Expansion	See COH Treatment Expansion and Distribution Expansion		2010	NA	Multiple		Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	1	1	1	1	1	1	1	1	1	1	1	1	1		No	No
Missouri City GRP	Missouri City	Conversion of Missouri City and surrounding area to surface water. Also includes Aquifer Storage and Recovery.	\$92,070,990 capital cost to WWP, \$8,397,800 infrastructure cost to participating WUGs / GRP participation)	\$378 per ac-ft (WWP cost only - excludes infrastructure cost of customer WUGs / GRP participation)		2020 (2013)	4,790 (new supply from reuse + ASR)	Brazos, San Jacinto-Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0						1	No	No
Fort Bend County MUD 25 GRP	Fort Bend MUD 25	A combination of reuse and surface water to allow for groundwater reduction.	\$766,100 capital cost (estimated as \$564 per acre-foot construction cost based on Wastewater Reuse for Municipal Irrigation WMS).	\$499 for infrastructure - does not include customer contract rate		2020 (2013)	589 (Reuse)	Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0						1	No	No
Fort Bend County WCID No. 2 GRP	Fort Bend County WCID No. 2	Surface water conversion	\$24,828,857	\$353		2020 (2013)	NA	San Jacinto, San Jacinto-Brazos	No	Potential disturbance due to construction.	due to transmission line construction. Land required for plant	-1	0	1	0	0	1	0	0						1	No	No
NFBWA GRP	NFBWA	Conversion of NFBWA to surface water. Also includes reuse and major water supply infrastructure.	\$1,838,000 infrastructure cost to WUGS. WWP infrastructure detailed separately.	See inf. Cost		2020 (2013)	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion			0	1	0	0	1	0	0	0				2	No	No
NHCRWA GRP	NHCRWA	Conversion of NHCRWA to surface water. Also includes major water supply infrastructure.	\$17,814,600 infrastructure cost to WUGS. WWP infrastructure detailed separately.	See inf. Cost		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion			0	1	0	0	1	0	0	0				2	No	Yes
Pecan Grove GRP	Pecan Grove	Conversion of Pecan Grove to surface water. Also includes reuse	\$15,960,000	\$865		2020 (2013)	NA	Brazos, San Jacinto-Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0						1	No	No
Richmond-Rosenberg GRP	Richmond, Rosenberg	Conversion of Richmond-Rosenberg to surface water.	\$117,220,150 capital cost for WWP contract	NA - existing contract		2020 (2015)	NA	Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion			0	1	0	0	1	0	0					2	No	No
River Plantation GRP	River Plantation	Entering into GRP with River Plantation CC golf course to provide additional WWTP effluent for irrigation purposes	\$484,926	495		2010	NA	San Jacinto	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	0	1	0	0	1	0	0						2	No	No
SJRA WRAP	Montgomery County	Conversion of Montgomery County to surface water. Also includes reuse and major water supply infrastructure.	\$900,000,000 capital cost for WWP. \$217,856,853 infrastructure cost for participating WUGs / GRP participation)	\$649. (WWP cost only - excludes infrastructure cost of customer WUGs / GRP participation)		2020 (2015)	NA	San Jacinto	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0	0					1	No	No
Sugar Land GRP	Sugar Land	Conversion of Sugar Land and surrounding area to surface water. Also includes reuse.	\$161,360,000 capital cost for WWP. \$6,360,100 infrastructure cost for participating WUGs / GRP participation)	\$1,234. (WWP cost only - excludes infrastructure cost of customer WUGs / GRP participation)		2020 (2013)	NA	Brazos, San Jacinto-Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0	0					1	No	No
WHCRWA GRP Infrastructure Strategies	WHCRWA	Conversion of WHCRWA to surface water. Also includes reuse and major water supply infrastructure.	\$35,269,000 infrastructure cost for participating WUGs. WWP infrastructure detailed separately.	See WHCRWA Transmission and WHCRWA Internal Distribution.		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion			0	1	0	0	1	0	0	0				2		Yes
BWA Brackish Groundwater	BWA	Desalinate of brackish groundwater from Gulf Coast Aquifer to enhance the yield of surface water sources in use in the lower Brazos River Basin.	\$30,570,395	\$390-594		2020	3,136	Multiple	No	Increased return flows form groundwater development and RO concentrate.	Limited disturbance outside of existing plant area.	-1	0	1	0	0	1	0	1	0					2	No	No
BWA Plant Expansion	BWA	Expansion of BWA's conventional SWTP to enhance the yield of surface water sources in use in the lower Brazos River Basin.	\$14,359,419	\$432		2020	NA	Multiple	No	Potential disturbance due to construction.	No disturbance outside of existing plant area.	-1	0	1	0	0	1	1	0	0					2	No	No
CHCRWA Transmission	CHCRWA	Transmission capacity development	TBD	TBD		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion			0	1	0	0	1	0	0					2	No	No
CHCRWA Distribution	CHCRWA	Distribution capacity development	TBD	TBD		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion			0	1	0	0	1	0	0					2	No	No
NFBWA Shared Transmission Line	NFBWA	Transmission capacity development	\$213,000,000 capital cost	\$150		2020 (2013)	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	0	1	0	0	1	0	0	0					2	No	No

**Region H**  
**Table 4A-3: Water Management Strategy Screening**

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Strategy Capital Cost (\$)	Average Annual Cost of Water (\$/ac-ft)	Major WWS	Earliest Potential Starting Decade	Firm Yield (ac-ft/yr)	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Decision Matrix Factors (High, Medium, Low)											Total of Screening Factors	Selected as Part of 2001 Plan	Selected as Part of 2006 Plan		
												Cost	Yield	Location	Water Quality	Environment	Local Preference	Institutional Constraints / Risk of Implementation	Impacts on Water Resources	Impacts of Other Management Strategies							
												1	1	1	1	1	1	1	1	1	1						
NFBWA Internal Distribution	NFBWA	Distribution capacity development	\$225,000,000 capital cost	\$85		2020 (2013)	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction. Land required for plant construction/expansion	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	1	0	1	0	0	1	0	0	0	0				3	No	No
NHCRWA Transmission	NHCRWA	Transmission capacity development	\$253,249,100 capital cost	\$106		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction. Land required for plant construction/expansion	due to transmission line construction. Land required for plant construction/expansion	0	0	1	0	0	1	0	0	0	0				2	No	No
NHCRWA Internal Distribution	NHCRWA	Distribution capacity development	\$535,881,400 capital cost	\$222		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction. Land required for plant construction/expansion	due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0	0				1	No	No	
WHCRWA Transmission	WHCRWA	Transmission capacity development	\$290,084,200 capital cost	\$178		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction. Land required for plant construction/expansion	due to transmission line construction. Land required for plant construction/expansion	0	0	1	0	0	1	0	0	0				2	No	No	
WHCRWA Internal Distribution	WHCRWA	Distribution capacity development	\$552,472,000 capital cost	\$338		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction. Land required for plant construction/expansion	due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0	0				1	No	No	
West Chambers County Supply System	CLCND	Develop a surface water supply system to meet demands in western Chambers County with water from the Trinity basin.	\$20,380,000	\$408		2020	NA	Sabine to San Jacinto	Yes (previously permitted)	Potential introduction of invasive species		-1	0	1	0	0	1	0	0	0				1	No	No	
COH Treatment Expansion	Houston	Increasing capacity in COH treatment facilities infrastructure.	\$2,045,672,200 capital cost	\$1,003		Various	NA	Trinity-San Jacinto, San Jacinto, San Jacinto-Brazos, Brazos	No	Footprint of facilities largely already developed.	Footprint of facilities largely already developed.	-1	1	1	0	0	1	0	0	1				3	No	No	
COH Distribution Expansion	Houston	Distribution expansion for WWP	\$261,040,000	TBD		2010 (2011)	NA	San Jacinto	No	Footprint of facilities largely already developed.	largely already developed.		1	0	0	0	1	0	0	1				3	No	No	
Huntsville WTP	Huntsville	WTP construction to utilize existing contracts	\$61,023,900 capital cost (estimated using Region H standard cost assumptions).	\$587		2010	NA	Trinity, San Jacinto	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	1	1	0	0	1	0	0	0				2	No	No	
LLWSSC Surface Water Project	Lake Livingston Water Supply and Sewer Service Company	Expansion of SWTP to meet municipal demands	\$3,087,974	\$373		2010	NA	Trinity	No	Potential disturbance due to construction.	Land required for facility construction	-1	1	1	0	0	1	0	-1	0				1	No	No	
Harris County MUD 50 SWTP	Harris MUD 50	Treat surface water from SJRA for municipal use.	\$6,131,600	\$736		2020	NA	San Jacinto	No	Potential disturbance due to construction.	Land required for facility construction	-1	1	1	0	0	1	0	-1	0				1	No	No	
Luce Bayou	COH	Development of a conveyance from the Trinity River to Lake Houston	\$253,917,000 capital cost	\$91		2020	NA	Trinity to San Jacinto	Yes (previously permitted)	Potential introduction of invasive species	Conveyance requires extensive canal construction	1	0	1	0	-1	1	-1	-1	0				0	Yes	Yes	
Sealy GW Treatment Expansion	Sealy	Expansion of a SWTP	\$6,450,000	\$966		2020	NA	Brazos	No	Potential disturbance due to construction.	Land required for facility construction	-1	1	1	0	0	1	0	-1	0				1	No	No	
Pearland SWTP	Pearland	Installation of a SWTP	\$265,000,000	\$848		2010	NA	San Jacinto - Brazos	No	Potential disturbance due to construction.	Land required for facility construction	-1	1	1	0	0	1	0	-1	0				1	No	No	
<b>Reservoir Strategies</b>																											
Allens Creek Reservoir	BRA / Houston	New reservoir in Austin County	\$222,752,400	\$197	Y	2020	99,650	Brazos	No	Wetlands and bottomland hardwoods impacted	Innundates 7,000 acres	0	0	1	1	-1	1	0	-1	1				2	Yes	Yes	
Bedias Reservoir	SJRA	New Reservoir in Madison/Grimes Counties	\$247,241,628	\$237	Y	2030	90,700	Trinity	No	7,300 acres of bottomland hardwoods	Innundates 27,400 acres	0	0	0	0	-1	0	-1	-1	-1				-4	Yes	No	
Dow Off-Channel Reservoir and Pump Station Expansion	Dow / Brazosport Water Authority	Increase total raw water pumping and storage capacity	\$226,837,000	\$256	Y	2020	80,000	Brazos	No	Potential habitat impacts to 2,000 acres. Impacts potentially already incurred due to agricultural use.	Impacts to 2,00 acres of agricultural land.	-1	1	1	0	0	0	1	-1	0				1	No	No	
Little River Reservoir	BRA / GCWA	New reservoir in Milam County	\$556,520,000	\$328	Y	2040	119,000	Brazos	No	Listed and endangered species habitat	Innundates 35,600 acres	-1	0	0	0	-1	-1	-1	-1	0				-5	Yes	No	
Little River Off-Channel Reservoir	BRA	New reservoir in Milam County	\$137,356,000	\$436	Y	2040	27,255	Brazos	No	Potential impact on terrestrial species habitats	Innundates 4,400 acres	-1	-1	0	0	0	0	0	-1	1				-2	No	Yes	
Brazoria Off-Channel Reservoir	Brazoria County	New reservoir in Brazoria County	\$173,898,602	\$1,206	Y	2030	24,000	San Jacinto - Brazos	No	Potential impact on terrestrial species habitats	Innundates 3,200 acres	-1	1	1	0	0	1	0	-1	0				1	No	No	
Fort Bend Off-Channel Reservoir	Fort Bend County	New reservoir in Fort Bend County	\$202,514,788	1893 (based on allocated volume)	Y	2030	46,000	San Jacinto - Brazos	No	Potential impact on terrestrial species habitats	Innundates 3,000 acres	-1	1	1	0	0	1	0	-1	0				1	No	No	
GCWA Off-Channel Reservoirs	GCWA	Use storage to enhance the yield of existing GCWA rights	\$197,448,012	\$827	Y	2030	39,530	San Jacinto - Brazos	No	Potential impact on terrestrial species habitats	Innundates 4,000 acres	-1	1	1	0	0	1	0	-1	0				1	No	No	
Lower Lake Creek Reservoir	SJRA	New reservoir in Montgomery County	\$480,777,860	\$583	Y	2040	67,200	San Jacinto	No	Some endangered species have been identified. Innundates 71,000 acres. Approximately 17,000 acres of mixed bottomland hardwoods. Probable high environmental impacts.	There are about 2,200 acres of bottomland hardwoods, 7,000 acres of oak, hickory, and pine forest, and 1,800 acres of shrubland and grasses. Some Endangered Species Identified	-1	1	0	0	-1	0	-1	-1	1				-2	No	No	
Millican Reservoir (Panther Creek Dam)	BRA	New reservoir in Brazos, Madison, Leon, and Robertson Counties	\$1,159,907,000	\$1,241 (allocated portion only - for fully-utilized reservoir, unit cost is \$424 per acre-foot)	Y	2040	194,500	Brazos	No	Some endangered species have been identified. Innundates 71,000 acres. Approximately 17,000 acres of mixed bottomland hardwoods. Probable high environmental impacts.	Innundates 71,000 acres. Approximately 17,000 acres of mixed bottomland hardwoods.	-1	0	-1	0	-1	0	-1	-1	0				-5	No	No	



Region H  
Table 4A-3: Water Management Strategy Screening

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Strategy Capital Cost (\$)	Average Annual Cost of Water (\$/ac-ft)	Major WMS	Earliest Potential Starting Decade	Firm Yield (ac-ft/yr)	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Decision Matrix Factors (High, Medium, Low)											Total of Screening Factors	Selected as Part of 2011 Plan	Selected as Part of 2016 Plan
												Cost	Yield	Location	Water Quality	Environment	Local Preference	Institutional Constraints / Risk of Implementation	Impacts on Water Resources	Impacts on Other Management Strategies					
Screening Factor Weight:																									
Millican-Bundic Reservoir	BRA	New reservoir in Brazos, Madison, Leon, and Robertson Counties	\$720,224,000	\$1,431	Y	2030	36,990	Brazos	No	Avoids Manning and Yegua lignite, avoids Kurten oil and gas field, avoids the Wilcox lignite in the upper river reaches and avoids significant bottomland hardwood population. Size of lake would be constrained by the Wilcox lignite, and inundation of marsh area upstream of Old San Antonio Road. Probable moderate to high environmental and instream flows impacts.	The inundation area impacts approximately 9,210 acres of mixed Bottomland Hardwood Forest, 4,086 acres of Grasses/Forbs, and 1,334 acres of Post Oak Woods.	-1	0	-1	0	-1	0	-1	-1	0	-5	No	No		
<b>Reuse Strategies</b>																									
Fulshear Reuse	Fulshear	Development of a direct reuse system to provide reclaimed water to Fulshear and surrounding communities.	\$566,600 capital cost (estimated as \$564 per acre-foot construction cost based on Wastewater Reuse for Municipal Irrigation WMS).	\$502		2020	430	Brazos, San Jacinto-Brazos	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	None	-1	0	1	1	0	1	0	-1	0	1	No	No		
Houston Indirect Wastewater Reuse	Houston	Reuse wastewater from all city WWTPs in lieu of Trinity Supply.	\$721,822,900 infrastructure cost for participating WUGs.	\$402 to \$1,232 (average)	Y	2020	Up to 490,223	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	0	1	1	0	0	0	-1	-1	1	1	Yes	Yes		
Montgomery County MUDs 8/9 Reuse	Montgomery MUDs 8/9	Reuse water from Montgomery County MUDs 8/9	\$12,245,700	\$878 per acre-foot (based on allocated volume)		2020 (2016)	1,120 (max)	San Jacinto	No	This WMS will not be permitted to negatively impact downstream rights.	none	-1	1	1	0	1	1	0	0	0	3	No	No		
NHCRWA Indirect Wastewater Reuse	NHCRWA	Reuse wastewater from member WWTPs in lieu of purchasing additional supply.	\$66,778,694	\$702 per acre-foot allocated	Y	2010	Up to 157,000	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	0	1	1	0	0	0	-1	-1	1	1	Yes	Yes		
Wastewater Reclamation for Industry	Houston, Manufacturing	Deliver treated wastewater to industry for use in lieu of Trinity River supply.	\$332,051,761	\$893	Y	2010	67,200	San Jacinto	No	Minimal change in habitat	None	-1	1	1	1	0	1	0	1	1	5	Yes	Yes		
Wastewater Reclamation for Municipal Irrigation	County-Other and Authorities in Brazoria, Fort Bend, Harris, and Montgomery Counties	Reuse for municipal irrigation	\$48,043,200 infrastructure cost for participating WUGs.	\$539 average		2030	36,388 (in 2060)	Multiple	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	None	-1	0	1	1	0	1	0	-1	0	1	No	No		
<b>Permit Strategies</b>																									
BRA System Operations Permit	BRA	Use peak flows, when available, and systems management to reduce the use of water stored under other permits.	TBD - based on system rate of \$61 per acre-foot	TBD - based on system rate of \$61 per acre-foot	Y	2020 (2015)	25,350 (Region H)	Brazos	No	Harvests peak flows through system management, positive affect on below-median flows	New pump stations may be required.	1	1	1	0	0	1	-1	0	0	3	Yes	Yes		
Houston Bayous Permit	Houston	Use peak flows, when available, to reduce the use of water stored under other permits.	\$20,956,000	System rate		NA	0	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	1	-1	1	0	-1	1	-1	0	0	0	Yes	Yes		
<b>Other Strategies</b>																									
Brazoria County Interruptible Supplies for Irrigation	GCWA	Use of interruptible portion of GCWA water right for irrigation	NA	NA		2010	Non-firm 124,000 w/ GCWA off-channel)	Brazos, San Jacinto-Brazos	No	Reduced flows in Brazos River due to increased diversion	None	1	1	1	0	0	0	0	-1	0	2	NA	NA		
Brazos Salt Water Barrier	BRA / DOW	Prevent the seasonal migration of the saltwater wedge upstream to protect existing diversion points.	\$44,470,700	NA		2030	NA	Brazos	No	Will influence flood plain response to major storms.	New structure in river channel	0	-1	1	1	0	0	0	1	1	3	NA	Yes		
Freeport Desalination	BRA / DOW	Desalinate seawater for industrial and municipal use.	\$85,233,000 (11,200AF) - \$255,699,000 (33,600AF)	\$1,730 to \$2,376	Y	2040	11,200 to 33,600	Brazos, San Jacinto-Brazos	No	Offsets some use of Brazos basin flows.	New facility may require some land clearing.	-1	1	1	1	0	0	0	0	0	2	No	Yes		
Montgomery County MUD 8/9 Brackish Desal	Montgomery County MUDs 8 and 9	Development of a brackish groundwater desalination facility that would supplement existing wells, reducing dependence on fresh water formations of the Gulf Coast Aquifer.	TBD	TBD		2010 (2014)	Up to 2,240 acre-feet per year (average 2.0 MGD)	San Jacinto	No	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	No	No		
Sabine to Region H Transfer	Harris / Montgomery Counties	Transfer existing supply from Toledo Bend Reservoir to Region H.	\$760,813,320	Dependent on volume that would be allocated if selected as an alternative.	Y	2030	From 26,762 (2020) to 486,500 (2060)	Sabine to San Jacinto	Yes	Potential introduction of invasive species / Reduction of freshwater inflows to Sabine Lake	1398-acres	0	1	-1	0	-1	-1	-1	-1	1	-3	NA	No		
Galveston County Desal	GCWA		TBD	TBD				San Jacinto-Brazos			Unknown	-1	0	1	1	0	0	0	0	0	1	No	No		

**Attachment D:**

Amended Table 4A-4: Water Management Strategy Environmental Impacts



Region H  
Table 4A-4: Water Management Strategy Environmental Impacts

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Instream Flows	Bay and Estuary Inflows	Wildlife Habitat	Wetlands	Threatened and Endangered Species	Cultural Resources	Evaluation of Impacts of Water Management Strategies on Threats to Natural Resources	Use of Environmental Planning Criteria or Site-Specific Information on Environmental Flow Needs	Description of Regional Planning Area	Description of Water Sources, including Major Springs	Description of Natural Resources (Animal, Vegetable, or Mineral)	Identification of Water Quality Problems	Identification of Threats to Natural Resources	Recommendations for Ecologically Unique River and Stream Segments	Recommendations that are Needed and Desirable to Protect Natural Resources	
Screening Factor Weight:																						
<b>Conservation Strategies</b>																						
Industrial Conservation	Manufacturing	Reduce water demand through selected BMPs	All	No	No impact	None	Strategy reduces the demand for additional water supply, but also reduces return flows from existing sources.	Reduces return flows from current sources, but the rate of savings does not compensate for the rate of growth in the largest counties.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect on existing supply sources.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 regional plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Irrigation Conservation	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	Various	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Brazoria County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	Brazos, Brazos-Colorado	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Chambers County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	Trinity	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Galveston County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	San Jacinto - Brazos	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Liberty County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	Trinity	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Waller County	Irrigation	Reduce irrigation losses through land leveling, point irrigation	San Jacinto	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Municipal Conservation	Multiple	Reduce demand through various methods	All	No	No impact	None	Strategy reduces the demand for additional water supply, but also reduces per-capita return flows from groundwater use.	Reduces per capita return flows from groundwater, but the rate of savings does not compensate for the rate of population growth.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing per capita water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 regional plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
<b>Contractual Strategies</b>																						
Expand/ Increase Current Contracts	Multiple	Increase existing contracts to meet customer demands	Multiple	Yes	Reduced streamflows due to use of currently unused supplies	None	Reduces in-stream flows in all basins due to full use of existing water supplies.	Return flows (typically equal to 60% of diversion) will off-set increased diversions. Houston and SJRA use will result in return flows to Upper Galveston Bay vice Trinity Bay (if left unused).	NA - does not require the construction of new infrastructure beyond expansion of existing plants.	NA - does not require the construction of new infrastructure.	Does not require the construction of new infrastructure, but full use of permits will affect riparian habitat.	NA - does not require the development of new infrastructure sites.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 regional plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay		
New Contracts from Existing Supply	Multiple	Create new contracts from existing unallocated supplies	Multiple	Yes	Reduced streamflows due to use of currently unused supplies	None	Reduces in-stream flows in all basins due to full use of existing water supplies.	Return flows (typically equal to 60% of diversion) will off-set increased diversions. Houston and SJRA use will result in return flows to Upper Galveston Bay vice Trinity Bay (if left unused).	NA - does not require the construction of new infrastructure beyond expansion of existing plants.	NA - does not require the construction of new infrastructure.	Does not require the construction of new infrastructure, but full use of permits will affect riparian habitat.	NA - does not require the development of new infrastructure sites.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 regional plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay		
Reallocation of Existing Supply	Multiple	Reallocate surplus water to WUGs with shortages	Multiple	Yes	Altered location of return flows	None	Reduces in-stream flows in all basins due to full use of existing water supplies.	Return flows (typically equal to 60% of diversion) will off-set increased diversions. Houston and SJRA use will result in return flows to Upper Galveston Bay vice Trinity Bay (if left unused).	NA - does not require the construction of new infrastructure beyond expansion of existing plants.	NA - does not require the construction of new infrastructure.	Does not require the construction of new infrastructure, but full use of permits will affect riparian habitat.	NA - does not require the development of new infrastructure sites.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 regional plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay		
TRA to SJRA contract	TRA / SJRA	Sell uncommitted supply to SJRA.	Trinity to San Jacinto	Yes	Potential introduction of invasive species	Requires construction of new conveyance.	Transfers unused supply from the Trinity to the San Jacinto River basin, resulting in decreased flows below Lake Livingston.	Return flows (typically equal to 60% of diversion) will return to Upper Galveston Bay vice Trinity Bay.	Increased diversion from Lake Livingston will increase lake-level fluctuations and reduce flows in the lower Trinity. No new construction impacts are associated with this strategy.	No new construction impacts are associated with this strategy. Lake level fluctuations will affect wetlands along the shoreline and tributaries.	Potential impact to Wood Stork and Alligator Snapping Turtle habitat through reduced flows in lower Trinity River.	Potential impacts along conveyance route	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay		
TRA to Houston Contract	TRA / Houston	Sell uncommitted supply to Houston	Trinity to San Jacinto	Yes	Potential introduction of invasive species	Unknown	Transfers unused supply from the Trinity to the San Jacinto River basin, resulting in decreased flows below Lake Livingston.	Return flows (typically equal to 60% of diversion) will return to Upper Galveston Bay vice Trinity Bay.	Increased diversion from Lake Livingston will increase lake-level fluctuations and reduce flows in the lower Trinity. No new construction impacts are associated with this strategy.	No new construction impacts are associated with this strategy. Lake level fluctuations will affect wetlands along the shoreline and tributaries.	Potential impact to Wood Stork and Alligator Snapping Turtle habitat through reduced flows in lower Trinity River.	NA - does not require the construction of new infrastructure.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay		
WUG Level Contracts	Multiple WUGs	Contracts from WUGs to WUGs	All	Yes (source-dependent)	None - impacts associated with yield-creating WMS or infrastructure	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WUG Contracts	Multiple WUGs	Contracts between WUGs	All	Yes (source-dependent)	None - impacts associated with yield-creating WMS or infrastructure	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Groundwater Strategies</b>																						



Region H  
Table 4A-4: Water Management Strategy Environmental Impacts

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Instream Flows	Bay and Estuary Inflows	Wildlife Habitat	Wetlands	Threatened and Endangered Species	Cultural Resources	Evaluation of Impacts of Water Management Strategies on Threats to Natural Resources	Use of Environmental Planning Criteria or Site-Specific Information on Environmental Flow Needs	Description of Regional Planning Area	Description of Water Sources, including Major Springs	Description of Natural Resources (Animal, Vegetable, or Mineral)	Identification of Water Quality Problems	Identification of Threats to Natural Resources	Recommendations for Ecologically Unique River and Stream Segments	Recommendations that are Needed and Desirable to Protect Natural Resources
WHCROWA GRP Infrastructure Strategies	WHCROWA	Conversion of WHCROWA to surface water. Also includes reuse and major water supply infrastructure.	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
BWA Brackish Groundwater	BWA	Desalinate of brackish groundwater from Gulf Coast Aquifer to enhance the yield of surface water sources in use in the lower Brazos River Basin.	Multiple	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to stream.	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	TBD. Potential mitigation of impacts to Waters of the US from pipeline alignments.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
BWA Plant Expansion	BWA	Expansion of BWA's conventional SWTP to enhance the yield of surface water sources in use in the lower Brazos River Basin.	Multiple	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Low probability of significant impacts	Low probability of significant impacts	Limited potential for impact at existing plant site.	Limited potential for impact at existing plant site.	Limited potential for impact at existing plant site.	Limited potential for impact at existing plant site.	N/A	Diversions covered under existing supplies.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
CHCROWA Transmission	CHCROWA	Transmission capacity development	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to streams in all basins.	Full utilization of groundwater reduces potential for transfer from Trinity Basin, leaving flows into Trinity Bay.	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
CHCROWA Distribution	CHCROWA	Distribution capacity development	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to streams in all basins.	Full utilization of groundwater reduces potential for transfer from Trinity Basin, leaving flows into Trinity Bay.	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
NFBWA Shared Transmission Line	NFBWA	Transmission capacity development	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
NFBWA Internal Distribution	NFBWA	Distribution capacity development	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
NHCROWA Transmission	NHCROWA	Transmission capacity development	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
NHCROWA Internal Distribution	NHCROWA	Distribution capacity development	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
WHCROWA Transmission	WHCROWA	Transmission capacity development	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
WHCROWA Internal Distribution	WHCROWA	Distribution capacity development	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
West Chambers County Supply System	CLCND	Develop a surface water supply system to meet demands in western Chambers County with water from the Trinity basin.	Sabine to San Jacinto	Yes (previously permitted)	Potential introduction of invasive species	Conveyance requires extensive canal construction	Will reduce instream flows to convey water to the west	Return flows will be returned to Galveston Bay	Potential impact to habitat along transmission system alignment	Potential impact to wetlands along transmission system alignment	Potential impact to T&E species along transmission system alignment	Potential impact to cultural resources along transmission system alignment	N/A	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
COH Treatment Expansion	Houston	Increasing capacity in COH treatment facilities infrastructure.	Trinity-San Jacinto, San Jacinto, San Jacinto-Brazos	No	Footprint of facilities largely already developed.	Footprint of facilities largely already developed.	Low probability of significant impacts	Low probability of significant impacts	Potential impact to habitat on SWTP site	Potential impact to wetlands on SWTP site	Potential impact to T&E species on site	Potential impact to cultural resources on SWTP site	N/A	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
COH Distribution Expansion	Houston	Distribution expansion for WWP	San Jacinto	No	Footprint of facilities largely already developed.	Footprint of facilities largely already developed.	Low probability of significant impacts	Low probability of significant impacts	Potential impact to habitat along transmission corridor.	Potential impact to habitat along transmission corridor.	Potential impact to habitat along transmission corridor.	Potential impact to cultural resources along transmission corridor.	N/A	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Huntsville WTP	Huntsville	WTP construction to utilize existing contracts	Trinity, San Jacinto	No	Potential impact to habitat on site	Land required for facility construction	Low probability of significant impacts	Low probability of significant impacts	Potential impact to habitat on SWTP site	Potential impact to wetlands on SWTP site	Potential impact to T&E species on site	Potential impact to cultural resources on SWTP site	N/A	N/A	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Harris County MUD 50 SWTP	Harris MUD 50	Treat surface water from SJRA for municipal use.	San Jacinto	No	Potential impact to habitat on site	Land required for facility construction	Low probability of significant impacts	Low probability of significant impacts	Potential impact to habitat on SWTP site	Potential impact to wetlands on SWTP site	Potential impact to T&E species on site	Potential impact to cultural resources on SWTP site	N/A	N/A	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay

Region H  
Table 4A-4: Water Management Strategy Environmental Impacts

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Instream Flows	Bay and Estuary Inflows	Wildlife Habitat	Wetlands	Threatened and Endangered Species	Cultural Resources	Evaluation of Impacts of Water Management on Threats to Natural Resources	Use of Environmental Planning Criteria or Site-Specific Information on Environmental Flow Needs	Description of Regional Planning Area	Description of Water Sources, including Major Springs	Description of Natural Resources (Animal, Vegetable, or Mineral)	Identification of Water Quality Problems	Identification of Threats to Natural Resources	Recommendations for Ecologically Unique River and Stream Segments	Recommendations that are Needed and Desirable to Protect Natural Resources	
LLWSSSC Surface Water Project	Lake Livingston Water Supply and Sewer Service Company	Expansion of SWTP to meet municipal demands	Trinity	No	Potential impact to habitat on site	Land required for facility expansion	Low probability of significant impacts	Low probability of significant impacts	Potential impact to habitat on SWTP site	Potential impact to wetlands on SWTP site	Potential impact to T&E species on site	Potential impact to cultural resources on SWTP site	N/A		2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Luce Bayou	COH	Development of a conveyance from the Trinity River to Lake Houston	Trinity to San Jacinto	Yes (previously permitted)	Potential introduction of invasive species	Conveyance requires extensive canal construction	Reduces flow in the Trinity River below Liberty.	Return flows (typically equal to 60% of diversion) will return to Upper Galveston Bay vice Trinity Bay.	Conveyance requires 23.6 miles of canal. Blending supply in Lake Houston may affect lake habitat.	Potential impact due to diversion structure. Potential wetland impacts due to project.	Potential impact to White-faced Ibis, Wood Stork and Alligator Snapping Turtle habitat through reduced flows in lower Trinity River. Increased flow in Luce Bayou may impact Creek Chubsucker habitat.	Privately owned ranches and farms along Luce Bayou. Pump station study identified historic homestead, which was studied and cataloged at the time of the original permit.			2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Sealy GW Treatment Expansion	Sealy	Expansion of a SWTP	Brazos	No	Potential impact to habitat on site	Land required for facility construction	Low probability of significant impacts	Low probability of significant impacts	Potential impact to habitat on SWTP site	Potential impact to wetlands on SWTP site	Potential impact to T&E species on site	Potential impact to cultural resources on SWTP site	N/A		2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Pearland SWTP	Pearland	Installation of a SWTP	San Jacinto	No	Potential impact to habitat on site	Land required for facility construction	Low probability of significant impacts	Low probability of significant impacts	Potential impact to habitat on SWTP site	Potential impact to wetlands on SWTP site	Potential impact to T&E species on site	Potential impact to cultural resources on SWTP site	N/A		2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
<b>Reservoir Strategies</b>																						
Alleys Creek Reservoir	BRA / Houston	New reservoir in Austin County	Brazos	No	Wetlands and bottomland hardwoods impacted	Inundates 7,000 acres		Diverts peak flows. When base flow is above median, diversions cannot reduce it below media. When base flow is above 25th percentile, diversions cannot reduce it below 25th percentile. Below 25th percentile, diversions cannot reduce it below a 70Z.							2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Dow Off-Channel Reservoir and Pump Station Expansion		Increase total raw water pumping and storage capacity	Brazos	No	Potential habitat impacts to 2,000 acres. Impacts potentially already incurred due to agricultural use.	Impacts to 2,000 acres of agricultural land.	Some impacts possible due to increased diversions. Source is existing senior right.	Some impacts possible due to increased diversions. Source is existing senior right.	Impacts to 2,000 acres which are likely already impacted due to existing agricultural use.	Potential impacts. Assessment as part of project development.	Potential for multiple threatened and endangered species to be located within the vicinity of the proposed project site.	Cultural Resources survey will be required to determine impacts to cultural resources in the area	Potential reduction to B&E inflows. Limited impacts to other strategies anticipated as source is senior right near basin outlet.	Diversion would be from existing senior right modeled in ICFE WAM.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Little River Off-Channel Reservoir	BRA	New reservoir in Milam County	Brazos	No	Potential impact on terrestrial species habitats	Inundates 4400 acres		Will have substantial impacts on the instream biological community at the proposed reservoir site. However, there would be minimal impacts in the Little River diversion site. It is not likely that this project, alone, would have a substantial influence on total discharge in the Brazos River, in which case there would be minimal influence on freshwater inflows to the Brazos River estuary. However, the cumulative impact of multiple projects may reduce freshwater inflows into the estuary.	Would inundate 4,343 acres; Projected wildlife habitat that will be impacted includes 2,215 acres of Mixed Grassland, 1,839 acres of Post Oak Woods, and 289 acres of Mixed Riparian Woods/Forest.		The species that could occur within the vicinity of the site include Houston toad, bald eagle interior least tern, piping plover, and whooping crane, and Navasota ladies'-tresses.	31 archeological sites have been documented within the general vicinity of the proposed reservoir. Pin Oak Cemetery may lie within the reservoir site. Prior to reservoir inundation, the project must be coordinated with the Texas Historical Commission and a cultural resources survey must be conducted to determine if any cultural resources are present within the conservation pool.	Water potentially available for impoundment estimated using the Brazos G WAM. Firm yield computed subject to the reservoir and Little River diversion having to pass inflows to meet CCEFN instream flow requirements	Regional G Draft RPP Technical Evaluations of WMS, 4B.13.5	Regional G Draft RPP Technical Evaluations of WMS, 4B.13.5	Regional G Draft RPP Technical Evaluations of WMS, 4B.13.5	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	The project is expected to have negligible impacts to the stream flow and water quality in the Little River and Brazos River.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay		
Brazoria County Off-Channel Reservoir	Brazoria County	New reservoir in Brazoria County	San Jacinto - Brazos	No	Potential impact on terrestrial species habitats	Inundates 4,000 acres		The project would promote a minor reduction in instream flows, but as a percentage of total flow the difference would be minor.			Potential for multiple threatened and endangered species to be located within the vicinity of the proposed project site.	Cultural Resources survey will be required to determine impacts to cultural resources in the area	Lower streamflows, declining water quality, and reduced inflows to reservoirs.	Water potentially available for impoundment estimated using the Brazos G WAM. Firm yield computed subject to diversion having to pass inflows to meet CCEFN instream flow requirements	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Fort Bend County Off-Channel Reservoir	Fort Bend County	New reservoir in Fort Bend County	Brazos	No	Potential impact on terrestrial species habitats	Inundates 4,000 acres		The project would promote a minor reduction in instream flows, but as a percentage of total flow the difference would be minor.			Potential for multiple threatened and endangered species to be located within the vicinity of the proposed project site.	Cultural Resources survey will be required to determine impacts to cultural resources in the area	Lower streamflows, declining water quality, and reduced inflows to reservoirs.	Water potentially available for impoundment estimated using the Brazos G WAM. Firm yield computed subject to the reservoir and diversion having to pass inflows to meet CCEFN instream flow requirements	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
GCWA Off-Channel Reservoirs	GCWA	Use storage to enhance the yield of existing GCWA rights	San Jacinto - Brazos	No	Potential impact on terrestrial species habitats	Inundates 4,000 acres		The project would promote a minor reduction in instream flows, but as a percentage of total flow the difference would be minor.			Potential for multiple threatened and endangered species to be located within the vicinity of the proposed project site.	Cultural Resources survey will be required to determine impacts to cultural resources in the area	Lower streamflows, declining water quality, and reduced inflows to reservoirs.	Water potentially available for impoundment estimated using the Brazos G WAM. Firm yield computed subject to the reservoir and diversion having to pass inflows to meet CCEFN instream flow requirements	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
<b>Reuse Strategies</b>																						
Fulshear Reuse	Fulshear	Development of a direct reuse system to provide reclaimed water to Fulshear and surrounding communities.	Brazos, San Jacinto-Brazos	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Houston Indirect Wastewater Reuse	Houston	Reuse wastewater from all city WWTPs in lieu of Trinity Supply.	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	All return flows remain in Galveston Bay watershed. Reuse of supplies in San Jacinto Basin reduces potential need for transfer from Trinity Basin.	Permit applications point out the urbanized watershed	Permit applications state that potential diversion points will have minimal impacts on wetlands adjacent to streams.	Permit applications are silent on this issue	NA	N/A	SJRA permit addresses flows using existing downstream diversion point. Other applications are silent on this issue.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	

Region H  
Table 4A-4: Water Management Strategy Environmental Impacts

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Instream Flows	Bay and Estuary Inflows	Wildlife Habitat	Wetlands	Threatened and Endangered Species	Cultural Resources	Evaluation of Impacts of Water Management Strategies on Threats to Natural Resources	Use of Environmental Planning Criteria or Site-Specific Information on Environmental Flow Needs	Description of Regional Planning Area	Description of Water Sources, including Major Springs	Description of Natural Resources (Animal, Vegetable, or Mineral)	Identification of Water Quality Problems	Identification of Threats to Natural Resources	Recommendations for Ecologically Unique River and Stream Segments	Recommendations that are Needed and Desirable to Protect Natural Resources
Montgomery County MUDs 8/9 Reuse	Montgomery MUDs 8/9	Reuse water from Montgomery County MUDs 8/9	San Jacinto	No	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	none	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	All return flows remain in Galveston Bay watershed.	TBD. Impacts expected to be minimal	TBD. Impacts expected to be minimal	TBD. Impacts expected to be minimal	TBD	TBD		2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
NHCRWA Indirect Wastewater Reuse	NHCRWA	Reuse wastewater from member WWTPs in lieu of purchasing additional supply.	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	All return flows remain in Galveston Bay watershed. Reuse of supplies in San Jacinto Basin reduces the potential need for transfer from Trinity Basin.	Majority of the needed infrastructure will be constructed in urbanized areas. Therefore, the impact to wildlife habitat will be limited.	Majority of the needed infrastructure will be constructed in urbanized areas. Therefore, the impact to wetlands will be limited.	Potential impact to Creek Chubsucker and Alligator Snapping Turtle habitat through reduced wastewater return flows.	NA	N/A	SJRA permit addresses flows using existing downstream diversion point. Other applications are silent on this issue.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Wastewater Reclamation for Industry	Houston, Manufacturing	Deliver treated wastewater to industry for use in lieu of Trinity River supply.	San Jacinto	No	Minimal change in habitat	None	Reduces municipal return flows into Sims and Buffalo Bayous. Manufacturing return flows into the ship channel will not be affected.	Reuse water is intended to offset supply transferred from Lake Livingston, leaving the inflows for Trinity Bay vice Upper Galveston Bay	Sims and Buffalo Bayous will realize reduced freshwater flows due to reuse. Central treatment facility may impact up to 15 acres of undeveloped land.	4 new pipeline crossings may impact 6 acres (assumed 1.5 acres each).	Potential impact to Wood Stork and Alligator Snapping Turtle habitat through reduced wastewater return flows.	Project is within an industrial area, but site studies must still be conducted for new facilities.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Wastewater Reclamation for Municipal Irrigation	County-Other and Authorities in Brazoria, Fort Bend, Harris, and Montgomery Counties	Reuse for municipal irrigation	Multiple	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	None	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	Potential to reduce return flows in specific basin of use.	Permit applications point out the urbanized watershed	Permit applications state that potential diversion points will have minimal impacts on wetlands adjacent to streams.	Permit applications are silent on this issue	NA	N/A		2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
<b>Permit Strategies</b>																					
BRA System Operations Permit	BRA	Use peak flows, when available, and systems management to reduce the use of water stored under other permits.	Brazos	No	Harvests peak flows through system management, positive affect on below-median flows	New pump stations may be required.	Diverts from streamflows when above median flow, reducing peaks. Releases from storage when below median flows, increasing the flows above diversion points.	Reduces peak flushing effects due to diversions above median flows. Flows below median are minimally affected.	Application points to the deferred or eliminated need for Little River Reservoir	Application points to the deferred or eliminated need for Little River Reservoir. New diversion points must be assessed as needed.	None discussed in permit application. Deferring Little River Reservoir reduces overall basin impact.	Application points to the deferred or eliminated need for Little River Reservoir	N/A	TCEQ Draft permit has been granted	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Houston Bayous Permit	Houston	Use peak flows, when available, to reduce the use of water stored under other permits.	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	Permit applications refer to capturing peak flows. Model includes current Lake Houston instream flow requirement	Permit applications refer to capturing peak flows. Model includes current Lake Houston instream flow requirement	Permit applications point out the urbanized watershed	Permit applications state that potential diversion points will have minimal impacts on wetlands adjacent to streams.	Permit applications are silent on this issue	N/A - Does not recommend new diversion point	N/A	SJRA permit addresses flows using existing downstream diversion point. Other applications are silent on this issue.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
<b>Other Strategies</b>																					
Brazoria County Interruptible Supplies for Irrigation	GCWA	Use of interruptible portion of GCWA water right for irrigation	San Jacinto-Brazos	No	Reduced flows in Brazos River due to increased diversion	None	Use of interruptible supplies will decrease instream flows														
Brazos Salt Water Barrier	BRA / DOW	Prevent the seasonal migration of the saltwater wedge upstream to protect existing diversion points.	Brazos	No	Will influence flood plain response to major storms.	New structure in river channel	Structure will create a pool during low-flow periods, but river flows should spill at the same rate as before the structure.	The structure will be designed not to impound seasonal low flows.	The structure will fill [TBD] acres. Access road will require [TBD] acres. The introduction of the barrier may impact migratory fish species.	The structure will affect [TBD] acres of river bottomlands.	Potential habitat impacts to Black Rail, White-faced Ibis, Wood Stork, Diamondback Terrapin and Corkwood.	Siting study is required to identify any cultural resources being impacted. Site will be above Sea Center Texas hatchery.	Strategy reduces the influence of saltwater migration upstream to protect freshwater diversion points. This reduces the need for replacement supplies.	NA - strategy will not impound water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Freeport Desalination	BRA / DOW	Desalinate seawater for industrial and municipal use.	Brazos, San Jacinto-Brazos	No	Offsets some use of Brazos basin flows.	New facility may require some land clearing.	Displacement of water that is currently diverted to meet municipal demands.	Saline water release is made into Dow discharge canal that empties directly into the Gulf of Mexico.	As many as 530 acres of property impacted by the installation of delivery lines, some of which follow existing easements.	Same as wildlife impact potential.	Unknown. Will require assessment before implementation of the strategy.	Will require study before implementation of the strategy.	Will require study before implementation of the strategy.	Will require study before implementation of the strategy.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Montgomery County MUD 8/9 Brackish Desal	Montgomery County MUDs 8 and 9	Development of a brackish groundwater desalination facility that would supplement existing wells, reducing dependence on fresh water formations of the Gulf Coast Aquifer.	San Jacinto	No	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Sabine to Region H Transfer	Harris / Montgomery Counties	Transfer existing supply from Toledo Bend Reservoir to Region H.	Sabine to San Jacinto	Yes	Potential introduction of invasive species / Reduction of freshwater inflows to Sabine Lake	TBD	Displacement of water from Lake Livingston and reduced use of Livingston water in lower basin will result in reduced flow between the lake and the IBT discharge point on the Trinity.	Inflows to Sabine Lake could potentially be impacted.	Nearly entire Neches-Trinity segment is within Priority 3, 5, and 6 designated bottomland hardwood.	Wetlands would be affected in the majority of areas crossed by new canal segments.	Route would potentially impact the Bald Eagle, Brown Pelican, Houston Toad, Interior Least Tern, Louisianians Pike Snake, Navasota Ladies'-Tresses, Northern Scarlet Snake, Red-cockaded Woodpecker, and Smooth Green Snake.	Private property along the transfer route, especially in sections of entirely new canal or pipeline. The segment between Lake Livingston and the San Jacinto River passes through the Sam Houston National Forest.			2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay





**Attachment E:**

Amended Table 4A-5: Recommended WMS by County



**Region H**  
**Table 4A-5: Recommended WMS by County (ac-ft/yr)**

	2010	2020	2030	2040	2050	2060
<b>Austin</b>						
Initial Shortage	0	-739	-1,240	-1,496	-1,635	-1,865
Expanded GW	0	739	1,240	1,496	1,635	1,865
Municipal Conservation	0	223	251	265	273	285
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>223</b>	<b>251</b>	<b>265</b>	<b>273</b>	<b>285</b>
<b>Brazoria</b>						
Initial Shortage	-150,907	-186,760	-211,634	-238,588	-266,405	-299,199
Expanded GW	0	4,049	12,988	13,515	15,658	16,209
Municipal Conservation	1,476	2,610	2,978	3,249	3,567	3,918
Contract Expansions	7,750	7,750	7,750	7,750	7,750	7,750
<b>Net Shortage</b>	<b>-141,681</b>	<b>-172,351</b>	<b>-187,918</b>	<b>-214,074</b>	<b>-239,430</b>	<b>-271,322</b>
Irrigation Conservation	18,792	18,792	18,792	18,792	18,792	18,792
Wastewater Reclamation for Mun. Irrigation	0	0	116	227	344	465
Brazoria Co. Interruptible Supplies for Irr.	98,189	86,759	64,000	64,000	64,000	64,000
Reallocate Existing Supply	13,694	13,694	13,895	13,988	14,019	13,694
Interim Strategies	24,916	0	0	0	0	0
GCWA Offchannel Reservoir	0	0	39,500	39,500	39,500	39,500
Allens Creek Lake/Reservoir	0	45,277	41,779	66,665	58,092	66,196
BRA System Operations Permit	0	3,010	3,010	3,010	3,010	3,010
Brazoria OCR	0	0	0	0	0	24,000
Freeport Desalination Plant	0	0	0	0	33,600	33,600
Dow Off-channel Reservoir and Pump Station Expansion	0	80,000	80,000	80,000	80,000	80,000
New Groundwater Wells for Livestock	0	27	27	27	27	27
BWA Brackish Groundwater	0	3,136	3,136	3,136	3,136	3,136
<b>Total after Recommendations</b>	<b>13,910</b>	<b>78,344</b>	<b>76,337</b>	<b>75,271</b>	<b>75,090</b>	<b>75,098</b>
<b>Chambers</b>						
Initial Shortage	-42,520	-47,412	-50,831	-54,251	-57,612	-61,065
Expanded GW	0	577	681	796	905	1,010
Municipal Conservation	137	195	219	239	263	291
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-42,383</b>	<b>-46,640</b>	<b>-49,931</b>	<b>-53,216</b>	<b>-56,444</b>	<b>-59,764</b>
Irrigation Conservation	24,018	24,018	24,018	24,018	24,018	24,018
CLCND W Chambers System	0	1,691	1,978	2,235	2,511	2,804
Reallocate Existing Supply	21,010	21,264	21,389	21,509	21,627	21,725
Interim Strategies	903	0	0	0	0	0
New Contract from Existing Supply	13,823	17,083	19,972	22,888	25,732	28,672
<b>Total after Recommendations<sup>1</sup></b>	<b>17,371</b>	<b>17,416</b>	<b>17,426</b>	<b>17,434</b>	<b>17,444</b>	<b>17,455</b>

**Region H**  
**Table 4A-5: Recommended WMS by County (ac-ft/yr)**

	2010	2020	2030	2040	2050	2060
<b>Fort Bend</b>						
Initial Shortage	-86	-11,410	-52,608	-84,380	-123,623	-178,948
Expanded GW	0	6,886	3,423	3,813	4,378	5,052
Municipal Conservation	1,435	7,077	10,277	12,253	14,678	17,497
Contract Expansions	0	367	1,295	1,226	1,225	1,016
<b>Net Shortage</b>	<b>1,349</b>	<b>2,920</b>	<b>-37,613</b>	<b>-67,088</b>	<b>-103,342</b>	<b>-155,383</b>
Irrigation Conservation	5,197	5,197	5,197	5,197	5,197	5,197
WHCRWA GRP	0	0	0	0	0	0
NFBWA GRP	0	0	0	0	0	0
Sugar Land GRP	0	488	4,921	4,835	4,915	4,961
Missouri City GRP	0	4,401	4,401	4,401	4,401	4,401
Wastewater Reclamation for Mun. Irrigation	0	0	2,136	4,744	8,403	12,277
Fort Bend MUD 25 GRP	0	589	589	589	589	589
BRA System Operations Permit	0	3,611	15,860	22,340	22,340	22,340
Fort Bend OCR	0	0	0	0	90	45,943
Allens Creek Lake/Reservoir	0	0	0	6,605	25,864	16,145
TRA to Houston Contract	0	0	13,813	27,824	39,179	39,179
Reallocate Existing Supply	0	0	4,687	4,510	3,720	13,762
Fulshear Reuse	0	287	430	430	430	430
Industrial Conservation	0	558	558	558	558	558
<b>Total after Recommendations</b>	<b>6,546</b>	<b>18,051</b>	<b>14,979</b>	<b>14,945</b>	<b>12,344</b>	<b>10,399</b>
<b>Galveston</b>						
Initial Shortage	-16,307	-16,466	-17,787	-18,738	-19,884	-21,276
Expanded GW	0	811	1,352	1,350	1,352	1,352
Municipal Conservation	768	846	886	896	903	914
Contract Expansions	0	25,630	25,630	25,630	25,630	25,630
<b>Net Shortage</b>	<b>-15,539</b>	<b>10,821</b>	<b>10,081</b>	<b>9,138</b>	<b>8,001</b>	<b>6,620</b>
Irrigation Conservation	2,392	2,392	2,392	2,392	2,392	2,392
New Contract from Existing Supply	16	23	26	29	33	37
Interim Strategies	6,410	0	0	0	0	0
Allens Creek Lake/Reservoir	0	12,101	13,234	14,175	15,310	16,687
New Groundwater Wells for Livestock	0	14	14	14	14	14
Interruptible Supplies for Irr.	6,788	0	0	0	0	0
<b>Total after Recommendations</b>	<b>67</b>	<b>25,351</b>	<b>25,747</b>	<b>25,748</b>	<b>25,750</b>	<b>25,750</b>
<b>Harris</b>						
Initial Shortage	-51,413	-194,925	-270,301	-323,711	-375,414	-458,509
Expanded GW	0	15,481	27,659	27,693	27,727	27,560
Municipal Conservation	37,292	46,836	51,902	56,748	61,656	66,947
Contract Expansions	0	108,852	66,039	51,840	42,538	31,971
<b>Net Shortage</b>	<b>-14,121</b>	<b>-23,756</b>	<b>-124,701</b>	<b>-187,430</b>	<b>-243,493</b>	<b>-332,031</b>
New Contract from Existing Supply	23,008	31,264	38,732	54,777	54,805	54,849
NHCRWA GRP	0	0	0	0	0	0
WHCRWA GRP	-65	-258	-409	-566	-751	-968
COH GRP	0	0	0	0	0	0
Missouri City GRP	0	386	386	386	386	386
Wastewater Reclamation for Mun. Irrigation	0	0	3,268	6,616	10,027	13,431
Reallocate Existing Supply	18,253	15,276	7,308	19,232	30,220	96,881
Interim Strategies	15	0	0	0	0	0
Allens Creek Lake/Reservoir	0	15	83	336	384	622
TRA to Houston Contract	0	0	93,744	86,519	75,164	75,164
NHCRWA Indirect Reuse	0	0	0	7,300	16,300	16,300
Wastewater Reuse for Industry	0	0	0	0	0	67,200
Houston Indirect Reuse	0	0	0	66,420	114,679	128,801
<b>Total after Recommendations</b>	<b>27,090</b>	<b>22,927</b>	<b>18,411</b>	<b>53,590</b>	<b>57,721</b>	<b>120,635</b>

**Region H**  
**Table 4A-5: Recommended WMS by County (ac-ft/yr)**

	2010	2020	2030	2040	2050	2060
<b>Leon</b>						
Initial Shortage	0	-376	-614	-707	-779	-908
Expanded GW	0	376	614	707	779	908
Municipal Conservation	0	126	140	124	107	116
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>126</b>	<b>140</b>	<b>124</b>	<b>107</b>	<b>116</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>126</b>	<b>140</b>	<b>124</b>	<b>107</b>	<b>116</b>
<b>Liberty</b>						
Initial Shortage	-11,846	-15,142	-18,687	-22,539	-27,061	-32,363
Expanded GW	0	2,537	4,590	6,809	9,399	12,544
Municipal Conservation	0	539	641	744	868	995
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-11,846</b>	<b>-12,066</b>	<b>-13,456</b>	<b>-14,986</b>	<b>-16,794</b>	<b>-18,824</b>
Irrigation Conservation	20,876	20,876	20,876	20,876	20,876	20,876
Reallocate Existing Supply	6,657	6,697	6,732	6,767	6,805	6,833
<b>Total after Recommendations</b>	<b>15,687</b>	<b>15,507</b>	<b>14,152</b>	<b>12,657</b>	<b>10,887</b>	<b>8,885</b>
<b>Madison</b>						
Initial Shortage	-1	-130	-228	-239	-323	-450
Expanded GW	0	130	228	239	323	450
Municipal Conservation	1	91	110	112	116	119
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>91</b>	<b>110</b>	<b>112</b>	<b>116</b>	<b>119</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>91</b>	<b>110</b>	<b>112</b>	<b>116</b>	<b>119</b>
<b>Montgomery</b>						
Initial Shortage	-17,728	-47,619	-69,513	-81,350	-120,398	-165,162
Expanded GW	0	5,615	4,471	5,614	9,034	11,820
Municipal Conservation	4,460	6,007	7,384	8,838	10,795	13,089
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-13,268</b>	<b>-35,997</b>	<b>-57,658</b>	<b>-66,898</b>	<b>-100,569</b>	<b>-140,253</b>
MUD 8 AND 9 Reuse	0	657	816	1,120	1,120	1,120
Wastewater Reclamation for Mun. Irrigation	0	0	1,752	3,838	6,787	10,215
SJRA WRAP	0	36,377	55,538	54,582	53,581	52,534
Interim Strategies	13,268	0	0	0	0	0
TRA To SJRA Contract	0	0	0	7,935	39,096	76,476
<b>Total after Recommendations</b>	<b>0</b>	<b>1,037</b>	<b>448</b>	<b>577</b>	<b>15</b>	<b>92</b>
<b>Polk</b>						
Initial Shortage	0	-117	-205	-272	-384	-513
Expanded GW	0	117	205	272	384	513
Municipal Conservation	0	158	173	180	187	198
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>158</b>	<b>173</b>	<b>180</b>	<b>187</b>	<b>198</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>158</b>	<b>173</b>	<b>180</b>	<b>187</b>	<b>198</b>
<b>San Jacinto</b>						
Initial Shortage	0	-300	-533	-695	-793	-869
Expanded GW	0	542	928	984	1,007	1,060
Municipal Conservation	19	148	163	174	181	184
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>19</b>	<b>390</b>	<b>558</b>	<b>463</b>	<b>395</b>	<b>375</b>
<b>Total after Recommendations</b>	<b>19</b>	<b>390</b>	<b>558</b>	<b>463</b>	<b>395</b>	<b>375</b>

**Region H**  
**Table 4A-5: Recommended WMS by County (ac-ft/yr)**

	2010	2020	2030	2040	2050	2060
<b>Trinity</b>						
Initial Shortage	0	0	0	0	0	0
Expanded GW	0	36	36	21	0	0
Municipal Conservation	0	2	1	0	0	0
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>38</b>	<b>37</b>	<b>21</b>	<b>0</b>	<b>0</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>38</b>	<b>37</b>	<b>21</b>	<b>0</b>	<b>0</b>
<b>Walker</b>						
Initial Shortage	0	-815	-1,655	-1,973	-2,384	-2,853
Expanded GW	0	816	1,651	1,963	2,374	2,843
Municipal Conservation	0	68	74	89	90	92
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>69</b>	<b>70</b>	<b>79</b>	<b>80</b>	<b>82</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>69</b>	<b>70</b>	<b>79</b>	<b>80</b>	<b>82</b>
<b>Waller</b>						
Initial Shortage	-82	-1,926	-2,940	-4,579	-8,177	-12,355
Expanded GW	0	1,447	2,231	3,644	5,382	7,431
Municipal Conservation	17	392	497	592	708	849
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-65</b>	<b>-87</b>	<b>-212</b>	<b>-343</b>	<b>-2,087</b>	<b>-4,075</b>
Irrigation Conservation	0	0	0	0	6,606	6,606
WHCRWA GRP	65	258	409	566	751	968
<b>Total after Recommendations</b>	<b>0</b>	<b>171</b>	<b>197</b>	<b>223</b>	<b>5,270</b>	<b>3,499</b>

**Notes:**

<sup>1</sup>Lines for reallocation of existing supplies include only the positive portions of reallocations, as negative portions remove surpluses from some WUGs. Shortage values reflect the sum of all WUG shortages without offsets for other WUG surpluses.

**Attachment F:**

Amended Table 4A-6: Decadal WMS Summary









**Attachment G:**

Amended Table 4A-7: WMS Supply Allocations by WUG

























**Attachment H:**

Amended Table 4A-8: WUG-Level Contracts













**Attachment I:**

Revised Technical Memorandum 4B-47 (Dow Off-Channel Reservoir and Pump Station Expansion)



# REGION H WATER MANAGEMENT STRATEGY ANALYSIS TECHNICAL MEMORANDUM

**STRATEGY TITLE: Dow Off-Channel Reservoir and Pump Station Expansion**

**DATE: August 18, 2014**

## **SUMMARY**

**STRATEGY DESCRIPTION:** The Dow Chemical Company – Texas Operations plans to increase the total raw water pumping and storage capacity available for use at their industrial site in Freeport, Texas. Increasing the site's reservoir storage capacity and building a new river intake and pump station would give Dow more flexibility in managing their raw water resources and provide protection during drought conditions when pumping from the Brazos River is limited or curtailed. This project does not require a new water right appropriation because it is intended to firm up existing water rights held by Dow and the Brazosport Water Authority to meet manufacturing and municipal shortages in Brazoria County. The proposed reservoir would provide an additional firm yield supply quantity of 80,000 acre-feet/year.

**SUPPLY QUANTITY:** 80,000 acre-feet/year

**SUPPLY SOURCE:** Brazos River

**IMPLEMENTATION DECADE:** 2020

**TOTAL STRATEGY COST:** \$226,837,000 (Costs rounded to nearest \$100)

**ANNUAL UNIT WATER COST:** \$256 per acre-foot

## **Water Management Strategy Analysis Description**

### **Introduction:**

Dow pumps raw water supply from the Brazos River to meet the manufacturing demands of its industrial site, manufacturing demands of fence line partners, and municipal demands of the Brazosport Water Authority and its customers. Water is diverted by Dow under Dow's water rights and on behalf of Brazosport Water Authority under the authority's water rights. The current supply available from the water rights held by Dow and the Brazosport Water Authority is 153,967 acre-feet per year, including 137,763 for manufacturing use (includes approximately 288 acre-feet per year provided to industry by BWA) and 16,204 acre-feet per year for municipal use. This was determined using the Brazos Basin WAM developed for use by the Brazos G and Region H Water Planning Groups during development of the 2011 Plans. During the drought in the summer of 2009, extremely low flows caused Dow to cease pumping from the Brazos River into their raw water storage reservoirs. The proposed project would increase the amount of off-channel reservoir storage capacity by 56,760 acre-feet and would provide a 4- to 8-month supply for Dow during the driest months of the critical drought, allowing Dow to meet more of its current raw water demand and the demands of the municipal customers of the Brazosport Water Authority. A new raw water intake and pump station, with a pumping capacity of 200,000 gpm, will make efficient use of the additional storage capacity, and allow Dow to provide an additional 80,000 acre-feet per year of firm supply when used in conjunction with Dow's and the Brazosport Water Authority's existing water rights and Dow's Two-Tier BRA contract.

### **Analysis:**

The reservoir expansion would consist of an earthen embankment built to an elevation of 79 feet, MSL, with a conservation storage pool level of 73 feet, MSL. The reservoir expansion would have an average



water depth of 33 feet with an average embankment height of approximately 39 feet. An exploratory geotechnical analysis indicates that sufficient on-site materials exist to construct the compacted clay embankment. The embankment would include a vertical chimney drain and horizontal sand blanket drain. The materials for both drains would need to be imported from off-site. An outlet works system would discharge into Oyster Creek for transport to Dow's pumping facility in Lake Jackson.

A new intake and pump station on the Brazos River having a capacity of 200,000 gpm would be constructed, consisting of a headwall and intake screens leading to four 50,000 gpm vertical end-suction pumps with 1500 HP motors, which will discharge into a sedimentation basin adjacent to the reservoir expansion. Water pumped into the sediment basin will be allowed to flow into both the existing Harris Reservoir storage and the storage expansion.

**Water User Group Application:**

The supply developed by the project would be used to more effectively meet projected manufacturing and municipal supply shortages in Brazoria County during drought conditions. Historical use from the Dow reservoir system has been 80% for Dow's benefit and 20% for non-Dow benefit, which includes municipal and other industrial users. The seven member cities of the Brazosport Water Authority will be beneficiaries of the additional supply developed by the project.

**Environmental Impact:**

The project would impact approximately 2,000 acres of land, which is currently used for agricultural production and grazing.

Although a number of federal and state endangered and threatened species are listed for Brazoria County, the existing disturbed condition of the proposed site suggests that impacts to listed species essentially have already occurred and any additional impacts will be moderate to low.

Large changes in nearby property values are not anticipated due to the rural nature of the existing area. Recreational use of the reservoir will be closely managed by Dow and is anticipated to include fishing and bird watching.

**Issues and Considerations:**

The development of a project of this nature will require the study and consideration of many issues. These will include, but not necessarily limited to: TCEQ water rights permitting for additional off-channel storage capacity (application has been submitted to the TCEQ for the additional storage capacity), U.S. Army Corps of Engineers Section 404 permitting, environmental assessments of the intake and pump station and reservoir sites, Sand, Gravel and Marl permit from the Texas Parks and Wildlife Department, compliance with TCEQ dam safety regulations including reviews and construction approvals, revisions to FEMA floodplain mapping for the Oyster Creek and Brazos River floodplains, utility relocations, new electrical power supply to the pump station site, road relocations, sediment removal (permitting and facility design), Storm Water Pollution Prevention Plans for construction operations, and site security.

**Table 1  
Off-Channel Reservoir Expansion Cost Summary**

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
<b>PROJECT COST SUMMARY</b>					
1	CONSTRUCTION (CAPITAL) COST	1	LS	\$ 155,810,000	\$ 155,810,000
2	ENGINEERING, FINANCIAL & LEGAL SERVICES, AND CONTINGENCIES	1	LS	\$ 54,534,000	\$ 54,534,000
3	LAND & EASEMENTS & SURVEYING	1	LS	\$ 100,000	\$ 100,000
4	ENVIRONMENTAL - STUDIES & MITIGATION	1	LS	\$ 2,000,000	\$ 2,000,000
5	INTEREST DURING CONSTRUCTION	1	LS	\$ 14,393,000	\$ 14,393,000
<b>PROJECT COST</b>					<b>\$ 226,837,000</b>

ITEM	DESCRIPTION	ANNUAL TOTAL					
ANNUAL COST SUMMARY		2010	2020	2030	2040	2050	2060
1	DEBT SERVICE (Off-Channel Reservoir)	\$ -	\$ 10,577,000	\$ 10,577,000	\$ 10,577,000	\$ 10,577,000	\$ 10,577,000
2	DEBT SERVICE (Intake and Pump Station)	\$ -	\$ 5,901,000	\$ 5,901,000	\$ 5,901,000	\$ -	\$ -
3	OPERATION & MAINTENANCE (O&M)	\$ -	\$ 2,397,000	\$ 2,397,000	\$ 2,397,000	\$ 2,397,000	\$ 2,397,000
4	PUMPING ENERGY COSTS	\$ -	\$ 1,431,000	\$ 1,431,000	\$ 1,431,000	\$ 1,431,000	\$ 1,431,000
5	PURCHASE OF WATER	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>TOTAL ANNUAL COST</b>		<b>\$ -</b>	<b>\$ 20,306,000</b>	<b>\$ 20,306,000</b>	<b>\$ 20,306,000</b>	<b>\$ 14,405,000</b>	<b>\$ 14,405,000</b>

**ALL FACILITIES**

**CONSTRUCTION COSTS**

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
<b>CONSTRUCTION COST SUMMARY</b>					
1	PUMP STATIONS	1	LS	\$ 31,310,000	\$ 31,310,000
2a	PIPELINES	0	LS	\$ -	\$ -
2b	PIPELINE CROSSINGS	0	LS	\$ -	\$ -
3	WATER TREATMENT PLANTS	0	LS	\$ -	\$ -
4	WATER STORAGE TANKS	0	LS	\$ -	\$ -
5	OFF-CHANNEL RESERVOIRS	1	LS	\$ 107,600,000	\$ 107,600,000
6	WELL FIELDS	0	LS	\$ -	\$ -
7	DAMS & RESERVOIRS	0	LS	\$ -	\$ -
8	RELOCATIONS	0	LS	\$ -	\$ -
9	WATER DISTRIBUTION SYSTEM IMPROVEMENTS	0	LS	\$ -	\$ -
10	STILLING BASINS	0	LS	\$ -	\$ -
11	WASTEWATER RECLAMATION PLANTS	0	LS	\$ -	\$ -
12	OTHER ITEMS	1	LS	\$ 16,900,000.000	\$ 16,900,000
<b>PROJECT COST</b>					<b>\$ 155,810,000</b>

**Table 1 (cont'd)  
Off-Channel Reservoir Expansion Cost Summary**

**ALL FACILITIES**

**OPERATIONS & MAINTENANCE (O&M) COSTS**

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
<b>OPERATION &amp; MAINTENANCE (O&amp;M) COST SUMMARY</b>					
1	PUMP STATIONS	2.5%	%	\$ 31,310,000	\$ 783,000
2a	PIPELINES	1.0%	%	\$ -	\$ -
2b	PIPELINE CROSSINGS	1.0%	%	\$ -	\$ -
3	WATER TREATMENT PLANTS	1	LS	\$ -	\$ -
4	WATER STORAGE TANKS	1.0%	%	\$ -	\$ -
5	OFF-CHANNEL RESERVOIRS	1.5%	%	\$ 107,600,000	\$ 1,614,000
6	WELL FIELDS	1.0%	%	\$ -	\$ -
7	DAMS & RESERVOIRS	2.5%	%	\$ -	\$ -
8	RELOCATIONS	1.0%	%	\$ -	\$ -
9	WATER DISTRIBUTION SYSTEM IMPROVEMENTS	1.0%	%	\$ -	\$ -
10	STILLING BASINS	1.0%	%	\$ -	\$ -
11	WASTEWATER RECLAMATION PLANTS (see previous	1	LS	\$ -	\$ -
12	OTHER ITEMS	1.0%	%	\$ 16,900,000	\$ 169,000
<b>ANNUAL OPERATION &amp; MAINTENANCE COST</b>					<b>\$ 2,566,000</b>

**Attachment J:**

Amended Table 4C-1: WWP-Level Project Costs



Region H  
Table 4C-1: WWP-Level Project Cost

WMS	Source Identifiers							Sponsor / Purchaser WWP	WWP ID	Project Volume (ac-ft/yr)							Capital Costs (\$)						
	Source Name	Source RWPG	Source Basin	Source County	Source ID	Source Basin ID	ID + Basin			2010	2020	2030	2040	2050	2060	Peak Value	2010	2020	2030	2040	2050	2060	
<b>Contractual Strategies</b>																							
BRA to Brazosport Water Authority Contract - Allens Creek	ALLENS CREEK LAKE/RESERVOIR	H	BRAZOS	RESERVOIR	12900	12	1290012	BRAZOSPORT WATER AUTHORITY	2000	0	116	124	1,557	3,183	5,435	5,435	\$0	\$0	\$0	\$0	\$0	\$0	
BRA to GCWA Contract - Allens Creek	ALLENS CREEK LAKE/RESERVOIR	H	BRAZOS	RESERVOIR	12900	12	1290012	GULF COAST WATER AUTHORITY	325	0	12,165	27,627	31,782	37,777	42,624	42,624	\$0	\$0	\$0	\$0	\$0	\$0	
BRA to GCWA Contract - Brazos Main Stem System	BRAZOS RIVER AUTHORITY MAIN STEM SYSTEM	G	BRAZOS	RESERVOIR	120E0	12	120E012	GULF COAST WATER AUTHORITY	325	0	4,324	4,324	4,324	4,324	4,324	4,324	\$0	\$0	\$0	\$0	\$0	\$0	
BRA to GCWA Contract - Fort Bend OCR	FORT BEND OCR	H	BRAZOS	RESERVOIR	FBCOCR	12	FBCOCR12	GULF COAST WATER AUTHORITY	325	0	0	0	0	0	4,517	4,517	\$0	\$0	\$0	\$0	\$0	\$0	
BRA to GCWA Contract - SysOps Supply	BRA SYSTEM OPERATIONS PERMIT	H	BRAZOS	RESERVOIR	12080	12	1208012	GULF COAST WATER AUTHORITY	325	0	1,290	8,057	14,099	14,099	14,099	14,099	\$0	\$0	\$0	\$0	\$0	\$0	
BRA to NRG Contract - Fort Bend OCR	FORT BEND OCR	H	BRAZOS	RESERVOIR	FBCOCR	12	FBCOCR12	NRG	398300	0	0	0	0	0	8,500	8,500	\$0	\$0	\$0	\$0	\$0	\$0	
BRA to Richmond-Rosenberg Contract - Allens Creek	ALLENS CREEK LAKE/RESERVOIR	H	BRAZOS	RESERVOIR	12900	12	1290012	RICHMOND-ROSENBERG	999905	0	0	0	1,091	2,970	1,848	2,970	\$0	\$0	\$0	\$0	\$0	\$0	
BRA to Richmond-Rosenberg Contract - Fort Bend OCR	FORT BEND OCR	H	BRAZOS	RESERVOIR	FBCOCR	12	FBCOCR12	RICHMOND-ROSENBERG	999905	0	0	0	0	90	3,797	3,797	\$0	\$0	\$0	\$0	\$0	\$0	
BRA to Sugar Land - Allens Creek	ALLENS CREEK LAKE/RESERVOIR	H	BRAZOS	RESERVOIR	12900	12	1290012	SUGAR LAND	999906	0	0	0	231	490	449	498	\$0	\$0	\$0	\$0	\$0	\$0	
BRA to Sugar Land - Fort Bend OCR	FORT BEND OCR	H	BRAZOS	RESERVOIR	FBCOCR	12	FBCOCR12	SUGAR LAND	999906	0	0	0	0	0	922	922	\$0	\$0	\$0	\$0	\$0	\$0	
BRA to Sugar Land - SysOps Supply	BRA SYSTEM OPERATIONS PERMIT	H	BRAZOS	RESERVOIR	12080	12	1208012	SUGAR LAND	999906	0	1,027	2,947	3,385	3,385	3,385	3,385	\$0	\$0	\$0	\$0	\$0	\$0	
COH to Baytown Area Water Authority - Lake Livingston	LIVINGSTON-WALLISVILLE SYSTEM	H	TRINITY	RESERVOIR	084H0	08	084H008	BAYTOWN AREA WATER AUTHORITY	15	0	26	262	398	535	692	692	\$0	\$0	\$0	\$0	\$0	\$0	
COH to BRA Contract - Allens Creek	ALLENS CREEK LAKE/RESERVOIR	H	BRAZOS	RESERVOIR	12900	12	1290012	BRAZOS RIVER AUTHORITY	331	0	27,498	25,201	57,886	69,755	69,755	69,755	\$0	\$0	\$0	\$0	\$0	\$0	
COH to CHCRWA Contract - Lake Houston	HOUSTON LAKE/RESERVOIR	H	SAN JACINTO	RESERVOIR	10030	10	1003010	CHCRWA	999902	0	977	862	720	631	546	977	\$0	\$0	\$0	\$0	\$0	\$0	
COH to CHCRWA Contract - Lake Livingston	LIVINGSTON-WALLISVILLE SYSTEM	H	TRINITY	RESERVOIR	084H0	08	084H008	CHCRWA	999902	0	794	1,552	1,711	1,800	1,885	1,885	\$0	\$0	\$0	\$0	\$0	\$0	
COH to City of Pasadena Contract - Lake Livingston	LIVINGSTON-WALLISVILLE SYSTEM	H	TRINITY	RESERVOIR	084H0	08	084H008	CITY OF PASADENA	651900	1,865	2,278	2,665	3,153	3,579	4,068	4,068	\$0	\$0	\$0	\$0	\$0	\$0	
COH to NFBWA Contract - Lake Livingston	LIVINGSTON-WALLISVILLE SYSTEM	H	TRINITY	RESERVOIR	084H0	08	084H008	NFBWA	999901	0	444	17,971	31,161	41,172	50,442	50,442	\$0	\$0	\$0	\$0	\$0	\$0	
COH to NHCRRWA Contract - Houston Indirect Reuse	HOUSTON INDIRECT REUSE	H	SAN JACINTO	HARRIS	3510101	10	351010110	NHCRRWA	999904	0	0	0	18,130	31,629	0	31,629	\$0	\$0	\$0	\$0	\$0	\$0	
COH to NHCRRWA Contract - Lake Houston	HOUSTON LAKE/RESERVOIR	H	SAN JACINTO	RESERVOIR	10030	10	1003010	NHCRRWA	999904	0	30,880	30,880	32,734	29,030	25,398	32,734	\$0	\$0	\$0	\$0	\$0	\$0	
COH to NHCRRWA Contract - Lake Livingston	LIVINGSTON-WALLISVILLE SYSTEM	H	TRINITY	RESERVOIR	084H0	08	084H008	NHCRRWA	999904	0	25,573	52,161	32,177	17,382	57,643	57,643	\$0	\$0	\$0	\$0	\$0	\$0	
COH to North Channel Water Authority Contract - Lake Livingston	LIVINGSTON-WALLISVILLE SYSTEM	H	TRINITY	RESERVOIR	084H0	08	084H008	NORTH CHANNEL WATER AUTHORITY	607473	1,954	2,392	2,869	3,511	4,157	4,912	4,912	\$0	\$0	\$0	\$0	\$0	\$0	
COH to SIRA Contract - Lake Conroe	CONROE LAKE/RESERVOIR	H	SAN JACINTO	RESERVOIR	10060	10	1006010	SAN JACINTO RIVER AUTHORITY	240	0	36,377	55,538	54,582	53,581	52,534	55,538	\$0	\$0	\$0	\$0	\$0	\$0	
COH to WHCRWA Contract - Lake Livingston	LIVINGSTON-WALLISVILLE SYSTEM	H	TRINITY	RESERVOIR	084H0	08	084H008	WHCRWA	999907	1,241	31,837	46,324	52,759	55,549	58,402	58,402	\$0	\$0	\$0	\$0	\$0	\$0	
GCWA to City of Galveston Contract - Brazos Main Stem System	BRAZOS RIVER AUTHORITY MAIN STEM SYSTEM	G	BRAZOS	RESERVOIR	120E0	12	120E012	CITY OF GALVESTON	316200	0	1,225	1,225	1,225	1,225	1,225	1,225	\$0	\$0	\$0	\$0	\$0	\$0	
GCWA to City of Galveston Contract - Brazos Run-of-River	BRAZOS RIVER RUN-OF-RIVER	H	BRAZOS	FORT BEND	3461205322B	12	3461205322B12	CITY OF GALVESTON	316200	0	5,360	5,360	5,360	5,360	5,360	5,360	\$0	\$0	\$0	\$0	\$0	\$0	
GCWA to City of Galveston Contract - San Jacinto-Brazos Run-of-River	SAN JACINTO-BRAZOS RIVER RUN-OF-RIVER	H	SAN JACINTO-BRAZOS	BRAZORIA	3461105357A	11	3461105357A11	CITY OF GALVESTON	316200	0	677	677	677	677	677	677	\$0	\$0	\$0	\$0	\$0	\$0	
GCWA to Fort Bend County WCID #2 Contract - SysOps Supply	BRA SYSTEM OPERATIONS PERMIT	H	BRAZOS	RESERVOIR	12080	12	1208012	FORT BEND COUNTY WCID #2	821000	0	491	1,092	1,092	1,092	1,092	1,092	\$0	\$0	\$0	\$0	\$0	\$0	
GCWA to Galveston County WCID #1 Contract - Allens Creek	ALLENS CREEK LAKE/RESERVOIR	H	BRAZOS	RESERVOIR	12900	12	1290012	GALVESTON COUNTY WCID #1	316325	0	131	274	305	340	379	379	\$0	\$0	\$0	\$0	\$0	\$0	
GCWA to Galveston County WCID #1 Contract - Brazos Main Stem System	BRAZOS RIVER AUTHORITY MAIN STEM SYSTEM	G	BRAZOS	RESERVOIR	120E0	12	120E012	GALVESTON COUNTY WCID #1	316325	0	107	107	107	107	107	107	\$0	\$0	\$0	\$0	\$0	\$0	
GCWA to Galveston County WCID #1 Contract - Brazos Run-of-River	BRAZOS RIVER RUN-OF-RIVER	H	BRAZOS	FORT BEND	3461205322B	12	3461205322B12	GALVESTON COUNTY WCID #1	316325	0	469	469	469	469	469	469	\$0	\$0	\$0	\$0	\$0	\$0	
GCWA to Galveston County WCID #1 Contract - San Jacinto-Brazos Run-of-River	SAN JACINTO-BRAZOS RIVER RUN-OF-RIVER	H	SAN JACINTO-BRAZOS	BRAZORIA	3461105357A	11	3461105357A11	GALVESTON COUNTY WCID #1	316325	0	59	59	59	59	59	59	\$0	\$0	\$0	\$0	\$0	\$0	
GCWA to Missouri City Contract - Allens Creek	ALLENS CREEK LAKE/RESERVOIR	H	BRAZOS	RESERVOIR	12900	12	1290012	MISSOURI CITY	999903	0	0	68	321	571	594	594	\$0	\$0	\$0	\$0	\$0	\$0	
GCWA to Missouri City Contract - Fort Bend OCR	FORT BEND OCR	H	BRAZOS	RESERVOIR	FBCOCR	12	FBCOCR12	MISSOURI CITY	999903	0	0	0	0	0	4,501	4,501	\$0	\$0	\$0	\$0	\$0	\$0	
GCWA to Missouri City Contract - SysOps Supply	BRA SYSTEM OPERATIONS PERMIT	H	BRAZOS	RESERVOIR	12080	12	1208012	MISSOURI CITY	999903	0	713	6,262	10,340	10,340	10,340	10,340	\$0	\$0	\$0	\$0	\$0	\$0	
SIRA to COH Contract - Lake Houston	HOUSTON LAKE/RESERVOIR	H	SAN JACINTO	RESERVOIR	10030	10	1003010	SAN JACINTO RIVER AUTHORITY	240	0	0	1,356	5,300	3,872	2,428	5,300	\$0	\$0	\$0	\$0	\$0	\$0	
TRA to Houston Transfer	LIVINGSTON-WALLISVILLE SYSTEM	H	TRINITY	RESERVOIR	084H0	08	084H008	CITY OF HOUSTON	396200	0	0	116,738	123,524	123,524	123,524	123,524	\$0	\$0	\$0	\$0	\$0	\$0	
TRA to SIRA Transfer	LIVINGSTON-WALLISVILLE SYSTEM	H	TRINITY	RESERVOIR	084H0	08	084H008	SAN JACINTO RIVER AUTHORITY	240	0	0	0	7,935	39,096	76,476	76,476	\$0	\$0	\$0	\$302,781,597	\$0	\$0	
<b>Groundwater Reduction Plans</b>																							
CHCRWA GRP	Multiple	H	Multiple	Multiple	Multiple	Multiple	Multiple	CHCRWA	999902	2,375	4,146	4,789	4,806	4,806	4,806	4,806	\$0	\$0	\$0	\$0	\$0	\$0	
COH GRP	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple	CITY OF HOUSTON	396200	3,762	11,417	16,809	19,870	22,399	24,990	24,990	\$0	\$0	\$0	\$0	\$0	\$0	
Fort Bend WCID #2 GRP	BRA SYSTEM OPERATIONS PERMIT	H	BRAZOS	RESERVOIR	12080	12	1208012	FORT BEND COUNTY WCID #2	821000	0	2,296	5,753	5,753	5,753	5,753	5,753	\$0	\$10,631,491	\$7,098,683	\$7,098,683	\$0	\$0	
NFBWA GRP	LIVINGSTON-WALLISVILLE SYSTEM	H	TRINITY	RESERVOIR	084H0	08	084H008	NFBWA	999901	35,009	61,021	70,363	84,943	96,103	106,402	106,402	\$0	\$0	\$0	\$0	\$0	\$0	
NHCRRWA GRP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NHCRRWA	999904	34,714	91,167	117,755	99,625	81,126	117,755	117,755	\$0	\$0	\$0	\$0	\$0	\$0	
Missouri City GRP	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple	MISSOURI CITY	999903	0	5,182	9,431	13,149	13,149	17,562	17,562	\$0	\$51,260,490	\$40,810,500	\$0	\$0	\$0	
Richmond Rosenberg GRP (WFB SWTP)	BRAZOS RIVER AUTHORITY MAIN STEM SYSTEM	G	BRAZOS	RESERVOIR	120E0	12	120E012	RICHMOND-ROSENBERG	999905	7,500	7,500	7,500	7,500	7,500	7,500	7,500	\$0	\$43,205,325	\$29,963,475	\$29,963,475	\$0	\$14,153,450	
SIRA WRAP	Multiple	H	Multiple	Multiple	Multiple	Multiple	Multiple	SAN JACINTO RIVER AUTHORITY	240	0	36,377	55,538	62,517	92,677	129,010	129,010	\$0	\$380,000,000	\$180,000,000	\$200,000,000	\$0	\$140,000,000	
Sugar Land GRP	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple	SUGAR LAND	999906	0	1,587	7,987	8,656	8,915	9,796	9,796	\$0	\$82,825,000	\$78,535,049	\$0	\$0	\$0	
WHCRWA GRP	LIVINGSTON-WALLISVILLE SYSTEM	H	TRINITY	RESERVOIR	084H0	08	084H008	WHCRWA	999907	21,678	52,274	66,761	73,196	75,985	78,839	78,839	\$0	\$0	\$0	\$0	\$0	\$0	
<b>Reservoir Strategies</b>																							
Allens Creek Reservoir	ALLENS CREEK LAKE/RESERVOIR	H	BRAZOS	RESERVOIR	12900	12	1290012	BRAZOS RIVER AUTHORITY / CITY OF HOUSTON	331 / 396200	0	57,393	55,096	87,781	99,650	99,650	99,650	\$0	\$222,752,400	\$0	\$0	\$0	\$0	
Brazoria Off-Channel Reservoir	BRAZORIA OCR	H	BRAZOS	RESERVOIR	BRAOCR	12	BRAOCR12	BRAZOS RIVER AUTHORITY	331	0	0	0	0	0	24,000	24,000	\$0	\$0	\$0	\$0	\$0	\$173,898,602	
Dow Off-Channel Reservoir and Pump Station Expansion	DOW OCR AND PS EXPANSION	H	BRAZOS	RESERVOIR	DOWOCR	12	DOWOCR12	THE DOW CHEMICAL CO.	237200	0	80,000	80,000	80,000	80,000	80,000	80,000	\$0	\$226,837,000	\$0	\$0	\$0	\$0	\$0
Fort Bend Off-Channel Reservoir	FORT BEND OCR	H	BRAZOS	RESERVOIR	FBCOCR	12	FBCOCR12	BRAZOS RIVER AUTHORITY	331	0	0	0	0	90	45,943	45,943	\$0	\$0	\$0	\$0	\$0	\$202,514,788	
GCWA Off-Channel Reservoir	GCWA OFFCHANNEL RESERVOIR	H	SAN JACINTO-BRAZOS	RESERVOIR	GCWAOC	11	GCWAOC11	GULF COAST WATER AUTHORITY	325	0	0	39,											

Region H  
Table 4C-1: WWP-Level Project Cost

WMS	Total Capital Cost	Total Annual Costs (\$/year)					Source	Notes	
		2010	2020	2030	2040	2050			2060
<b>Contractual Strategies</b>									
BRA to Brazosport Water Authority Contract - Allens Creek	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
BRA to GCWA Contract - Allens Creek	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
BRA to GCWA Contract - Brazos Main Stem System	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
BRA to GCWA Contract - Fort Bend OCR	\$0	\$0	\$0	\$0	\$0	\$0	\$0		
BRA to GCWA Contract - SysOps Supply	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
BRA to NRG Contract - Fort Bend OCR	\$0	\$0	\$0	\$0	\$0	\$0	\$0		
BRA to Richmond-Rosenberg Contract - Allens Creek	\$0	\$0	\$0	\$0	\$0	\$0	\$0		
BRA to Richmond-Rosenberg Contract - Fort Bend OCR	\$0	\$0	\$0	\$0	\$0	\$0	\$0		
BRA to Sugar Land - Allens Creek	\$0	\$0	\$0	\$0	\$0	\$0	\$0		
BRA to Sugar Land - Fort Bend OCR	\$0	\$0	\$0	\$0	\$0	\$0	\$0		
BRA to Sugar Land - SysOps Supply	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
COH to Baytown Area Water Authority - Lake Livingston	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
COH to BRA Contract - Allens Creek	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
COH to CHCRWA Contract - Lake Houston	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
COH to CHCRWA Contract - Lake Livingston	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
COH to City of Pasadena Contract - Lake Livingston	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
COH to NFBWA Contract - Lake Livingston	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
COH to NHRWA Contract - Houston Indirect Reuse	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
COH to NHRWA Contract - Lake Houston	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
COH to NHRWA Contract - Lake Livingston	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
COH to North Channel Water Authority Contract - Lake Livingston	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
COH to SJRA Contract - Lake Conroe	\$0	\$0	\$0	\$0	\$0	\$0	\$0		
COH to WHCRWA Contract - Lake Livingston	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
GCWA to City of Galveston Contract - Brazos Main Stem System	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
GCWA to City of Galveston Contract - Brazos Run-of-River	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
GCWA to City of Galveston Contract - San Jacinto-Brazos Run-of-River	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
GCWA to Fort Bend County WCID #2 Contract - SysOps Supply	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
GCWA to Galveston County WCID #1 Contract - Allens Creek	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
GCWA to Galveston County WCID #1 Contract - Brazos Main Stem System	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
GCWA to Galveston County WCID #1 Contract - Brazos Run-of-River	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
GCWA to Galveston County WCID #1 Contract - San Jacinto-Brazos Run-of-River	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
GCWA to Missouri City Contract - Allens Creek	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
GCWA to Missouri City Contract - Fort Bend OCR	\$0	\$0	\$0	\$0	\$0	\$0	\$0		
GCWA to Missouri City Contract - SysOps Supply	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
SJRA to COH Contract - Lake Houston	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H 2011 RWP	No cost as infrastructure reflected under other strategies. Raw water cost not assumed.
TRA to Houston Transfer	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H RWP Tech Memo	Strategy cost associated with Luce Bayou
TRA to SJRA Transfer	\$302,781,597	\$0	\$0	\$0	\$37,101,862	\$37,101,862	\$10,703,983	Region H RWP Tech Memo	Cost associated with development of conveyance infrastructure.
<b>Groundwater Reduction Plans</b>									
CHCRWA GRP	\$0	\$0	\$0	\$0	\$0	\$0	\$0	No data available	No data available
COH GRP	\$0	\$0	\$0	\$0	\$0	\$0	\$0	Region H RWP Tech Memo - Treatment	No cost as volume and treatment / distribution is associated with other strategies.
Fort Bend WCID #2 GRP	\$24,828,857	\$0	\$1,310,164	\$2,312,320	\$2,387,576	\$1,768,681	\$1,149,785	FBC WCID 2 GRP	Annual O&M includes electric cost
NFBWA GRP	\$0	\$0	\$0	\$0	\$0	\$0	\$0	NFBWA GRP	No cost as volume and treatment / distribution is associated with other strategies.
NHRWA GRP	\$0	\$0	\$0	\$0	\$0	\$0	\$0	NHRWA GRP	No cost as volume and treatment / distribution is associated with other strategies.
Missouri City GRP	\$92,070,990	\$0	\$5,750,635	\$10,328,943	\$5,859,820	\$2,301,775	\$2,301,775	Missouri City GRP	Annual O&M cost assumed as 2.5% of project capital cost. No annual energy cost assumed due to limited information.
Richmond Rosenberg GRP (WFB SWTP)	\$117,220,150	\$0	\$6,652,597	\$13,441,309	\$16,083,787	\$13,471,435	\$17,440,442	West FBC Regional SWTP PER	
SJRA WRAP	\$900,000,000	\$0	\$42,630,132	\$62,823,352	\$52,130,132	\$52,142,749	\$34,705,838	SJRA WRAP Part 2	Annual costs beyond debt service estimated from SJRA WRAP Part II. O&M costs include electricity.
Sugar Land GRP	\$161,360,049	\$0	\$17,561,104	\$17,561,104	\$3,493,000	\$3,493,000	\$3,493,000	Sugar Land CIP, Sugar Land GRP	Assuming O&M constant after 2014. No annual energy cost assumed due to limited information.
WHCRWA GRP	\$0	\$0	\$0	\$0	\$0	\$0	\$0	WHCRWA Summary	No cost as volume and treatment / distribution is associated with other strategies.
<b>Reservoir Strategies</b>									
Allens Creek Reservoir	\$222,752,400	\$0	\$18,706,144	\$18,706,144	\$18,706,144	\$18,706,144	\$3,901,678	Region H RWP Tech Memo	
Brazoria Off-Channel Reservoir	\$173,898,602	\$0	\$0	\$0	\$0	\$0	\$28,951,707		
Dow Off-Channel Reservoir and Pump Station Expansion	\$226,837,000	\$0	\$20,306,000	\$20,306,000	\$20,306,000	\$14,405,000	\$14,405,000	Dow and HDR, Inc.	
Fort Bend Off-Channel Reservoir	\$202,514,788	\$0	\$0	\$0	\$0	\$43,566,686	\$43,566,686		
GCWA Off-Channel Reservoir	\$197,448,012	\$0	\$0	\$32,678,970	\$32,678,970	\$32,678,970	\$32,678,970	Region H 2011 RWP	
<b>Reuse Strategies</b>									
Wastewater Reuse for Industry	\$332,051,761	\$0	\$0	\$0	\$0	\$0	\$60,010,614	Region H RWP Tech Memo	
<b>Permit / Other Strategies</b>									
BRA System Operations Permit	\$0	\$0	\$0	\$0	\$0	\$0	\$0	HDR, Inc.	
Freeport Desalination	\$255,699,000	\$0	\$0	\$0	\$28,685,479	\$28,685,479	\$6,392,475	Region H 2011 RWP	Assuming O&M as 2.5 percent of capital cost. No annual energy cost assumed due to limited information.
Houston Bayous Permit	\$20,956,000	\$0	\$1,827,040	\$1,827,040	\$0	\$0	\$0	Region H RWP Tech Memo	
<b>Infrastructure Strategies</b>									
BWA Brackish Groundwater	\$30,570,395	\$0	\$5,735,790	\$5,735,790	\$3,177,681	\$3,177,681	\$3,177,681	CDM Smith	Based on anticipated operation.
BWA Plant Expansion	\$14,359,419	\$0	\$3,274,279	\$3,274,279	\$2,072,693	\$2,072,693	\$2,072,693	SDM Smith	Based on peak capacity.
Brazos Saltwater Barrier	\$44,470,739	\$0	\$4,988,930	\$4,988,930	\$1,111,768	\$1,111,768	\$1,111,768	Region H RWP Tech Memo	Annual O&M cost assumed as 2.5% of project capital cost. No annual energy cost assumed due to limited information.
CHCRWA Transmission	\$0	\$0	\$0	\$0	\$0	\$0	\$0	No data available	No data available
CHCRWA Internal Distribution	\$0	\$0	\$0	\$0	\$0	\$0	\$0	No data available	No data available
CLCND West Chambers County System	\$20,380,000	\$0	\$1,980,621	\$1,980,621	\$203,800	\$203,800	\$203,800	CLCND Funding App	Annual O&M cost assumed as 1.0% of project capital cost. No annual energy cost assumed due to limited information.
COH Treatment Expansion	\$2,045,672,161	\$7,670,034	\$121,707,226	\$168,015,257	\$109,009,300	\$89,583,305	\$89,598,340	Estimated using Reg H procedures	Energy costs not assumed due to limited data.
COH Distribution Expansion	\$261,040,000	\$0	\$22,293,166	\$25,369,057	\$5,369,791	\$2,610,400	\$2,610,400	No data available	Not enough data available to estimate costs at this time.
Huntsville WTP	\$61,023,906	\$10,120,710	\$10,120,710	\$4,800,368	\$4,800,368	\$4,800,368	\$4,800,368	Standard Region H assumptions	Annual O&M cost assumed as 2.5% of project capital cost. Assumes 10 MGD plant and pump station capacity.
Luce Bayou	\$253,916,914	\$0	\$31,798,394	\$31,798,394	\$9,660,760	\$9,660,760	\$9,660,760	Luce Bayou Alternatives Analysis	O&M and electric scaled using CCI
NFBWA 2025 Shared Transmission (w/ WHCRWA)	\$213,000,000	\$0	\$1,220,584	\$13,600,791	\$17,349,727	\$4,969,520	\$0	NFBWA Table from BGE	O&M costs not included as they include part of COH infrastructure O&M. No annual energy cost assumed due to limited information.
NFBWA Internal Distribution	\$225,000,000	\$6,451,657	\$7,759,425	\$10,549,331	\$10,113,409	\$1,743,692	\$1,743,692	NFBWA Table from BGE	O&M costs not included as they include part of COH infrastructure O&M. No annual energy cost assumed due to limited information.
NHRWA Internal 2010 Distribution	\$153,149,640	\$14,883,780	\$14,883,780	\$1,531,496	\$1,531,496	\$1,531,496	\$1,531,496		
NHRWA Internal 2020 Distribution	\$345,292,192	\$0	\$33,557,069	\$33,557,069	\$3,452,922	\$3,452,922	\$3,452,922		
NHRWA Internal 2030 Distribution	\$37,439,584	\$0	\$3,638,549	\$3,638,549	\$374,396	\$374,396	\$374,396		
NHRWA Transmission 2010	\$80,690,624	\$7,841,883	\$7,841,883	\$806,906	\$806,906	\$806,906	\$806,906		
NHRWA Transmission 2020	\$172,558,512	\$0	\$16,770,023	\$16,770,023	\$1,725,585	\$1,725,585	\$1,725,585		
NHRWA Transmission 2030	\$0	\$0	\$0	\$0	\$0	\$0	\$0		
WHCRWA Internal Distribution	\$552,472,000	\$13,149,945	\$46,238,371	\$41,894,891	\$12,211,165	\$5,524,720	\$5,524,720	WHCRWA Summary	Annual O&M cost assumed as 1.0% of project capital cost. No annual energy cost assumed due to limited information.
WHCRWA 2020 Shared Transmission (w/ NFBWA)	\$290,084,193	\$4,384,014	\$28,191,704	\$24,258,792	\$2,900,842	\$2,900,842	\$2,900,842	WHCRWA Summary	Annual O&M cost assumed as 1.0% of project capital cost. No annual energy cost assumed due to limited information.
<b>Alternative Strategies</b>									

**Attachment K:**

Amended Table 4C-2: WUG-Level Project Costs

















**Attachment L:**

Summary of database entries anticipated for DB12





**DB12 Entries: Dow Off-Channel Reservoir and Pump Station Expansion**

**WMS Project**

<b>Sponsor Region:</b>	H
<b>WMS Project ID:</b>	H52-DOWOCR
<b>WMS Project Name:</b>	DOW OFF-CHANNEL RESERVOIR AND PUMP STATION EXPANSION
<b>WMS Description:</b>	Dow off-channel Reservoir .
<b>WMS Type:</b>	N : NEW SURFACE WATER OR NEW GROUNDWATER SOURCE
<b>WMS Infrastructure:</b>	NO INFRASTRUCTURE
<b>Additional RWPGs:</b>	None
<b>Included in State Water Plan:</b>	Y

**Source(s)**

Source Region	Source Name	County Name	Basin Name	Source ID	Source Type
H	ZOS RIVER RUN-OF-RI	BAZORIA	BRAZOS	3461205328B	SW
<b>Is Source Supply selected for Rollup?</b>				Y	
<b>Is Source Cost selected for Rollup?</b>				Y	

<b>County Name:</b>	BRAZORIA	<b>Water Quality Improvements</b>	: NO WATER QUALITY IMPROVEME
<b>County ID:</b>	020	<b>Online Data</b>	2020
<b>Basin Name:</b>	BRAZOS	<b>WMS Funding Date</b>	2020
<b>Basin ID:</b>	12		
<b>Include in State Water Plan?</b>			Y
<b>Include WMS Source Total Yield numbers in WMS Project Total Yield Rollup?</b>			Y
<b>Include WMS Source Cost numbers in WMS Project Cost Rollup?</b>			Y

1.

Sponsor Region:	WWP Name:					
H	DOW CHEMICAL USA					
	<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>Total Strategy Supply Volume for this WWP:</b>	0	80,000	80,000	80,000	80,000	80,000

Recommendation Type?	Is Used to Meet Need?						IBT?
Recommended	Y						N
<b>Include WWP WMS Cost numbers in WMS Source Cost Rollup?</b>							
	<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>	
<b>WWP WMS Annual Cost:</b>	\$0	\$20,306,000	\$20,306,000	\$20,306,000	\$14,405,000	\$14,405,000	
<b>WWP Capital Costs:</b>	\$226,837,000						
<b>Term of Debt Service:</b>	50						

DB12 Entries: Dow to BWA Contract

WMS Project

Sponsor Region:	H
WMS Project ID:	
WMS Project Name:	DOW TO BWA CONTRACT
WMS Description:	Dow Chemical to BWA contract
WMS Type:	N : NEW SURFACE WATER OR NEW GROUNDWATER SOURCE
WMS Infrastructure:	NO INFRASTRUCTURE
Additional RWPGs:	None
Included in State Water Plan:	Y

Source(s)

Source Region	Source Name	County Name	Basin Name	Source ID	Source Type
H	ZOS RIVER RUN-OF-RI	BAZORIA	BRAZOS	3461205328B	SW
Is Source Supply selected for Rollup?				Y	
Is Source Cost selected for Rollup?				Y	

County Name:	BRAZORIA	Water Quality Improvements	: NO WATER QUALITY IMPROVEME
County ID:	020	Online Data	2020
Basin Name:	BRAZOS	WMS Funding Date	2020
Basin ID:	12		
Include in State Water Plan?			Y
Include WMS Source Total Yield numbers in WMS Project Total Yield Rollup?			Y
Include WMS Source Cost numbers in WMS Project Cost Rollup?			Y

1.	Sponsor Region:	WWP Name:					
	H	BRAZOSPORT WATER AUTHORITY					
		2010:	2020:	2030:	2040:	2050:	2060:
	Total Strategy Supply Volume for this WWP:	0	8,569	8,569	8,569	8,569	8,569

Recommendation Type?	Is Used to Meet Need?						IBT?
Recommended	Y						N
Include WWP WMS Cost numbers in WMS Source Cost Rollup?		Y					
	2010:	2020:	2030:	2040:	2050:	2060:	
WWP WMS Annual Cost:	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WWP Capital Costs:	\$0						
Term of Debt Service:	0						

DB12 Entries: Dow to WUG Contract

WMS Project

Sponsor Region:	H
WMS Project ID:	H07-WUGC23
WMS Project Name:	DOW TO WUG CONTRACT
WMS Description:	Dow Chemical to WUG contract
WMS Type:	N : NEW SURFACE WATER OR NEW GROUNDWATER SOURCE
WMS Infrastructure:	NO INFRASTRUCTURE
Additional RWPGs:	None
Included in State Water Plan:	Y

Source(s)

Source Region	Source Name	County Name	Basin Name	Source ID	Source Type
H	ZOS RIVER RUN-OF-RI	BAZORIA	BRAZOS	3461205328B	SW
Is Source Supply selected for Rollup?				Y	
Is Source Cost selected for Rollup?				Y	

County Name:	BRAZORIA	Water Quality Improvements	: NO WATER QUALITY IMPROVEME
County ID:	020	Online Data	2020
Basin Name:	BRAZOS	WMS Funding Date	2020
Basin ID:	12		
Include in State Water Plan?			Y
Include WMS Source Total Yield numbers in WMS Project Total Yield Rollup?			Y
Include WMS Source Cost numbers in WMS Project Cost Rollup?			Y

1. WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:	Basin Name:			
H	MANUFACTURING	NONE	081001020	BRAZORIA	BRAZOS			
Total Strategy Supply Volume for this WUG:			2010:	2020:	2030:	2040:	2050:	2060:
			0	62,414	62,414	62,414	62,414	62,414
Is WUG selected for Rollup?			Y					
Is WUG Cost selected for Rollup?			Y					

Recommendation Type?	Is Used to Meet Need?				IBT?	
Recommended	Y				N	
Seller's Name:	Seller's Alpha:	WWP ID:	WUG ID:			
DOW CHEMICAL USA	237200	250208165	N/A			
Recursive WMS Supply?:	Recursive WMS Project ID:					
N						
Include WUG WMS Cost numbers in WMS Source Cost Rollup?						
Y						
WUG WMS Annual Cost:	2010:	2020:	2030:	2040:	2050:	2060:
	\$0	\$43,784,622	\$50,808,631	\$37,290,661	\$33,783,225	\$33,975,408
WUG Capital Costs:	\$321,962,428					
Term of Debt Service:	20					

2. WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:	Basin Name:			
H	MANUFACTURING	NONE	81001020	BRAZORIA	SAN JACINTO-BRAZOS			
Total Strategy Supply Volume for this WUG:			2010:	2020:	2030:	2040:	2050:	2060:
			0	9,017	9,017	9,017	9,017	9,017
Is WUG selected for Rollup?			Y					
Is WUG Cost selected for Rollup?			Y					

Recommendation Type?	Is Used to Meet Need?				IBT?	
Recommended	Y				Y	
Seller's Name:	Seller's Alpha:	WWP ID:	WUG ID:			
DOW CHEMICAL USA	237200	250208165	N/A			
Recursive WMS Supply?:	Recursive WMS Project ID:					
N						
Include WUG WMS Cost numbers in WMS Source Cost Rollup?						
Y						
WUG WMS Annual Cost:	2010:	2020:	2030:	2040:	2050:	2060:
	\$0	\$8,523,262	\$10,236,036	\$7,162,096	\$5,990,937	\$6,554,803
WUG Capital Costs:	\$90,336,210					
Term of Debt Service:	20					

DB12 Entries: BWA to WUG Contract

WMS Project

Sponsor Region:	H
WMS Project ID:	H07-WUG03
WMS Project Name:	BWA TO WUG CONTRACT
WMS Description:	Contract with Brazosport Water Authority
WMS Type:	N : NEW SURFACE WATER OR NEW GROUNDWATER SOURCE
WMS Infrastructure:	OTHER INFRASATRUCTION
Additional RWPGs:	None
Included in State Water Plan:	Y

Source(s)

Source Region	Source Name	County Name	Basin Name	Source ID	Source Type
H	ZOS RIVER RUN-OF-R	BAZORIA	BRAZOS	3461205328B	SW
Is Source Supply selected for Rollup?				Y	
Is Source Cost selected for Rollup?				Y	

County Name:	BRAZORIA	Water Quality Improvements	: NO WATER QUALITY IMPROVEME
County ID:	020	Online Data	2020
Basin Name:	BRAZOS	WMS Funding Date	2020
Basin ID:	12		
Includes in State Water Plan			Y
Include WMS Source Total Yield numbers in WMS Project Total Yield Rollup?			Y
Include WMS Source Cost numbers in WMS Project Cost Rollup?			Y

WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:	Basin Name:			
H	ANGLETON	NONE	080018000	BRAZORIA	SAN JACINTO-BRAZOS			
Total Strategy Supply Volume for this WUG:			2010: 0	2020: 994	2030: 997	2040: 1,001	2050: 1,026	2060: 1,063
Is WUG selected for Rollup?			Y					
Is WUG Cost selected for Rollup?			Y					

Recommendation Type?	Is Used to Meet Need?	IBT?				
Recommended	Y	Y				
Seller's Name:	Seller's Alpha:	WWP ID:				
BRAZOSPORT WATER AUTHORITY	2000	120208093				
Recursive WMS Supply?:	Recursive WMS Project ID:					
N						
Include WUG WMS Cost numbers in WMS Source Cost Rollup?						
Y						
WUG WMS Annual Cost:	2010: \$0	2020: \$171,671	2030: \$173,000	2040: \$48,864	2050: \$59,318	2060: \$73,816
WUG Capital Costs:	\$1,738,499					
Term of Debt Service:	20					

WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:	Basin Name:			
H	BRAZORIA	NONE	080072000	BRAZORIA	BRAZOS			
Total Strategy Supply Volume for this WUG:			2010: 0	2020: 175	2030: 175	2040: 175	2050: 175	2060: 175
Is WUG selected for Rollup?			Y					
Is WUG Cost selected for Rollup?			Y					

Recommendation Type?	Is Used to Meet Need?	IBT?				
Recommended	Y	N				
Seller's Name:	Seller's Alpha:	WWP ID:				
BRAZOSPORT WATER AUTHORITY	2000	120208093				
Recursive WMS Supply?:	Recursive WMS Project ID:					
N						
Include WUG WMS Cost numbers in WMS Source Cost Rollup?						
Y						
WUG WMS Annual Cost:	2010: \$0	2020: \$43,623	2030: \$43,623	2040: \$8,599	2050: \$8,599	2060: \$8,599
WUG Capital Costs:	\$401,718					
Term of Debt Service:	20					

DB12 Entries: BWA to WUG Contract

3.	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>		<b>County Name:</b>		<b>Basin Name:</b>	
	H	CLUTE	NONE	080118000		BRAZORIA		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>Total Strategy Supply Volume for this WUG:</b>			0	582	594	604	626	657
	<b>Is WUG selected for Rollup?</b>			Y					
	<b>Is WUG Cost selected for Rollup?</b>			Y					

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>	
Recommended		N				Y	
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>		<b>WWP ID:</b>		<b>WUG ID:</b>	
BRAZOSPORT WATER AUTHORITY		2000		120208093		N/A	
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>					
N							
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y					
		<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>WUG WMS Annual Cost:</b>	\$0	\$122,878	\$129,159	\$39,529	\$44,692	\$54,466
	<b>WUG Capital Costs:</b>	\$1,409,074					
	<b>Term of Debt Service:</b>	20					

4.	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>		<b>County Name:</b>		<b>Basin Name:</b>	
	H	COUNTY-OTHER	NONE	080757020		BRAZORIA		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>Total Strategy Supply Volume for this WUG:</b>			0	3,173	3,501	3,273	2,999	2,579
	<b>Is WUG selected for Rollup?</b>			Y					
	<b>Is WUG Cost selected for Rollup?</b>			Y					

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>	
Recommended		N				Y	
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>		<b>WWP ID:</b>		<b>WUG ID:</b>	
BRAZOSPORT WATER AUTHORITY		2000		120208093		N/A	
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>					
N							
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y					
		<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>WUG WMS Annual Cost:</b>	\$0	\$247,490	\$316,781	\$209,124	\$185,634	\$173,563
	<b>WUG Capital Costs:</b>	\$3,394,515					
	<b>Term of Debt Service:</b>	20					

5.	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>		<b>County Name:</b>		<b>Basin Name:</b>	
	H	FREESPORT	NONE	080217000		BRAZORIA		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>Total Strategy Supply Volume for this WUG:</b>			0	1,039	1,126	1,217	1,337	1,483
	<b>Is WUG selected for Rollup?</b>			Y					
	<b>Is WUG Cost selected for Rollup?</b>			Y					

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>	
Recommended		N				Y	
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>		<b>WWP ID:</b>		<b>WUG ID:</b>	
BRAZOSPORT WATER AUTHORITY		2000		120208093		N/A	
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>					
N							
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y					
		<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>WUG WMS Annual Cost:</b>	\$0	\$209,181	\$246,904	\$124,246	\$136,844	\$155,999
	<b>WUG Capital Costs:</b>	\$3,334,813					
	<b>Term of Debt Service:</b>	20					

6.	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>		<b>County Name:</b>		<b>Basin Name:</b>	
	H	LAKE JACKSON	NONE	080338000		BRAZORIA		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>Total Strategy Supply Volume for this WUG:</b>			0	1,532	1,595	1,709	1,865	2,049
	<b>Is WUG selected for Rollup?</b>			Y					
	<b>Is WUG Cost selected for Rollup?</b>			Y					

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>	
Recommended		N				Y	
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>		<b>WWP ID:</b>		<b>WUG ID:</b>	
BRAZOSPORT WATER AUTHORITY		2000		120208093		N/A	
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>					
N							
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y					
		<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>WUG WMS Annual Cost:</b>	\$0	\$208,804	\$231,332	\$122,835	\$154,017	\$178,383
	<b>WUG Capital Costs:</b>	\$3,178,443					
	<b>Term of Debt Service:</b>	20					

DB12 Entries: BWA to WUG Contract

7.	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>		<b>County Name:</b>		<b>Basin Name:</b>	
	H	MANUFACTURING	NONE	081001020		BRAZORIA		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>Total Strategy Supply Volume for this WUG:</b>			0	849	349	347	280	280
	<b>Is WUG selected for Rollup?</b>			Y					
	<b>Is WUG Cost selected for Rollup?</b>			Y					

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>	
Recommended		N				Y	
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>		<b>WWP ID:</b>		<b>WUG ID:</b>	
BRAZOSPORT WATER AUTHORITY		2000		120208093		N/A	
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>					
N							
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y					
		<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>WUG WMS Annual Cost:</b>	\$0	\$166,838	\$154,561	\$28,706	\$56,180	\$56,180
	<b>WUG Capital Costs:</b>	\$1,729,257					
	<b>Term of Debt Service:</b>	20					

8.	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>		<b>County Name:</b>		<b>Basin Name:</b>	
	H	OYSTER CREEK	NONE	080730000		BRAZORIA		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>Total Strategy Supply Volume for this WUG:</b>			0	71	77	85	95	107
	<b>Is WUG selected for Rollup?</b>			Y					
	<b>Is WUG Cost selected for Rollup?</b>			Y					

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>	
Recommended		N				Y	
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>		<b>WWP ID:</b>		<b>WUG ID:</b>	
BRAZOSPORT WATER AUTHORITY		2000		120208093		N/A	
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>					
N							
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y					
		<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>WUG WMS Annual Cost:</b>	\$0	\$11,008	\$13,059	\$7,694	\$9,095	\$10,566
	<b>WUG Capital Costs:</b>	\$192,361					
	<b>Term of Debt Service:</b>	20					

9.	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>		<b>County Name:</b>		<b>Basin Name:</b>	
	H	RICHWOOD	NONE	080501000		BRAZORIA		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>Total Strategy Supply Volume for this WUG:</b>			0	154	155	158	166	176
	<b>Is WUG selected for Rollup?</b>			Y					
	<b>Is WUG Cost selected for Rollup?</b>			Y					

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>	
Recommended		N				Y	
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>		<b>WWP ID:</b>		<b>WUG ID:</b>	
BRAZOSPORT WATER AUTHORITY		2000		120208093		N/A	
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>					
N							
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y					
		<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
	<b>WUG WMS Annual Cost:</b>	\$0	\$25,239	\$25,825	\$8,730	\$11,291	\$14,108
	<b>WUG Capital Costs:</b>	\$292,333					
	<b>Term of Debt Service:</b>	20					

**Attachment M:**

Comments received regarding proposed amendment





The public comment period for this amendment concluded January 12, 2015 with no comments being received by the Region H Water Planning Group or the project sponsor.

## Agenda Item 6

Receive presentation on and discuss proposal to amend the 2011 Region H Regional Water Plan related to proposed development of a system by Gulf Coast Water Authority to utilize reclaimed wastewater effluent from the City of Houston.

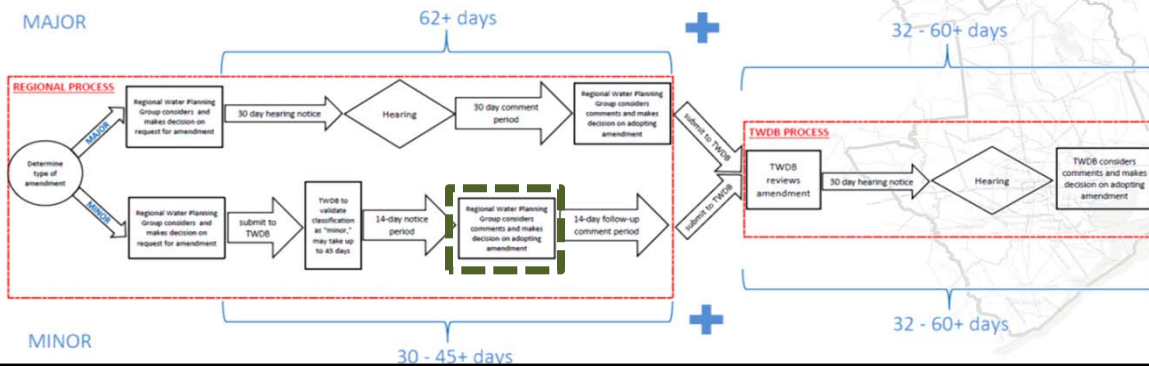
## Agenda Item 6 GCWA Amendment

Receive presentation on and discuss proposal to amend the 2011 Region H Regional Water Plan related to proposed development of a system by Gulf Coast Water Authority to utilize reclaimed wastewater effluent from the City of Houston.



## Agenda Item 6 GCWA Amendment

- Since November
  - Submitted draft amendment package to TWDB
  - Received confirmation of minor amendment status
  - Provided proper notice and posting of amendment package



## Agenda Item 6 GCWA Amendment

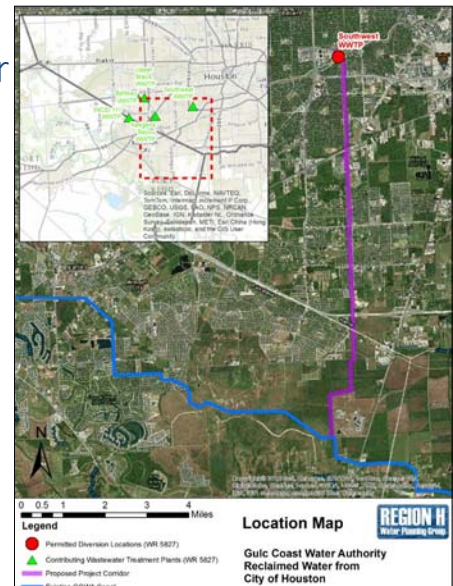
- Amendment process
  - 14-day notice has been provided
  - TODAY: Review proposed amendment
  - TODAY: Consider action on amending 2011 RWP
  - 14-day comment period
  - Submit amendment package and comments to TWDB



## Agenda Item 6 GCWA Amendment

- Gulf Coast Water Authority Reclaimed Water from City of Houston

<b>Description</b>	Transfer of reclaimed water from the City of Houston Southwest Wastewater Plant and other treatment facilities upstream along Brays Bayou.
<b>Quantity</b>	Direct Intake: 30.1 MGD average Combined Intake: 50.8 MGD average
<b>Source</b>	Effluent from as many as five City of Houston wastewater treatment plants.
<b>Decade</b>	2020 (Online date in 2018)
<b>Total Cost</b>	Direct Intake: \$53,857,800 Combined Intake: \$66,840,500
<b>Unit Cost</b>	Direct Intake: \$112 per ac-ft Combined Intake: \$80 per ac-ft



## Agenda Item 6 GCWA Amendment

- Gulf Coast Water Authority Reclaimed Water from City of Houston
  - Reuse source
    - City of Houston Water Right Number 5827
    - Already a supply in 2011 RWP
    - Remaining availability to accommodate GCWA project
    - Availability based on
      - Plant discharge
      - Diversion rates
      - B&E flows
      - Instream flows
  - Basis for strategy
    - Ongoing study of medium- and long-term strategies by GCWA
    - Identified from a list of over 30 strategy alternatives
    - Lower-cost, near-term option



## Agenda Item 6 GCWA Amendment

- 2011 RWP amendment package
  - Revisions to Executive Summary
  - Revisions to Chapter 4
    - Appendix 4A supply allocation tables
    - Appendix 4C cost tables
    - Appendix 4E environmental flows analysis
  - New tech memorandum
    - Gulf Coast Water Authority Reclaimed Water from City of Houston
  - Revisions to Chapter 5
  - DB12 database entries



# RECEIVED

DEC 15 2014

San Jacinto River Authority  
G&A Office

## Texas Water Development Board



P.O. Box 13231, 1700 N. Congress Ave.  
Austin, TX 78711-3231, [www.twdb.texas.gov](http://www.twdb.texas.gov)  
Phone (512) 463-7847, Fax (512) 475-2053

December 1, 2014

Mr. Mark Evans  
Region H Chair  
North Harris County Regional Water Authority  
3648 Cypress Creek Parkway #110  
Houston, Texas 77068

Re: Region H's written request, received November 11, 2014, for a determination regarding whether or not amending the 2011 Region H Regional Water Plan to include Gulf Coast Water Authority's Purchase of Treated Effluent from the City of Houston as a recommended water management strategy would be a minor amendment under 31 TAC Section §357.51(c).

Dear Mr. Evans:

I have reviewed Region H's request, and based on Region H's request and supporting materials, have determined that adding Gulf Coast Water Authority's Purchase of Treated Effluent from the City of Houston as a new recommended water management strategy constitutes a minor amendment under 31 TAC Section §357.51(c).

If Region H adopts the proposed minor amendment, Region H will need to:

1. Provide the Texas Water Development Board (TWDB) with documentation of the planning group action adopting this water management strategy as a minor amendment;
2. Issue and distribute an amendment to the 2011 Region H Regional Water Plan updating the plan accordingly;
3. Provide TWDB with corrected DB12 data to reflect all the associated changes to the 2011 Region H Regional Water Plan and the 2012 State Water Plan; and,
4. Request that the Gulf Coast Water Authority obtain a web link from TWDB staff in order to fill out an associated online Infrastructure Financing Survey regarding how the entity plans to finance the projects associated with the amendment.

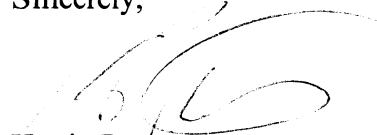
If Region H makes any substantive changes to the project components or configuration during the minor amendment process, TWDB will need to review the modified proposed amendment to ensure that the modified project still meets all of the criteria under 31 TAC §357.51(c) to qualify as a minor amendment.

Our Mission	:	Board Members
To provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas	:	Carlos Rubinstein, Chairman   Bech Bruun, Member   Kathleen Jackson, Member
	:	Kevin Patteson, Executive Administrator

Mr. Mark Evans, Region H Chair  
December 1, 2014  
Page 2

If you have any questions concerning this approval or its associated requirements, please contact Lann Bookout, the TWDB's designated regional water planning project manager for this region.

Sincerely,



Kevin Patteson  
Executive Administrator

cc: ~~Mr.~~ Jace Houston, General Manager, San Jacinto River Authority, PO Box 329, Conroe,  
Texas 77305  
Lann Bookout, TWDB





**MINOR AMENDMENT TO THE  
2011 REGION H REGIONAL  
WATER PLAN**

**Gulf Coast Water Authority**



Attachment	Description
A	Amended excerpts from Executive Summary including Tables ES-7 and ES-8.
B	Amended excerpts from Chapter 4: Identification, Evaluation and Selection of Water Management Strategies Based on Needs
C	Amended Table 4A-3: Water Management Strategy Screening
D	Amended Table 4A-4: Water Management Strategy Environmental Impacts
E	Amended Table 4A-5: Recommended WMS by County
F	Amended Table 4A-6: Decadal WMS Summary
G	Amended Table 4A-7: WMS Supply Allocations by WUG
H	Amended Table 4A-8: WUG-Level Contracts
I	Amended Technical Memorandum 4B-07: WWP Contracts
J	New Technical Memorandum: 4B-54: Gulf Coast Water Authority Reclaimed Water from City of Houston
K	Amended Table 4C-1: WWP-Level Project Costs
L	Amended Table 4C-2: WUG-Level Project Costs
M	Amended Appendix 4E: Environmental Flows Modeling for New WMS
N	Amended excerpts from Chapter 5: Impacts of Management Strategies on Water Quality and Impacts of Moving Water from Rural and Agricultural Areas
O	Summary of database entries anticipated for DB12



**Attachment A:**

Amended excerpts from Executive Summary including Tables ES-7 and ES-8



- **River Plantation MUD**
- **San Jacinto River Authority WRAP**
- **Sugar Land**
- **West Harris County Regional Water Authority**

### Reservoir Strategies

- **Allen's Creek Reservoir** – This proposed reservoir creates 99,650 ac-ft/yr of supplies for the City of Houston and the Brazos River Authority.
- **Brazoria County Off-Channel Reservoir** – This proposed reservoir creates 24,000 ac-ft/yr of firm supply for manufacturing demands in Brazoria County.
- **Dow Off-Channel Reservoir** – This proposed reservoir creates 21,800 ac-ft/yr in firm supply by increasing the storage associated with an existing Dow water right.
- **Fort Bend Off-Channel Reservoir** – This proposed reservoir creates 46,000 ac-ft/yr of firm supply for municipal and industrial demands in Fort Bend County
- **GCWA Off-Channel Reservoir** – This proposed reservoir creates 39,500 ac-ft/yr of firm supply for manufacturing use served by GCWA. This reservoir uses existing water rights with surplus interruptible supply to produce this firm yield.

### Reuse Strategies

- **Fulshear Reuse** – Development of a direct reuse project for the City of Fulshear and surrounding utilities.
- **GCWA Reclaimed Water from City of Houston** – Transfer of reclaimed water from the City of Houston Southwest Wastewater Treatment Plant and other treatment facilities upstream along Brays Bayou
- **Houston Indirect Wastewater Reuse**—The City of Houston has applied for a water right permit to indirectly reuse up to 580,900 ac-ft/yr of wastewater discharges. A portion of that is recommended for direct reuse to industry.
- **Montgomery County MUD 8/9 Reuse** – Indirect reuse project for potable water by districts along Lake Conroe in Montgomery County.
- **NHCRWA Indirect Wastewater Reuse** –The North Harris County Regional Water Authority has the potential to indirectly reuse up to 126,000 ac-ft/yr of wastewater discharges.
- **Wastewater Reclamation for Industry** –This strategy proposes that 67,200 ac-ft/yr of Houston's municipal wastewater be treated and directly reused by industries along the Houston Ship Channel.
- **Wastewater Reclamation for Municipal Irrigation** – This strategy anticipates the development of direct reuse project incorporated into new community growth in the rapidly-developing counties of Region H.

### Permit Strategies

- **Brazos River Authority System Operations** –The Brazos River Authority has applied for a water right that permits existing additional yield within their reservoirs, and new yield that can be achieved through operation of their reservoirs as a basin-wide system. Approximately 25,350 ac-ft/yr of this water will be available for customers in Region H.

NFBWA Internal Distribution	106,402	\$225,000,000	N/A	2020
NFBWA Shared Transmission Line	71,876	\$213,000,000	N/A	2020
NHCRWA Internal 2010 Distribution	34,714	\$153,149,640	N/A	2010
NHCRWA Internal 2020 Distribution	91,167	\$345,292,192	N/A	2020
NHCRWA Internal 2030 Distribution	117,755	\$37,439,584	N/A	2030
NHCRWA Transmission 2010	34,714	\$80,690,624	N/A	2010
NHCRWA Transmission 2020	91,167	\$172,558,512	N/A	2020
NHCRWA Transmission 2030	117,755	\$0	N/A	2030
Pearland SWTP	13,420	\$0	\$265,000,000	TBD
Sealy GW Treatment Expansion	888	\$0	\$6,450,000	2020
WHCRWA Internal Distribution	78,839	\$552,472,000	N/A	2010
WHCRWA Transmission Line	78,839	\$290,084,193	N/A	2010

**Reservoir Strategies:**

Allens Creek Reservoir	99,650	\$222,752,400	See Contracts	2020
Brazoria County Off-channel Reservoir	24,100	\$173,898,602	See Contracts	2060
Dow Off-channel Reservoir	21,800	\$124,468,000	See Contracts	2020
Fort Bend County Off-channel Reservoir	46,000	\$202,514,788	See Contracts	2050
GCWA Off-channel Reservoir	39,500	\$197,448,012	See Contracts	2030

**Reuse Strategies:**

Fulshear Reuse	430	\$0	\$566,625	TBD
GCWA Reclaimed Water from COH	56,896	\$65,920,541	See Contracts	2020
Houston Indirect Reuse	128,801	\$0	\$721,822,850	2040
Montgomery MUD 8/9 Indirect Reuse	1,120	\$0	\$12,245,687	2016
NHCRWA Indirect Reuse	16,300	\$0	\$66,778,694	2040
Wastewater Reuse for Industry	67,200	\$332,051,761	\$0	2060
Wastewater Reclamation for Mun. Irrigation	36,388	\$0	\$48,043,249	2030

**Permit Strategies:**

BRA System Operations Permit	25,400	TBD	See Contracts	2020
Houston Bayous Permit*	0	\$20,956,000	\$0	2020

**Other Strategies:**

Brazoria Co. Interruptible Supplies for Irr.	104,977	\$0	\$0	2010
Freeport Desalination Plant	33,600	\$255,699,000	See Contracts	2050
Brazos Saltwater Barrier	N/A	\$44,470,739	\$0	2030

1. WUG-level costs for a number of WMS are indicated as "See Contracts". The WUG-level costs for these strategies will be infrastructure costs associated with implementing *future* contracts from WWPs. For simplification, these costs are collectively represented under the "WUG-Level Contracts" WMS, as common infrastructure from a WUG may treat or transmit water from multiple WMS.
2. Yield value includes surface water transmission volume and is therefore not additional yield.
3. Includes supply volume of TRA to SJRA Contract
4. The Houston Bayous Permit has not yet been approved by TCEQ.



**Table ES-8**  
**Recommended Water Management Strategies by County (in ac-ft/yr)**

	2010	2020	2030	2040	2050	2060
<b>Austin</b>						
Initial Shortage	0	-739	-1,240	-1,496	-1,635	-1,865
Expanded GW	0	739	1,240	1,496	1,635	1,865
Municipal Conservation	0	223	251	265	273	285
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>223</b>	<b>251</b>	<b>265</b>	<b>273</b>	<b>285</b>
<b>Brazoria</b>						
Initial Shortage	-150,907	-186,760	-211,634	-238,588	-266,405	-299,199
Expanded GW	0	4,049	12,988	13,515	15,658	16,209
Municipal Conservation	1,476	2,610	2,978	3,249	3,567	3,918
Contract Expansions	7,750	7,750	7,750	7,750	7,750	7,750
<b>Net Shortage</b>	<b>-141,681</b>	<b>-172,351</b>	<b>-187,918</b>	<b>-214,074</b>	<b>-239,430</b>	<b>-271,322</b>
Irrigation Conservation	18,792	18,792	18,792	18,792	18,792	18,792
Wastewater Reclamation for Mun. Irrigation	0	0	116	227	344	465
Brazoria Co. Interruptible Supplies for Irr.	98,189	86,759	64,000	64,000	64,000	64,000
Reallocate Existing Supply	13,694	13,694	13,895	13,988	14,019	13,694
Interim Strategies	24,916	0	0	0	0	0
GCWA Offchannel Reservoir	0	0	39,500	39,500	39,500	39,500
Allens Creek Lake/Reservoir	0	45,277	41,779	66,665	58,092	66,196
BRA System Operations Permit	0	3,010	3,010	3,010	3,010	3,010
Brazoria OCR	0	0	0	0	0	24,000
Freeport Desalination Plant	0	0	0	0	33,600	33,600
Dow Offchannel Reservoir	0	21,800	21,800	21,800	21,800	21,800
New Groundwater Wells for Livestock	0	27	27	27	27	27
BWA Brackish Groundwater	0	3,136	3,136	3,136	3,136	3,136
GCWA Reclaimed Water from COH	0	6,363	6,557	7,106	7,826	8,719
<b>Total after Recommendations</b>	<b>13,910</b>	<b>26,507</b>	<b>24,694</b>	<b>24,177</b>	<b>24,716</b>	<b>25,617</b>
<b>Chambers</b>						
Initial Shortage	-42,520	-47,412	-50,831	-54,251	-57,612	-61,065
Expanded GW	0	577	681	796	905	1,010
Municipal Conservation	137	195	219	239	263	291
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-42,383</b>	<b>-46,640</b>	<b>-49,931</b>	<b>-53,216</b>	<b>-56,444</b>	<b>-59,764</b>
Irrigation Conservation	24,018	24,018	24,018	24,018	24,018	24,018
CLCND W Chambers System	0	1,691	1,978	2,235	2,511	2,804
Reallocate Existing Supply	21,010	21,264	21,389	21,509	21,627	21,725
Interim Strategies	903	0	0	0	0	0
New Contract from Existing Supply	13,823	17,083	19,972	22,888	25,732	28,672
<b>Total after Recommendations<sup>1</sup></b>	<b>17,371</b>	<b>17,416</b>	<b>17,426</b>	<b>17,434</b>	<b>17,444</b>	<b>17,455</b>
<b>Fort Bend</b>						
Initial Shortage	-86	-11,410	-52,608	-84,380	-123,623	-178,948
Expanded GW	0	6,886	3,423	3,813	4,378	5,052
Municipal Conservation	1,435	7,077	10,277	12,253	14,678	17,497
Contract Expansions	0	367	1,295	1,226	1,225	1,016
<b>Net Shortage</b>	<b>1,349</b>	<b>2,920</b>	<b>-37,613</b>	<b>-67,088</b>	<b>-103,342</b>	<b>-155,383</b>
Irrigation Conservation	5,197	5,197	5,197	5,197	5,197	5,197
WHCRWA GRP	0	0	0	0	0	0

	2010	2020	2030	2040	2050	2060
NFBWA GRP	0	0	0	0	0	0
Sugar Land GRP	0	488	4,921	4,835	4,915	4,961
Missouri City GRP	0	4,401	4,401	4,401	4,401	4,401
Wastewater Reclamation for Mun. Irrigation	0	0	2,136	4,744	8,403	12,277
Fort Bend MUD 25 GRP	0	589	589	589	589	589
BRA System Operations Permit	0	3,611	15,860	22,340	22,340	22,340
Fort Bend OCR	0	0	0	0	90	45,943
Allens Creek Lake/Reservoir	0	0	0	6,605	25,864	16,145
TRA to Houston Contract	0	0	13,813	27,824	39,179	39,179
Reallocate Existing Supply	0	0	4,687	4,510	3,720	13,762
Fulshear Reuse	0	287	430	430	430	430
Industrial Conservation	0	558	558	558	558	558
<b>Total after Recommendations</b>	<b>6,546</b>	<b>18,051</b>	<b>14,979</b>	<b>14,945</b>	<b>12,344</b>	<b>10,399</b>

**Galveston**

Initial Shortage	-16,307	-16,466	-17,787	-18,738	-19,884	-21,276
Expanded GW	0	811	1,352	1,350	1,352	1,352
Municipal Conservation	768	846	886	896	903	914
Contract Expansions	0	25,630	25,630	25,630	25,630	25,630
<b>Net Shortage</b>	<b>-15,539</b>	<b>10,821</b>	<b>10,081</b>	<b>9,138</b>	<b>8,001</b>	<b>6,620</b>
Irrigation Conservation	2,392	2,392	2,392	2,392	2,392	2,392
New Contract from Existing Supply	16	23	26	29	33	37
Interim Strategies	6,410	0	0	0	0	0
Allens Creek Lake/Reservoir	0	12,101	13,234	14,175	15,310	16,687
New Groundwater Wells for Livestock	0	14	14	14	14	14
Interruptible Supplies for Irr.	6,788	0	0	0	0	0
GCWA Reclaimed Water from COH	0	50,533	50,339	49,790	49,070	48,177
<b>Total after Recommendations</b>	<b>67</b>	<b>75,884</b>	<b>76,086</b>	<b>75,538</b>	<b>74,820</b>	<b>73,927</b>

**Harris**

Initial Shortage	-51,413	-194,925	-270,301	-323,711	-375,414	-458,509
Expanded GW	0	15,481	27,659	27,693	27,727	27,560
Municipal Conservation	37,292	46,836	51,902	56,748	61,656	66,947
Contract Expansions	0	108,852	66,039	51,840	42,538	31,971
<b>Net Shortage</b>	<b>-14,121</b>	<b>-23,756</b>	<b>-124,701</b>	<b>-187,430</b>	<b>-243,493</b>	<b>-332,031</b>
New Contract from Existing Supply	23,008	31,264	38,732	54,777	54,805	54,849
NHCRWA GRP	0	0	0	0	0	0
WHCRWA GRP	-65	-258	-409	-566	-751	-968
COH GRP	0	0	0	0	0	0
Missouri City GRP	0	386	386	386	386	386
Wastewater Reclamation for Mun. Irrigation	0	0	3,268	6,616	10,027	13,431
Reallocate Existing Supply	18,253	15,276	7,308	19,232	30,220	96,881
Interim Strategies	15	0	0	0	0	0
Allens Creek Lake/Reservoir	0	15	83	336	384	622
TRA to Houston Contract	0	0	93,744	86,519	75,164	75,164
NHCRWA Indirect Reuse	0	0	0	7,300	16,300	16,300
Wastewater Reuse for Industry	0	0	0	0	0	67,200
Houston Indirect Reuse	0	0	0	66,420	114,679	128,801
<b>Total after Recommendations</b>	<b>27,090</b>	<b>22,927</b>	<b>18,411</b>	<b>53,590</b>	<b>57,721</b>	<b>120,635</b>

**Attachment B:**

Amended excerpts from Chapter 4: Identification, Evaluation and Selection of Water Management Strategies Based on Needs



- WWP Contracts

#### Groundwater Strategies

- Expanded Use of Groundwater
- Interim Strategies
- New Groundwater Wells for Livestock

#### Groundwater Reduction Plans

- CHCRWA GRP (see CHCRWA Transmission)
- City of Houston GRP (see COH Treatment Expansion)
- City of Missouri City GRP
- Fort Bend MUD 25 GRP
- Fort Bend WCID 2 GRP
- NFBWA GRP (see NFBWA Transmission)
- NHCRWA GRP (see NHCRWA Transmission)
- Pecan Grove GRP
- Richmond/Rosenberg GRP
- River Plantation GRP
- SJRA WRAP
- Sugar Land GRP
- WHCRWA GRP (see WHCRWA Transmission)

#### Reservoir Strategies:

- Allens Creek Reservoir
- Brazoria County Off-Channel Reservoir
- Dow Off-Channel Reservoir
- Fort Bend County Off-Channel Reservoir
- GCWA Off-channel Reservoir
- Millican Reservoir
- Little River Off-Channel Reservoir
- Other Potential Reservoirs

#### Reuse Strategies:

- Fulshear Reuse
- GCWA Reclaimed Water from City of Houston
- Houston Indirect Reuse
- Montgomery County MUD 8/9 Indirect Reuse

Huntsville WTP	11,200	\$61,023,906	\$0	2010
LLWSSSC Surface Water Project	954	\$0	\$3,087,974	2010
Luce Bayou Transfer	450,000	\$253,916,914	\$0	2020
NFBWA Internal Distribution	106,402	\$225,000,000	N/A	2020
NFBWA Shared Transmission Line	71,876	\$213,000,000	N/A	2020
NHCRWA Internal 2010 Distribution	34,714	\$153,149,640	N/A	2010
NHCRWA Internal 2020 Distribution	91,167	\$345,292,192	N/A	2020
NHCRWA Internal 2030 Distribution	117,755	\$37,439,584	N/A	2030
NHCRWA Transmission 2010	34,714	\$80,690,624	N/A	2010
NHCRWA Transmission 2020	91,167	\$172,558,512	N/A	2020
NHCRWA Transmission 2030	117,755	\$0	N/A	2030
Pearland SWTP	13,420	\$0	\$265,000,000	TBD
Sealy GW Treatment Expansion	888	\$0	\$6,450,000	2020
WHCRWA Internal Distribution	78,839	\$552,472,000	N/A	2010
WHCRWA Transmission Line	78,839	\$290,084,193	N/A	2010

**Reservoir Strategies:**

Allens Creek Reservoir	99,650	\$222,752,400	See Contracts	2020
Brazoria County Off-channel Reservoir	24,100	\$173,898,602	See Contracts	2060
Dow Off-channel Reservoir	21,800	\$124,468,000	See Contracts	2020
Fort Bend County Off-channel Reservoir	46,000	\$202,514,788	See Contracts	2050
GCWA Off-channel Reservoir	39,500	\$197,448,012	See Contracts	2030

**Reuse Strategies:**

Fulshear Reuse	430	\$0	\$566,625	TBD
GCWA Reclaimed Water from COH	56,896	\$66,840,044	See Contracts	2020
Houston Indirect Reuse	128,801	\$0	\$721,822,850	2040
Montgomery MUD 8/9 Indirect Reuse	1,120	\$0	\$12,245,687	2016
NHCRWA Indirect Reuse	16,300	\$0	\$66,778,694	2040
Wastewater Reuse for Industry	67,200	\$332,051,761	\$0	2060
Wastewater Reclamation for Mun. Irrigation	36,388	\$0	\$48,043,249	2030

**Permit Strategies:**

BRA System Operations Permit	25,400	TBD	See Contracts	2020
Houston Bayous Permit*	0	\$20,956,000	\$0	2020

**Other Strategies:**

Brazoria Co. Interruptible Supplies for Irr.	104,977	\$0	\$0	2010
Freeport Desalination Plant	33,600	\$255,699,000	See Contracts	2050
Brazos Saltwater Barrier	N/A	\$44,470,739	\$0	2030

1. WUG-level costs for a number of WMS are indicated as "See Contracts". The WUG-level costs for these strategies will be infrastructure costs associated with implementing *future* contracts from WWPs. For simplification, these costs are collectively represented under the "WUG-Level Contracts" WMS, as common infrastructure from a WUG may treat or transmit water from multiple WMS.
2. Yield value includes surface water transmission volume and is therefore not additional yield.
3. Includes supply volume of TRA to SJRA Contract
4. The Houston Bayous Permit has not yet been approved by TCEQ.

**Attachment C:**

Amended Table 4A-3: Water Management Strategy Screening





Region H  
Table 4A-3: Water Management Strategy Screening

Water Management Strategy Screening Factor Weight:	Water User Group or Wholesale Provider	Strategy Description	Strategy Capital Cost (\$)	Average Annual Cost of Water (\$/ac-ft)	Major WMS	Earliest Potential Starting Decade	Firm Yield (ac-ft/yr)	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Decision Matrix Factors (High, Medium, Low)										Total of Screening Factors	Selected as Part of 2001 Plan	Selected as Part of 2006 Plan	
												Cost	Yield	Location	Water Quality	Environment	Local Preference	Institutional Constraints	Risk of Implementability	Impacts on Water Resources	Impacts on Other Management Strategies				
<b>Conservation Strategies</b>																									
Industrial Conservation	Manufacturing	Reduce water demand through selected BMPs	TBD	TBD		2010	TBD	All	No	No impact	None	0	0	1	0	0	0	1	0	1	3	No	No		
Irrigation Conservation																									
Brazoria County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	\$1,850,200 annual cost, on-farm methods \$198,200 capital cost, canal lining	\$99		2010	18,792	Brazos, Brazos-Colorado	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1	5	Yes	Yes		
Chambers County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	\$2,336,300 annual cost, on-farm methods \$279,200 capital cost, canal lining	\$98		2010	24,018	Trinity	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1	5	Yes	Yes		
Fort Bend County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	\$509,900 annual cost, on-farm methods \$56,500 capital cost, canal lining	\$99		2010	5,198	Brazos, Brazos-Colorado, San Jacinto-Brazos	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1	5	Yes	Yes		
Galveston County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	\$231,100 annual cost, on-farm methods \$29,400 capital cost, canal lining	\$98		2010	2,392	San Jacinto - Brazos	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1	5	Yes	Yes		
Liberty County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	\$2,089,800 annual cost, on-farm methods i \$188,700 capital cost, canal lining	\$100		2010	20,877	Trinity	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1	5	Yes	Yes		
Waller County	Irrigation	Reduce irrigation losses through land leveling, point irrigation	\$726,700 annual cost, on-farm methods	\$110		2050	6,606	San Jacinto	No	Reduces losses that feed small streams	None	1	1	1	0	0	0	1	0	1	5	Yes	Yes		
Municipal Conservation	Multiple	Reduce demand through various methods	From \$9.9 to \$22.8 million for all WUGs collectively	\$202 (Sm Sys) \$311 (Med Sys) \$213 (Lg Sys)		2010	From 45,605 to 105,494	All	No	No impact	None	0	1	1	0	0	1	1	0	1	5	Yes	Yes		
<b>Contractual Strategies</b>																									
Expand/ Increase Current Contracts	Multiple	Increase existing contracts to meet customer demands	At WUG level	System Rate		2010	Varies by contract. No new supply created	Multiple	Yes	Reduced streamflows due to use of currently unused supplies	None	1	0	1	0	0	1	1	0	1	5	Yes	Yes		
New Contracts from Existing Supply	Multiple	Create new contracts from existing unallocated supplies	At WUG level	System Rate		2010	Varies by contract. No new supply created	Multiple	Yes	Reduced streamflows due to use of currently unused supplies	None	1	0	1	0	0	1	1	0	1	5		Yes		
Reallocation of Existing Supply	Multiple	Reallocate surplus water to WUGs with shortages	At WUG level	System Rate		2010	Varies by contract. No new supply created	Multiple	Yes	Altered location of return flows	None	1	0	1	0	0	1	1	0	1	5	No	No		
TRA to SJRA contract	TRA / SJRA	Sell uncommitted supply to SJRA.	\$302,781,597	\$687 Y		2040	76,476	Trinity to San Jacinto	Yes	Potential introduction of invasive species	Requires construction of new conveyance	0	1	0	0	0	0	0	-1	0	0	No	Yes		
TRA to Houston Contract	TRA / Houston	Sell uncommitted supply to Houston	None - Infrastructure cost already reflected under Luce Bayou WMS	None - Infrastructure cost already reflected under Luce Bayou WMS		2030	123,524	Trinity to San Jacinto	Yes	Potential introduction of invasive species via Luce Bayou conveyance.	Unknown	1	1	0	0	0	1	1	-1	0	3	Yes	Yes		
WUG Level Contracts	Multiple WUGs	Contracts from WWPs to WUGs. Includes contracts for volumes created under other yield-producing WMS	WUG-specific infrastructure N/A - cost associated with WWP infrastructure projects	Contract Rate		2010	Varies by contract. No new supply created	All	Yes (source-dependent)	None - impacts associated with yield-creating WMS or infrastructure	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
WWP Contracts	Multiple WWPs	Contracts between WWPs. Includes contracts for volumes created under other yield-producing WMS	WUG-specific infrastructure N/A - cost associated with WWP infrastructure projects	Contract Rate		2010	Varies by contract. No new supply created	All	Yes (source-dependent)	None - impacts associated with yield-creating WMS or infrastructure	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
<b>Groundwater Strategies</b>																									
Expanded Use of Groundwater	Multiple	Increase groundwater use, to the sustainable or permitted yield.	\$589,500 per 1 mgd well. \$165,928,999 total capital cost for WUG infrastructure	\$205		2010	90,617	All	No	Uses existing supply, return flows remain in basin of origin.	New wells may require some land clearing.	0	1	1	1	0	1	0	0	0	4	Yes			
Interim Strategies	Brazoria, Chambers, Galveston, Harris, and Montgomery Counties	Temporary groundwater use in excess of available supply	\$86,701,535 total capital cost for WUG infrastructure	\$788 Y		2010	NA - temporary use of 45,512 ac-ft/yr	Multiple	No	Potential for subsidence and excess drawdown	New wells may require some land clearing.	1	1	1	0	-1	1	0	1	0	4	No	No		
New Groundwater Wells for Livestock	Multiple	Added well capacity to facilitate expanded pumping or interim groundwater use	\$18,635	\$37		2010	41	San Jacinto-Brazos, Neches-Trinity	No	None - impacts associated with yield-creating WMS or infrastructure	New wells may require some land clearing.	0	NA	1	1	0	1	0	0	0	3	No	Yes		

Region H  
Table 4A-3: Water Management Strategy Screening

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Strategy Capital Cost (\$)	Average Annual Cost of Water (\$/ac-ft)	Major WWS	Earliest Potential Starting Decade	Firm Yield (ac-ft/yr)	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Decision Matrix Factors (High, Medium, Low)										Total of Screening Factors	Selected as Part of 2001 Plan	Selected as Part of 2006 Plan
												Cost	Yield	Location	Water Quality	Environment	Local Preference	Institutional Constructability	Regulatory Risk	Impacts on Water Resources	Impact of Other Management Strategies			
Screening Factor Weight:												1	1	1	1	1	1	1	1	1				
CHCRWA GRP	CHCRWA	Conversion of CHCRWA to surface water.	TBD	TBD		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	1	0	0	1	0	0			2	No	No	
COH GRP	COH	Conversion of portions of COH service area to surface water	See COH Expansion and Distribution Expansion	See COH Treatment Expansion and Distribution Expansion		2010	NA	Multiple		Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	1	0	0	1	0	0				No	No	
Missouri City GRP	Missouri City	Conversion of Missouri City and surrounding area to surface water. Also includes Aquifer Storage and Recovery.	\$92,070,990 capital cost to WWP. \$8,397,800 infrastructure cost to participating WUGs / GRP (participation)	\$378 per ac-ft (WWP cost only - excludes infrastructure cost of customer WUGs / GRP participation)		2020 (2013)	4,790 (new supply from reuse + ASR)	Brazos, San Jacinto-Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0		1	No	No	
Fort Bend County MUD 25 GRP	Fort Bend MUD 25	A combination of reuse and surface water to allow for groundwater reduction.	\$766,700 capital cost (estimated as \$564 per acre-foot construction cost based on Wastewater Reuse for Municipal Irrigation WMS).	\$499 for infrastructure - does not include customer contract rate		2020 (2013)	589 (Reuse)	Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0		1	No	No	
Fort Bend County WCID No. 2 GRP	Fort Bend County WCID No. 2	Surface water conversion	\$24,828,857 capital cost	\$353		2020 (2013)	NA	San Jacinto, San Jacinto-Brazos	No	Potential disturbance due to construction.	due to transmission line construction. Land required for plant	-1	0	1	0	0	1	0	0		1	No	No	
NFBWA GRP	NFBWA	Conversion of NFBWA to surface water. Also includes reuse and major water supply infrastructure.	infrastructure cost to WUGs. WWP infrastructure detailed separately.	See inf. Cost		2020 (2013)	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	1	0	0	1	0	0	0		2	No	No	
NHCRWA GRP	NHCRWA	Conversion of NHCRWA to surface water. Also includes reuse and major water supply infrastructure.	infrastructure cost to WUGs. WWP infrastructure detailed separately.	See inf. Cost		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	1	0	0	1	0	0	0		2	No	Yes	
Pecan Grove GRP	Pecan Grove	Conversion of Pecan Grove to surface water. Also includes reuse	\$15,960,000	\$865		2020 (2013)	NA	Brazos, San Jacinto-Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0		1	No	No	
Richmond-Rosenberg GRP	Richmond, Rosenberg	Conversion of Richmond-Rosenberg to surface water.	\$117,220,150 capital cost for WWP	NA - existing contract		2020 (2015)	NA	Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	0	1	0	0	1	0	0		2	No	No	
River Plantation GRP	River Plantation	Entering into GRP with River Plantation CC golf course to provide additional WWTP effluent for irrigation purposes	\$484,926	495		2010	NA	San Jacinto	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	0	1	0	0	1	0	0		2	No	No	
SJRA WRAP	Montgomery County	Conversion of Montgomery County to surface water. Also includes reuse and major water supply infrastructure.	\$900,000,000 capital cost for WWP. \$217,856,853 infrastructure cost for participating WUGs / GRP (participation)	\$649 (WWP cost only - excludes infrastructure cost of customer WUGs / GRP participation)		2020 (2015)	NA	San Jacinto	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0		1	No	No	
Sugar Land GRP	Sugar Land	Conversion of Sugar Land and surrounding area to surface water. Also includes reuse.	\$161,360,000 capital cost for WWP. \$6,360,100 infrastructure cost for participating WUGs / GRP (participation)	\$1,234 (WWP cost only - excludes infrastructure cost of customer WUGs / GRP participation)		2020 (2013)	NA	Brazos, San Jacinto-Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	0	1	0	0	1	0	0		1	No	No	
WHCRWA GRP Infrastructure Strategies	WHCRWA	Conversion of WHCRWA to surface water. Also includes reuse and major water supply infrastructure.	infrastructure cost for participating WUGs. WWP infrastructure detailed separately.	See WHCRWA Transmission and WHCRWA Internal Distribution.		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	1	0	0	1	0	0	0		2		Yes	
BWA Brackish Groundwater	BWA	Desalinate or brackish groundwater from Gulf Coast Aquifer to enhance the yield of surface water sources in use in the lower Brazos River Basin. Expansion of BWA's conventional SWTP to enhance the yield of surface water sources in use in the lower Brazos River Basin.	\$30,570,395	\$390-594		2020	3,136	Multiple	No	Increased return flows form groundwater development and RO concentrate.	Limited disturbance outside of existing plant area.	-1	0	1	0	0	1	0	1	0	2	No	No	
BWA Plant Expansion	BWA	Expansion of BWA's conventional SWTP to enhance the yield of surface water sources in use in the lower Brazos River Basin.	\$14,359,419	\$432		2020	NA	Multiple	No	Potential disturbance due to construction.	No disturbance outside of existing plant area.	-1	0	1	0	0	1	1	0	0	2	No	No	
CHCRWA Transmission	CHCRWA	Transmission capacity development	TBD	TBD		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	1	0	0	1	0	0		2	No	No		
CHCRWA Distribution	CHCRWA	Distribution capacity development	TBD	TBD		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	1	0	0	1	0	0		2	No	No		
NFBWA Shared Transmission Line	NFBWA	Transmission capacity development	\$213,000,000 capital cost	\$150		2020 (2013)	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	0	0	1	0	0	1	0	0		2	No	No	

Region H  
Table 4A-3: Water Management Strategy Screening

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Strategy Capital Cost (\$)	Average Annual Cost of Water (\$/ac-ft)	Major WWS Major WWS	Earliest Potential Starting Decade	Firm Yield (ac-ft/yr)	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Decision Matrix Factors (High, Medium, Low)										Total of Screening Factors	Selected as Part of 2001 Plan	Selected as Part of 2006 Plan
												Cost	Yield	Location	Water Quality	Environment	Local Preference	Institutional Constraints	Risk of Implementability	Impacts on Water Resources	Impacts on Other Management Strategies			
Screening Factor Weight:												1	1	1	1	1	1	1	1	1				
NFBWA Internal Distribution	NFBWA	Distribution capacity development	\$225,000,000 capital cost	\$85		2020 (2013)	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	1	0	1	0	0	1	0	0	0	3	No	No	
NHCRWA Transmission	NHCRWA	Transmission capacity development	\$253,249,100 capital cost	\$106		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant	0	0	1	0	0	1	0	0	0	2	No	No	
NHCRWA Internal Distribution	NHCRWA	Distribution capacity development	\$535,881,400 capital cost	\$222		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant	-1	0	1	0	0	1	0	0	0	1	No	No	
WHCRWA Transmission	WHCRWA	Transmission capacity development	\$290,084,200 capital cost	\$178		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant	0	0	1	0	0	1	0	0	0	2	No	No	
WHCRWA Internal Distribution	WHCRWA	Distribution capacity development	\$552,472,000 capital cost	\$338		2010	NA	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant	-1	0	1	0	0	1	0	0	0	1	No	No	
West Chambers County Supply System	CLCND	Develop a surface water supply system to meet demands in western Chambers County with water from the Trinity basin.	\$20,380,000	\$408		2020	NA	Sabine to San Jacinto	Yes (previously permitted)	Potential introduction of invasive species		-1	0	1	0	0	1	0	0	0	1	No	No	
COH Treatment Expansion	Houston	Increasing capacity in COH treatment facilities infrastructure.	\$2,045,672,200 capital cost	\$1,003		Various	NA	Trinity-San Jacinto, San Jacinto, San Jacinto-Brazos, Brazos	No	Footprint of facilities largely already developed.	Footprint of facilities largely already developed.	-1	1	1	0	0	1	0	0	1	3	No	No	
COH Distribution Expansion	Houston	Distribution expansion for WWP	\$261,040,000	TBD		2010 (2011)	NA	San Jacinto	No	Footprint of facilities largely already developed.	Footprint of facilities largely already developed.		1	0	0	0	1	0	0	1	3	No	No	
Huntsville WTP	Huntsville	WTP construction to utilize existing contracts	\$61,023,900 capital cost (estimated using Region H standard cost assumptions).	\$587		2010	NA	Trinity, San Jacinto	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	-1	1	1	0	0	1	0	0	0	2	No	No	
LLWSSSC Surface Water Project	Lake Livingston Water Supply and Sewer Service Company	Expansion of SWTP to meet municipal demands	\$3,087,974	\$373		2010	NA	Trinity	No	Potential disturbance due to construction.	Land required for facility construction	-1	1	1	0	0	1	0	-1	0	1	No	No	
Harris County MUD 50 SWTP	Harris MUD 50	Treat surface water from SJRA for municipal use.	\$6,131,600	\$736		2020	NA	San Jacinto	No	Potential disturbance due to construction.	Land required for facility construction	-1	1	1	0	0	1	0	-1	0	1	No	No	
Luce Bayou	COH	Development of a conveyance from the Trinity River to Lake Houston	\$253,917,000 capital cost	\$91		2020	NA	Trinity to San Jacinto	Yes (previously permitted)	Potential introduction of invasive species	Conveyance requires extensive canal construction	1	0	1	0	-1	1	-1	-1	0	0	Yes	Yes	
Sealy GW Treatment Expansion	Sealy	Expansion of a SWTP	\$6,450,000	\$966		2020	NA	Brazos	No	Potential disturbance due to construction.	Land required for facility construction	-1	1	1	0	0	1	0	-1	0	1	No	No	
Pearland SWTP	Pearland	Installation of a SWTP	\$265,000,000	\$848		2010	NA	San Jacinto - Brazos	No	Potential disturbance due to construction.	Land required for facility construction	-1	1	1	0	0	1	0	-1	0	1	No	No	
<b>Reservoir Strategies</b>																								
Allens Creek Reservoir	BRA / Houston	New reservoir in Austin County	\$222,752,400	\$197	Y	2020	99,650	Brazos	No	Wetlands and bottomland hardwoods impacted	Inundates 7,000 acres	0	0	1	1	-1	1	0	-1	1	2	Yes	Yes	
Bedias Reservoir	SJRA	New Reservoir in Madison/Grimes Counties	\$247,241,628	\$237	Y	2030	90,700	Trinity	No	7,300 acres of bottomland hardwoods	Inundates 27,400 acres	0	0	0	0	-1	0	-1	-1	-1	-4	Yes	No	
Little River Reservoir	BRA / GCWA	New reservoir in Miami County	\$556,520,000	\$328	Y	2040	119,000	Brazos	No	Listed and endangered species habitat	Inundates 35,600 acres	-1	0	0	0	-1	-1	-1	-1	0	-5	Yes	No	
Little River Off-Channel Reservoir	BRA	New reservoir in Miami County	\$137,356,000	\$436	Y	2040	27,255	Brazos	No	Potential impact on terrestrial species habitats	Inundates 4,400 acres	-1	-1	0	0	0	0	0	-1	1	-2	No	Yes	
Brazoria Off-Channel Reservoir	Brazoria County	New reservoir in Brazoria County	\$173,898,602	\$1,206	Y	2030	24,000	San Jacinto - Brazos	No	Potential impact on terrestrial species habitats	Inundates 3,200 acres	-1	1	1	0	0	1	0	-1	0	1	No	No	
Fort Bend Off-Channel Reservoir	Fort Bend County	New reservoir in Fort Bend County	\$202,514,788	\$827	Y	2030	46,000	San Jacinto - Brazos	No	Potential impact on terrestrial species habitats	Inundates 3,000 acres	-1	1	1	0	0	1	0	-1	0	1	No	No	
GCWA Off-Channel Reservoirs	GCWA	Use storage to enhance the yield of existing GCWA rights	\$197,448,012	\$827	Y	2030	39,530	San Jacinto - Brazos	No	Potential impact on terrestrial species habitats	Inundates 4,000 acres	-1	1	1	0	0	1	0	-1	0	1	No	No	
Lower Lake Creek Reservoir	SJRA	New reservoir in Montgomery County	\$480,777,860	\$583	Y	2040	67,200	San Jacinto	No	Some endangered species have been identified. Inundates about 13,100 acres including 2,200 acres of bottomland hardwoods, 7,000 acres of oak, hickory and pine forest, and 1,800 acres of shrubland and grasses. Some Endangered Species Identified	There are about 2,200 acres of bottomland hardwoods, 7,000 acres of oak, hickory and pine forest, and 1,800 acres of shrubland and grasses.	-1	1	0	0	-1	0	-1	-1	1	-2	No	No	
Millican Reservoir (Panther Creek Dam)	BRA	New reservoir in Brazos, Madison, Leon, and Robertson Counties	\$1,159,907,000	\$1,241 (allocated portion only - for fully-utilized reservoir, unit cost is \$424 per acre-foot)	Y	2040	194,500	Brazos	No	Some endangered species have been identified. Inundates 71,000 acres. Approximately 17,000 acres of mixed bottomland hardwoods. Probable high environmental impacts.	Inundates 71,000 acres. Approximately 17,000 acres of mixed bottomland hardwoods.	-1	0	-1	0	-1	0	-1	-1	0	-5	No	No	

Region H  
Table 4A-3: Water Management Strategy Screening

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Strategy Capital Cost (\$)	Average Annual Cost of Water (\$/ac-ft)	Major WMS	Earliest Potential Starting Decade	Firm Yield (ac-ft/yr)	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Decision Matrix Factors (High, Medium, Low)													Total of Screening Factors	Selected as Part of 2001 Plan	Selected as Part of 2006 Plan
												Cost	Yield	Location	Water Quality	Environment	Local Preference	Institutional Constraints / Reliability	Impacts on Water Resources	Impact of Other Management Strategies							
												1	1	1	1	1	1	1	1	1	1	1	1				
<b>Reuse Strategies</b>																											
Millican-Bundic Reservoir	BRA	New reservoir in Brazos, Madison, Leon, and Robertson Counties	\$720,224,000	\$1,431	Y	2030	36,990	Brazos		Avoids Manning and Yegua lignite, avoids Kurten oil and gas field, avoids the Wilcox lignite in the upper river reaches and avoids significant bottomland hardwood population. Size of lake would be constrained by the Wilcox lignite, and inundation of marsh area upstream of Old San Antonio Road. Probable moderate to high environmental and instream flows impacts.	The inundation area impacts approximately 9,210 acres of mixed Bottomland Hardwood Forest, 4,086 acres of Grasses/Forbs, and 1,334 acres of Post Oak Woods.	-1	0	-1	0	-1	0	-1	-1	0				-5	No	No	
Fulshear Reuse	Fulshear	Development of a direct reuse system to provide reclaimed water to Fulshear and surrounding communities.		\$502		2020	430	Brazos, San Jacinto-Brazos	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	None	-1	0	1	1	0	1	0	-1	0				1	No	No	
GCWA Reclaimed Water from City of Houston	GCWA	Transfer of reclaimed water from COH SWWWTP and upstream plants.	\$66,840,500	\$80	Y	2020	56,896	Brazos, San Jacinto-Brazos	Yes	Reduces return flows to Upper Galveston Bay.	Primarily developed in existing corridor.	0	1	-1	0	1	0	0	-1	0				0	No	No	
Houston Indirect Wastewater Reuse	Houston	Reuse wastewater from all city WWTPs in lieu of Trinity Supply.	\$721,822,900 infrastructure cost for participating WUGs.	\$402 to \$1,232 per ac-ft (\$777 average)	Y	2020	Up to 490,222	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	0	1	1	0	0	0	-1	-1	1				1	Yes	Yes	
Montgomery County MUDs 8/9 Reuse	Montgomery MUDs 8/9	Reuse water from Montgomery County MUDs 8/9	\$12,245,700	\$878 per acre-foot (based on allocated volume)		2020 (2016)	1,120 (max)	San Jacinto	No	This WMS will not be permitted to negatively impact downstream rights.	none	-1	1	1	0	1	1	0	0	0				3	No	No	
NHCRWA Indirect Wastewater Reuse	NHCRWA	Reuse wastewater from member WWTPs in lieu of purchasing additional supply.	\$66,778,694	\$702 per acre-foot allocated	Y	2010	Up to 157,000	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	0	1	1	0	0	0	-1	-1	1				1	Yes	Yes	
Wastewater Reclamation for Industry	Houston, Manufacturing	Deliver treated wastewater to industry for use in lieu of Trinity River supply.	\$332,051,761	\$893	Y	2010	67,200	San Jacinto	No	Minimal change in habitat	None	-1	1	1	1	0	1	0	1	1				5	Yes	Yes	
Wastewater Reclamation for Municipal Irrigation	County-Other and Authorities in Brazoria, Fort Bend, Harris, and Montgomery Counties	Reuse for municipal irrigation	\$48,043,200 infrastructure cost for participating WUGs.	\$539 average		2030	36,388 (in 2060)	Multiple	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	None	-1	0	1	1	0	1	0	-1	0				1	No	No	
<b>Permit Strategies</b>																											
BRA System Operations Permit	BRA	Use peak flows, when available, and systems management to reduce the use of water stored under other permits.	TBD – based on system rate of \$61 per acre-foot	TBD – based on system rate of \$61 per acre-foot	Y	2020 (2015)	25,350 (Region H)	Brazos	No	Harvests peak flows through system management, positive affect on below-median flows	New pump stations may be required.	1	1	1	0	0	1	-1	0	0				3	Yes	Yes	
Houston Bayous Permit	Houston	Use peak flows, when available, to reduce the use of water stored under other permits.	\$20,956,000	System rate		NA	0	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	1	-1	1	0	-1	1	-1	0	0				0	Yes	Yes	
<b>Other Strategies</b>																											
Brazoria County Interruption Supplies for Irrigation	GCWA	Use of interruptible portion of GCWA water right for irrigation	NA	NA		2010	Non-firm 124,000 64,000 w/ GCWA off-channel)	Brazos, San Jacinto-Brazos	No	Reduced flows in Brazos River due to increased diversion	None	1	1	1	0	0	0	0	-1	0				2	NA	NA	
Brazos Salt Water Barrier	BRA / DOW	Prevent the seasonal migration of the saltwater wedge upstream to protect existing diversion points.	\$44,470,700	NA		2030	NA	Brazos	No	Will influence flood plain response to major storms.	New structure in river channel	0	-1	1	1	0	0	0	1	1				3	NA	Yes	
Freeport Desalination	BRA / DOW	Desalinate seawater for industrial and municipal use.	\$85,233,000 (11,200AF) - \$255,699,000 (33,600AF)	\$1,730 to \$2,376	Y	2040	11,200 to 33,600	Brazos, San Jacinto-Brazos	No	Offsets some use of Brazos basin flows.	New facility may require some land clearing.	-1	1	1	1	0	0	0	0	0				2	No	Yes	
Montgomery County MUD 8/9 Brackish Desal	Montgomery County MUDs 8 and 9	Development of a brackish groundwater desalination facility that would supplement existing wells, reducing dependence on fresh water formations of the Gulf Coast Aquifer.	TBD	TBD		2010 (2014)	Up to 2,240 acre-feet per year (average 2.0 MGD)	San Jacinto	No	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD				TBD	No	No	
Sabine to Region H Transfer	Harris / Montgomery Counties	Transfer existing supply from Toledo Bend Reservoir to Region H.	\$760,813,320		Y	2030	From 26,762 (2020) to 486,500 (2060)	Sabine to San Jacinto	Yes	Potential introduction of invasive species / Reduction of freshwater inflows to Sabine Lake	1398-acres	0	1	-1	0	-1	-1	-1	-1	1				-3	NA	No	
Galveston County Desal	GCWA		TBD	TBD				San Jacinto-Brazos			Unknown	-1	0	1	1	0	0	0	0	0				1	No	No	

**Attachment D:**

Amended Table 4A-4: Water Management Strategy Environmental Impacts



Region H  
Table 4A-4: Water Management Strategy Environmental Impacts

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Instream Flows	Bay and Estuary Inflows	Wildlife Habitat	Wetlands	Threatened and Endangered Species	Cultural Resources	Evaluation of Impacts of Water Management Strategies on Threats to Natural Resources	Use of Environmental Planning Criteria or Site-Specific Information on Environmental Flow Needs	Description of Regional Planning Area	Description of Water Sources, including Major Springs	Description of Natural Resources (Animal, Vegetable, or Mineral)	Identification of Water Quality Problems	Identification of Threats to Natural Resources	Recommendations for Ecologically Unique River and Stream Segments	Recommendations that are Needed and Desirable to Protect Natural Resources	
Screening Factor Weight:																						
<b>Conservation Strategies</b>																						
Industrial Conservation	Manufacturing	Reduce water demand through selected BMPs	All	No	No impact	None	Strategy reduces the demand for additional water supply, but also reduces return flows from existing sources.	Reduces return flows from current sources, but the rate of savings does not compensate for the rate of growth in the largest counties.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect on existing supply sources.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 regional plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Irrigation Conservation	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	Various	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Brazoria County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	Brazos, Brazos-Colorado	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Chambers County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	Trinity	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Galveston County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	San Jacinto - Brazos	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Liberty County	Irrigation	Reduce irrigation losses through land leveling, point irrigation and canal lining	Trinity	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Waller County	Irrigation	Reduce irrigation losses through land leveling, point irrigation	San Jacinto	No	Reduces losses that feed small streams	None	Strategy reduces the demand for additional water supply, but also reduces run-off and seepage losses from existing irrigation.	No significant effect on bay and estuary flows.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	NA - Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows off fields, as well as reducing water flow habitat.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Municipal Conservation	Multiple	Reduce demand through various methods	All	No	No impact	None	Strategy reduces the demand for additional water supply, but also reduces per-capita return flows from groundwater use.	Reduces per capita return flows from groundwater, but the rate of savings does not compensate for the rate of population growth.	NA - does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Does not require the construction of new infrastructure.	NA - does not require the construction of new infrastructure.	Reducing per capita water demand provides a positive effect. Although instream flows potentially could be reduced due to less return flows.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 regional plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
<b>Contractual Strategies</b>																						
Expand/ Increase Current Contracts	Multiple	Increase existing contracts to meet customer demands	Multiple	Yes	Reduced streamflows due to use of currently unused supplies	None	Reduces in-stream flows in all basins due to full use of existing water supplies.	Return flows (typically equal to 60% of diversion) will off-set increased diversions. Houston and SJRA use will result in return flows to Upper Galveston Bay vice Trinity Bay (if left unused).	NA - does not require the construction of new infrastructure beyond expansion of existing plants.	NA - does not require the construction of new infrastructure.	Does not require the construction of new infrastructure, but full use of permits will affect riparian habitat.	NA - does not require the development of new infrastructure sites.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 regional plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay		
New Contracts from Existing Supply	Multiple	Create new contracts from existing unallocated supplies	Multiple	Yes	Reduced streamflows due to use of currently unused supplies	None	Reduces in-stream flows in all basins due to full use of existing water supplies.	Return flows (typically equal to 60% of diversion) will off-set increased diversions. Houston and SJRA use will result in return flows to Upper Galveston Bay vice Trinity Bay (if left unused).	NA - does not require the construction of new infrastructure beyond expansion of existing plants.	NA - does not require the construction of new infrastructure.	Does not require the construction of new infrastructure, but full use of permits will affect riparian habitat.	NA - does not require the development of new infrastructure sites.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 regional plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay		
Reallocation of Existing Supply	Multiple	Reallocate surplus water to WUGs with shortages	Multiple	Yes	Altered location of return flows	None	Reduces in-stream flows in all basins due to full use of existing water supplies.	Return flows (typically equal to 60% of diversion) will off-set increased diversions. Houston and SJRA use will result in return flows to Upper Galveston Bay vice Trinity Bay (if left unused).	NA - does not require the construction of new infrastructure beyond expansion of existing plants.	NA - does not require the construction of new infrastructure.	Does not require the construction of new infrastructure, but full use of permits will affect riparian habitat.	NA - does not require the development of new infrastructure sites.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 regional plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay		
TRA to SJRA contract	TRA / SJRA	Sell uncommitted supply to SJRA.	Trinity to San Jacinto	Yes	Potential introduction of invasive species	Requires construction of new conveyance.	Transfers unused supply from the Trinity to the San Jacinto River basin, resulting in decreased flows below Lake Livingston.	Return flows (typically equal to 60% of diversion) will return to Upper Galveston Bay vice Trinity Bay.	Increased diversion from Lake Livingston will increase lake-level fluctuations and reduce flows in the lower Trinity. No new construction impacts are associated with this strategy. Lake level fluctuations will affect wetlands along the shoreline and tributaries.	No new construction impacts are associated with this strategy. Lake level fluctuations will affect wetlands along the shoreline and tributaries.	Potential impact to Wood Stork and Alligator Snapping Turtle habitat through reduced flows in lower Trinity River.	Potential impacts along conveyance route	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay		
TRA to Houston Contract	TRA / Houston	Sell uncommitted supply to Houston	Trinity to San Jacinto	Yes	Potential introduction of invasive species	Unknown	Transfers unused supply from the Trinity to the San Jacinto River basin, resulting in decreased flows below Lake Livingston.	Return flows (typically equal to 60% of diversion) will return to Upper Galveston Bay vice Trinity Bay.	Increased diversion from Lake Livingston will increase lake-level fluctuations and reduce flows in the lower Trinity. No new construction impacts are associated with this strategy. Lake level fluctuations will affect wetlands along the shoreline and tributaries.	No new construction impacts are associated with this strategy. Lake level fluctuations will affect wetlands along the shoreline and tributaries.	Potential impact to Wood Stork and Alligator Snapping Turtle habitat through reduced flows in lower Trinity River.	NA - does not require the construction of new infrastructure.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay		
WUG Level Contracts	Multiple WUGs	Contracts from WUGs to WUGs	All	Yes (source-dependent)	None - impacts associated with yield-creating WMS or infrastructure	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WUG Contracts	Multiple WUGs	Contracts between WUGs	All	Yes (source-dependent)	None - impacts associated with yield-creating WMS or infrastructure	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Groundwater Strategies</b>																						

Region H  
Table 4A-4: Water Management Strategy Environmental Impacts

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Instream Flows	Bay and Estuary Inflows	Wildlife Habitat	Wetlands	Threatened and Endangered Species	Cultural Resources	Evaluation of Impacts of Water Management Strategies on Threats to Natural Resources	Use of Environmental Planning Criteria or Site-Specific Information on Environmental Flow Needs	Description of Regional Planning Area	Description of Water Sources, including Major Springs	Description of Natural Resources (Animal, Vegetable, or Mineral)	Identification of Water Quality Problems	Identification of Threats to Natural Resources	Recommendations for Ecologically Unique River and Stream Segments	Recommendations that are Needed and Desirable to Protect Natural Resources
Expanded Use of Groundwater	Multiple	Increase groundwater use, to the sustainable or permitted yield.	All	No	Uses existing supply, return flows remain in basin of origin.	New wells may require some land clearing.	Groundwater return flows contribute to streams in all basins.	Full utilization of groundwater reduces potential for transfer from Trinity Basin, leaving flows into Trinity Bay.	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Interim Strategies	Brazoria, Chambers, Galveston, Harris, and Montgomery Counties	Temporary groundwater use in excess of available supply	Multiple	No	Potential for subsidence and excess drawdown	New wells may require some land clearing.	Groundwater return flows contribute to streams in all basins.	Full utilization of groundwater reduces potential for transfer from Trinity Basin, leaving flows into Trinity Bay.	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
New Groundwater Wells for Livestock	Multiple	Added well capacity to facilitate expanded pumping or interim groundwater use	All	No	None - impacts associated with yield-creating WMS or infrastructure	New wells may require some land clearing.	Groundwater return flows contribute to streams in all basins.	Full utilization of groundwater reduces potential for transfer from Trinity Basin, leaving flows into Trinity Bay.	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
<b>Groundwater Reduction Plans</b>																					
CHCRWA GRP	CHCRWA	Conversion of CHCRWA to surface water.	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to streams in all basins.	Full utilization of groundwater reduces potential for transfer from Trinity Basin, leaving flows into Trinity Bay.	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
COH GRP	COH	Conversion of portions of COH service area to surface water	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Transfers unused supply from the Trinity to the San Jacinto River basin, resulting in decreased flows below Lake Livingston.	Return flows (typically equal to 60% of diversion) will return Upper Galveston Bay vice Trinity Bay.	Increased diversion from Lake Livingston will increase lake-level fluctuations and reduce flows in the lower Trinity. No new construction impacts are associated with this strategy.	No new construction impacts are associated with this strategy. Lake level fluctuations will affect wetlands along the shoreline and tributaries.	Potential impact to Wood Stork and Alligator Snapping Turtle habitat through reduced flows in lower Trinity River.	NA - does not require the construction of new infrastructure.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Missouri City GRP	Missouri City	Conversion of Missouri City and surrounding area to surface water. Also includes Aquifer Storage and Recovery.	Brazos, San Jacinto-Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Fort Bend County MUD 25 GRP	Fort Bend MUD 25	A combination of reuse and surface water to allow for groundwater reduction.	Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Fort Bend County WCID No. 2 GRP	Fort Bend County WCID No. 2	Surface water conversion	San Jacinto, San Jacinto-Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
NFBWA GRP	NFBWA	Conversion of NFBWA to surface water. Also includes reuse and major water supply infrastructure.	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
NHCRWA GRP	NHCRWA	Conversion of NHCRWA to surface water. Also includes reuse and major water supply infrastructure.	Multiple	Yes (previously permitted)	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Pecan Grove GRP	Pecan Grove	Conversion of Pecan Grove to surface water. Also includes reuse	Brazos, San Jacinto-Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Richmond-Rosenberg GRP	Richmond, Rosenberg	Conversion of Richmond-Rosenberg to surface water.	Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
River Plantation GRP	River Plantation MUD	Entering into GRP with River Plantation CC golf course to provide additional WWTP effluent for irrigation purposes	San Jacinto	No	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	none	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	All return flows remain in Galveston Bay watershed.	TBD. Impacts expected to be minimal	TBD. Impacts expected to be minimal	TBD. Impacts expected to be minimal	Site surveys must be conducted for each individual well site.	TBD	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
SJRA WRAP	Montgomery County	Conversion of Montgomery County to surface water. Also includes reuse and major water supply infrastructure.	San Jacinto	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Sugar Land GRP	Sugar Land	Conversion of Sugar Land and surrounding area to surface water. Also includes reuse.	Brazos, San Jacinto-Brazos	No	Potential disturbance due to construction.	Temporary disturbance due to transmission line construction. Land required for plant construction/expansion	Groundwater return flows contribute to increased instream flows	Groundwater return flows will contribute to increased B&E flows	Site surveys must be conducted for each individual well site.	Groundwater wells can usually be located outside of wetlands, near the point of use.	Groundwater wells should be sited to avoid or minimize impact on habitats.	Site surveys must be conducted for each individual well site.	N/A - uses supply allocated for this use in the 2001 plan	N/A - does not divert surface water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay





Region H  
Table 4A-4: Water Management Strategy Environmental Impacts

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Instream Flows	Bay and Estuary Inflows	Wildlife Habitat	Wetlands	Threatened and Endangered Species	Cultural Resources	Evaluation of Impacts of Water Management Strategies on Threats to Natural Resources	Use of Environmental Planning Criteria or Site-Specific Information on Environmental Flow Needs	Description of Regional Planning Area	Description of Water Sources, including Major Springs	Description of Natural Resources (Animal, Vegetable, or Mineral)	Identification of Water Quality Problems	Identification of Threats to Natural Resources	Recommendations for Ecologically Unique River and Stream Segments	Recommendations that are Needed and Desirable to Protect Natural Resources
LLWSSSC Surface Water Project	Lake Livingston Water Supply and Sewer Service Company	Expansion of SWTP to meet municipal demands	Trinity	No	Potential impact to habitat on site	Land required for facility expansion	Low probability of significant impacts	Low probability of significant impacts	Potential impact to habitat on SWTP site	Potential impact to wetlands on SWTP site	Potential impact to T&E species on site	Potential impact to cultural resources on SWTP site	N/A		2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay
Luce Bayou	COH	Development of a conveyance from the Trinity River to Lake Houston	Trinity to San Jacinto	Yes (previously permitted)	Potential introduction of invasive species	Conveyance requires extensive canal construction	Reduces flow in the Trinity River below Liberty.	Return flows (typically equal to 60% of diversion) will return to Upper Galveston Bay vice Trinity Bay.	Conveyance requires 23.6 miles of canal. Blending supply in Lake Houston may affect lake habitat.	Potential impact due to diversion structure. Potential wetland impacts due to project.	Potential impact to White-faced Ibis, Wood Stork and Alligator Snapping Turtle habitat through reduced flows in lower Trinity River. Increased flow in Luce Bayou may impact Creek Chubsucker habitat.	Privately owned ranches and farms along Luce Bayou. Pump station study identified historic homestead, which was studied and cataloged at the time of the original permit.			2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay

Region H  
Table 4A-4: Water Management Strategy Environmental Impacts

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Instream Flows	Bay and Estuary Inflows	Wildlife Habitat	Wetlands	Threatened and Endangered Species	Cultural Resources	Evaluation of Impacts of Water Management Strategies on Threats to Natural Resources	Use of Environmental Planning Criteria or Site-Specific Information on Environmental Flow Needs	Description of Regional Planning Area	Description of Water Sources, including Major Springs	Description of Natural Resources (Animal, Vegetable, or Mineral)	Identification of Water Quality Problems	Identification of Threats to Natural Resources	Recommendations for Ecologically Unique River and Stream Segments	Recommendations that are Needed and Desirable to Protect Natural Resources	
Sealy GW Treatment Expansion	Sealy	Expansion of a SWTP	Brazos	No	Potential impact to habitat on site	Land required for facility construction	Low probability of significant impacts	Low probability of significant impacts	Potential impact to habitat on SWTP site	Potential impact to wetlands on SWTP site	Potential impact to T&E species on site	Potential impact to cultural resources on SWTP site	N/A		2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Pearland SWTP	Pearland	Installation of a SWTP	San Jacinto	No	Potential impact to habitat on site	Land required for facility construction	Low probability of significant impacts	Low probability of significant impacts	Potential impact to habitat on SWTP site	Potential impact to wetlands on SWTP site	Potential impact to T&E species on site	Potential impact to cultural resources on SWTP site	N/A		2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
<b>Reservoir Strategies</b>																						
Allens Creek Reservoir	BRA / Houston	New reservoir in Austin County	Brazos	No	Wetlands and bottomland hardwoods impacted	Inundates 7,000 acres	Diverts peak flows. When base flow is above median, diversions cannot reduce it below media. When base flow is above 25th percentile, diversions cannot reduce it below 25th percentile. Below 25th percentile, diversions cannot reduce it below a 7Q2.	Divert peak flows, reducing magnitude of storm flush.	Inundates 7,000 acres	Site specific study ongoing. Potential impact from 700 to 1700 wetland acres, based upon initial studies.	Austin County is habitat for White-faced Ibis, Wood Stork and Houston Toad.	Site located near the town of Wallis. A detailed site survey must be conducted.	Reservoir modeled using minimum in-stream flow requirement.		2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Little River Off-Channel Reservoir	BRA	New reservoir in Milam County	Brazos	No	Potential impact on terrestrial species habitats	Inundates 4400 acres	The project would promote a minor reduction in instream flows, but as a percentage of total flow the difference would be minor.	Will have substantial impacts on the instream biological community at the proposed reservoir site. However, there would be minimal impacts in the Little River diversion site. It is not likely that this project, alone, would have a substantial influence on total discharge in the Brazos River, in which case there would be minimal influence on freshwater inflows to the Brazos River estuary. However, the cumulative impact of multiple projects may reduce freshwater inflows into the estuary.	Would inundate 4,343 acres. Projected wildlife habitat that will be impacted includes 2,215 acres of Mixed Grassland, 1,839 acres of Post Oak Woods, and 289 acres of Mixed Riparian Woods/Forest.	The species that could occur within the vicinity of the site include Houston least tern, piping plover, and whooping crane, and Navasota Ladies'-tresses.	31 archeological sites have been documented within the general vicinity of the proposed reservoir; Pin Oak Cemetery may lie within the reservoir site. Prior to reservoir inundation, the project must be coordinated with the Texas Historical Commission and a cultural resources survey must be conducted to determine if any cultural resources are present within the conservation pool.	Water potentially available for impoundment estimated using the Brazos G WAM. Firm yield computed subject to the reservoir and Little River diversion having to pass inflows to meet CCEFN instream flow requirements	Regional G Draft RPP Technical Evaluations of WMS, 4B.13.5	Regional G Draft RPP Technical Evaluations of WMS, 4B.13.5	Regional G Draft RPP Technical Evaluations of WMS, 4B.13.5	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	The project is expected to have negligible impacts to the stream flow and water quality in the Little River and Brazos River.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay			
Brazoria County Off-Channel Reservoir	Brazoria County	New reservoir in Brazoria County	San Jacinto - Brazos	No	Potential impact on terrestrial species habitats	Inundates 4,000 acres	The project would promote a minor reduction in instream flows, but as a percentage of total flow the difference would be minor.	Not likely to significantly impact bay and estuary inflows.	TBD	TBD	Potential for multiple threatened and endangered species to be located within the vicinity of the proposed project site.	Cultural Resources survey will be required to determine impacts to cultural resources in the area	Lower streamflows, declining water quality, and reduced inflows to reservoirs.	Water potentially available for impoundment estimated using the Brazos G WAM. Firm yield computed subject to diversion having to pass inflows to meet CCEFN instream flow requirements	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Fort Bend County Off-Channel Reservoir	Fort Bend County	New reservoir in Fort Bend County	Brazos	No	Potential impact on terrestrial species habitats	Inundates 4,000 acres	The project would promote a minor reduction in instream flows, but as a percentage of total flow the difference would be minor.	Not likely to significantly impact bay and estuary inflows.	TBD	TBD	Potential for multiple threatened and endangered species to be located within the vicinity of the proposed project site.	Cultural Resources survey will be required to determine impacts to cultural resources in the area	Lower streamflows, declining water quality, and reduced inflows to reservoirs.	Water potentially available for impoundment estimated using the Brazos G WAM. Firm yield computed subject to diversion having to pass inflows to meet CCEFN instream flow requirements	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
GCWA Off-Channel Reservoirs	GCWA	Use storage to enhance the yield of existing GCWA rights	San Jacinto - Brazos	No	Potential impact on terrestrial species habitats	Inundates 4,000 acres	The project would promote a minor reduction in instream flows, but as a percentage of total flow the difference would be minor.	Not likely to significantly impact bay and estuary inflows.	Project would inundate approximately 2,900 acres, habitat in the area to be investigated further.	Project would inundate approximately 2,900 acres, habitat in the area to be investigated further.	Potential for multiple threatened and endangered species to be located within the vicinity of the proposed project site.	Cultural Resources survey will be required to determine impacts to cultural resources in the area	Lower streamflows, declining water quality, and reduced inflows to reservoirs.	Water potentially available for impoundment estimated using the Brazos G WAM. Firm yield computed subject to the reservoir and diversion having to pass inflows to meet CCEFN instream flow requirements	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
<b>Reuse Strategies</b>																						
Fulshear Reuse	Fulshear	Development of a direct reuse system to provide reclaimed water to Fulshear and surrounding communities.	Brazos, San Jacinto-Brazos	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
GCWA Reclaimed Water from City of Houston	GCWA	Transfer of reclaimed water from COH SWWTP and upstream plants.	Brazos, San Jacinto-Brazos	Yes	Reduces return flows to Upper Galveston Bay.	Primarily developed in existing corridor.	Permit limits curb diversions to instream flows.	All return flows remain in Galveston Bay watershed.	Permit applications point out the urbanized watershed.	Permit applications state that potential diversion points will have minimal impacts on wetlands adjacent to streams.	Permit applications are silent on this issue.	NA	N/A	Water right permit addressed environmental flow needs.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Houston Indirect Wastewater Reuse	Houston	Reuse wastewater from all city WWTP's in lieu of Trinity Supply.	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	All return flows remain in Galveston Bay watershed. Reuse of supplies in San Jacinto Basin reduces potential need for transfer from Trinity Basin.	Permit applications point out the urbanized watershed.	Permit applications state that potential diversion points will have minimal impacts on wetlands adjacent to streams.	Permit applications are silent on this issue.	NA	N/A	SJRA permit addresses flows using existing downstream diversion point. Other applications are silent on this issue.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Montgomery County MUDs 8/9 Reuse	Montgomery MUDs 8/9	Reuse water from Montgomery County MUDs 8/9	San Jacinto	No	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	none	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	All return flows remain in Galveston Bay watershed.	TBD. Impacts expected to be minimal	TBD. Impacts expected to be minimal	TBD. Impacts expected to be minimal	TBD	TBD		2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
NHCRWA Indirect Wastewater Reuse	NHCRWA	Reuse wastewater from member WWTP's in lieu of purchasing additional supply.	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	All return flows remain in Galveston Bay watershed. Reuse of supplies in San Jacinto Basin reduces potential need for transfer from Trinity Basin.	Majority of the needed infrastructure will be constructed in urbanized areas. Therefore, the impact to wildlife habitat will be limited.	Majority of the needed infrastructure will be constructed in urbanized areas. Therefore, the impact to wetlands will be limited.	Potential impact to Creek Chubsucker and Alligator Snapping Turtle habitat through reduced wastewater return flows.	NA	N/A	SJRA permit addresses flows using existing downstream diversion point. Other applications are silent on this issue.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	

Region H  
Table 4A-4: Water Management Strategy Environmental Impacts

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Instream Flows	Bay and Estuary Inflows	Wildlife Habitat	Wetlands	Threatened and Endangered Species	Cultural Resources	Evaluation of Impacts of Water Management Strategies on Threats to Natural Resources	Use of Environmental Planning Criteria or Site-Specific Information on Environmental Flow Needs	Description of Regional Planning Area	Description of Water Sources, including Major Springs	Description of Natural Resources (Animal, Vegetable, or Mineral)	Identification of Water Quality Problems	Identification of Threats to Natural Resources	Recommendations for Ecologically Unique River and Stream Segments	Recommendations that are Needed and Desirable to Protect Natural Resources
Wastewater Reclamation for Industry	Houston, Manufacturing	Deliver treated wastewater to industry for use in lieu of Trinity River supply.	San Jacinto	No	Minimal change in habitat	None	Reduces municipal return flows into Sims and Buffalo Bayous. Manufacturing return flows into the ship channel will not be affected.	Reuse water is intended to offset supply transferred from Lake Livingston, leaving the inflows for Trinity Bay vice Upper Galveston Bay	Sims and Buffalo Bayous will realize reduced freshwater flows due to reuse. Central treatment facility may impact up to 15 acres of undeveloped land.	4 new pipeline crossings may impact 6 acres (assumed 1.5 acres each).	Potential impact to Wood Stork and Alligator Snapping Turtle habitat through reduced wastewater return flows.	Project is within an industrial area, but site studies must still be conducted for new facilities.	NA - strategy does not require a new reservoir or water right.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	

Region H  
Table 4A-4: Water Management Strategy Environmental Impacts

Water Management Strategy	Water User Group or Wholesale Provider	Strategy Description	Basin	Interbasin Transfer (Yes/No)	Impacts on Habitat / Stream / B&E Flows	Impacts on Landform	Instream Flows	Bay and Estuary Inflows	Wildlife Habitat	Wetlands	Threatened and Endangered Species	Cultural Resources	Evaluation of Impacts of Water Management Strategies on Threats to Natural Resources	Use of Environmental Planning Criteria or Site-Specific Information on Environmental Flow Needs	Description of Regional Planning Area	Description of Water Sources, including Major Springs	Description of Natural Resources (Animal, Vegetable, or Mineral)	Identification of Water Quality Problems	Identification of Threats to Natural Resources	Recommendations for Ecologically Unique River and Stream Segments	Recommendations that are Needed and Desirable to Protect Natural Resources	
Wastewater Reclamation for Municipal Irrigation <b>Permit Strategies</b>	County-Other and Authorities in Brazoria, Fort Bend, Harris, and Montgomery Counties	Reuse for municipal irrigation	Multiple	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	None	Instream flows potentially decreased due to wastewater reuse. However, indirect reuse potentially has less negative impacts on instream flows than direct reuse.	Potential to reduce return flows in specific basin of use.	Permit applications point out the urbanized watershed	Permit applications state that potential diversion points will have minimal impacts on wetlands adjacent to streams.	Permit applications are silent on this issue	NA	N/A		2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
BRA System Operations Permit	BRA	Use peak flows, when available, and systems management to reduce the use of water stored under other permits.	Brazos	No	Harvests peak flows through system management, positive affect on below-median flows	New pump stations may be required.	Diverts from streamflows when above median flow, reducing peaks. Releases from storage when below median flows, increasing the flows above diversion points.	Reduces peak flushing effects due to diversions above median flows. Flows below median are minimally affected.	Application points to the deferred or eliminated need for Little River Reservoir	Application points to the deferred or eliminated need for Little River Reservoir	None discussed in permit application. Deferring Little River Reservoir reduces overall basin impact.	Application points to the deferred or eliminated need for Little River Reservoir	N/A	TCEQ Draft permit has been granted	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Houston Bayous Permit <b>Other Strategies</b>	Houston	Use peak flows, when available, to reduce the use of water stored under other permits.	San Jacinto	No	Reduces return flows to Upper Galveston Bay, offset by reduced diversions from the Trinity Basin.	Size and location of diversion pump stations still TBD.	Permit applications refer to capturing peak flows. Model includes current Lake Houston instream flow requirement	Permit applications refer to capturing peak flows. Model includes current Lake Houston instream flow requirement	Permit applications point out the urbanized watershed	Permit applications state that potential diversion points will have minimal impacts on wetlands adjacent to streams.	Permit applications are silent on this issue	N/A - Does not recommend new diversion point	N/A	SJRA permit addresses flows using existing downstream diversion point. Other applications are silent on this issue.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Brazoria County Interruptible Supplies for Irrigation	GCWA	Use of interruptible portion of GCWA water right for irrigation	San Jacinto-Brazos	No	Reduced flows in Brazos River due to increased diversion	None	Use of interruptible supplies will decrease instream flows															
Brazos Salt Water Barrier	BRA / DOW	Prevent the seasonal migration of the saltwater wedge upstream to protect existing diversion points.	Brazos	No	Will influence flood plain response to major storms.	New structure in river channel	Structure will create a pool during low-flow periods, but river flows should spill at the same rate as before the structure.	The structure will be designed not to impound seasonal low flows.	The structure will fill [TBD] acres. Access road will require [TBD] acres. The introduction of the barrier may impact migratory fish species.	The structure will affect [TBD] acres of river bottomlands.	Potential habitat impacts to Black Rat, White-faced Ibis, Wood Stork, Diamondback Terrapin and Corkwood.	Siting study is required to identify any cultural resources being impacted. Site will be above Sea Center Texas hatchery.	Strategy reduces the influence of saltwater migration upstream to protect freshwater diversion points. This reduces the need for replacement supplies.	NA - strategy will not impound water	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Freeport Desalination	BRA / DOW	Desalinate seawater for industrial and municipal use.	Brazos, San Jacinto-Brazos	No	Offsets some use of Brazos basin flows.	New facility may require some land clearing.	Displacement of water that is currently diverted to meet municipal demands.	Saline water release is made into Dow discharge canal that empties directly into the Gulf of Mexico.	As many as 530 acres of property impacted by the installation of delivery lines, some of which follow existing easements.	Same as wildlife impact potential.	Unknown. Will require assessment before implementation of the strategy.	Will require study before implementation of the strategy.	Will require study before implementation of the strategy.	Will require study before implementation of the strategy.	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	
Montgomery County MUD 8/9 Brackish Desal	Montgomery County	Development of a brackish groundwater desalination facility that would supplement existing wells, reducing dependence on fresh water formations of the Gulf Coast Aquifer.	San Jacinto	No	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Sabine to Region H Transfer	Harris / Montgomery Counties	Transfer existing supply from Toledo Bend Reservoir to Region H.	Sabine to San Jacinto	Yes	Potential introduction of invasive species / Reduction of freshwater inflows to Sabine Lake	TBD	Displacement of water from Lake Livingston and reduced use of Livingston water in lower basin will result in reduced flow between the lake and the BT discharge point on the Trinity.	Inflows to Sabine Lake could potentially be impacted.	Nearly entire Neches-Trinity segment is within Priority 3, 5, and 6 designated bottomland hardwood.	Wetlands would be affected in the majority of areas crossed by new canal segments.	Route would potentially impact the Bald Eagle, Brown Pelican, Houston Towhee, Interior Least Tern, Louisiana Snake, Navasota Ladies'-tresses, Northern Scarlet Snake, Red-cockaded Woodpecker, and Smooth Green Snake.	Private property along the transfer route, especially in sections of entirely new canal or pipeline. The segment between Lake Livingston and the San Jacinto River passes through the Sam Houston National Forest.	0	0	2011 Regional Plan, Chapter 1	2011 Regional Plan, Chapters 1 and 3	2011 Regional Plan, Chapters 1 and 7	2011 Regional Plan Chapter 5 details the impacts of management strategies on water quality, and provides TCEQ 303(d) listed impaired waters within the Region.	2011 Regional Plan, Chapter 3 refers to protecting inflows to the Galveston Bay estuary. Chapter 8 designates unique stream segments for habitat protection.	2011 Regional Plan, Chapter 8	2011 Regional Plan, Chapter 3, Target Inflows for Galveston Bay	



**Attachment E:**

Amended Table 4A-5: Recommended WMS by County





**Region H**  
**Table 4A-5: Recommended WMS by County (ac-ft/yr)**

	2010	2020	2030	2040	2050	2060
<b>Austin</b>						
Initial Shortage	0	-739	-1,240	-1,496	-1,635	-1,865
Expanded GW	0	739	1,240	1,496	1,635	1,865
Municipal Conservation	0	223	251	265	273	285
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>223</b>	<b>251</b>	<b>265</b>	<b>273</b>	<b>285</b>
<b>Brazoria</b>						
Initial Shortage	-150,907	-186,760	-211,634	-238,588	-266,405	-299,199
Expanded GW	0	4,049	12,988	13,515	15,658	16,209
Municipal Conservation	1,476	2,610	2,978	3,249	3,567	3,918
Contract Expansions	7,750	7,750	7,750	7,750	7,750	7,750
<b>Net Shortage</b>	<b>-141,681</b>	<b>-172,351</b>	<b>-187,918</b>	<b>-214,074</b>	<b>-239,430</b>	<b>-271,322</b>
Irrigation Conservation	18,792	18,792	18,792	18,792	18,792	18,792
Wastewater Reclamation for Mun. Irrigation	0	0	116	227	344	465
Brazoria Co. Interruptible Supplies for Irr.	98,189	86,759	64,000	64,000	64,000	64,000
Reallocate Existing Supply	13,694	13,694	13,895	13,988	14,019	13,694
Interim Strategies	24,916	0	0	0	0	0
GCWA Offchannel Reservoir	0	0	39,500	39,500	39,500	39,500
Allens Creek Lake/Reservoir	0	45,277	41,779	66,665	58,092	66,196
BRA System Operations Permit	0	3,010	3,010	3,010	3,010	3,010
Brazoria OCR	0	0	0	0	0	24,000
Freeport Desalination Plant	0	0	0	0	33,600	33,600
Dow Offchannel Reservoir	0	21,800	21,800	21,800	21,800	21,800
New Groundwater Wells for Livestock	0	27	27	27	27	27
BWA Brackish Groundwater	0	3,136	3,136	3,136	3,136	3,136
GCWA Reclaimed Water from COH	0	6,363	6,557	7,106	7,826	8,719
<b>Total after Recommendations</b>	<b>13,910</b>	<b>26,507</b>	<b>24,694</b>	<b>24,177</b>	<b>24,716</b>	<b>25,617</b>
<b>Chambers</b>						
Initial Shortage	-42,520	-47,412	-50,831	-54,251	-57,612	-61,065
Expanded GW	0	577	681	796	905	1,010
Municipal Conservation	137	195	219	239	263	291
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-42,383</b>	<b>-46,640</b>	<b>-49,931</b>	<b>-53,216</b>	<b>-56,444</b>	<b>-59,764</b>
Irrigation Conservation	24,018	24,018	24,018	24,018	24,018	24,018
CLCND W Chambers System	0	1,691	1,978	2,235	2,511	2,804
Reallocate Existing Supply	21,010	21,264	21,389	21,509	21,627	21,725
Interim Strategies	903	0	0	0	0	0
New Contract from Existing Supply	13,823	17,083	19,972	22,888	25,732	28,672
<b>Total after Recommendations <sup>1</sup></b>	<b>17,371</b>	<b>17,416</b>	<b>17,426</b>	<b>17,434</b>	<b>17,444</b>	<b>17,455</b>

**Region H**  
**Table 4A-5: Recommended WMS by County (ac-ft/yr)**

	2010	2020	2030	2040	2050	2060
<b>Fort Bend</b>						
Initial Shortage	-86	-11,410	-52,608	-84,380	-123,623	-178,948
Expanded GW	0	6,886	3,423	3,813	4,378	5,052
Municipal Conservation	1,435	7,077	10,277	12,253	14,678	17,497
Contract Expansions	0	367	1,295	1,226	1,225	1,016
<b>Net Shortage</b>	<b>1,349</b>	<b>2,920</b>	<b>-37,613</b>	<b>-67,088</b>	<b>-103,342</b>	<b>-155,383</b>
Irrigation Conservation	5,197	5,197	5,197	5,197	5,197	5,197
WHCRWA GRP	0	0	0	0	0	0
NFBWA GRP	0	0	0	0	0	0
Sugar Land GRP	0	488	4,921	4,835	4,915	4,961
Missouri City GRP	0	4,401	4,401	4,401	4,401	4,401
Wastewater Reclamation for Mun. Irrigation	0	0	2,136	4,744	8,403	12,277
Fort Bend MUD 25 GRP	0	589	589	589	589	589
BRA System Operations Permit	0	3,611	15,860	22,340	22,340	22,340
Fort Bend OCR	0	0	0	0	90	45,943
Allens Creek Lake/Reservoir	0	0	0	6,605	25,864	16,145
TRA to Houston Contract	0	0	13,813	27,824	39,179	39,179
Reallocate Existing Supply	0	0	4,687	4,510	3,720	13,762
Fulshear Reuse	0	287	430	430	430	430
Industrial Conservation	0	558	558	558	558	558
<b>Total after Recommendations</b>	<b>6,546</b>	<b>18,051</b>	<b>14,979</b>	<b>14,945</b>	<b>12,344</b>	<b>10,399</b>
<b>Galveston</b>						
Initial Shortage	-16,307	-16,466	-17,787	-18,738	-19,884	-21,276
Expanded GW	0	811	1,352	1,350	1,352	1,352
Municipal Conservation	768	846	886	896	903	914
Contract Expansions	0	25,630	25,630	25,630	25,630	25,630
<b>Net Shortage</b>	<b>-15,539</b>	<b>10,821</b>	<b>10,081</b>	<b>9,138</b>	<b>8,001</b>	<b>6,620</b>
Irrigation Conservation	2,392	2,392	2,392	2,392	2,392	2,392
New Contract from Existing Supply	16	23	26	29	33	37
Interim Strategies	6,410	0	0	0	0	0
Allens Creek Lake/Reservoir	0	12,101	13,234	14,175	15,310	16,687
New Groundwater Wells for Livestock	0	14	14	14	14	14
Interruptible Supplies for Irr.	6,788	0	0	0	0	0
GCWA Reclaimed Water from COH	0	50,533	50,339	49,790	49,070	48,177
<b>Total after Recommendations</b>	<b>67</b>	<b>75,884</b>	<b>76,086</b>	<b>75,538</b>	<b>74,820</b>	<b>73,927</b>
<b>Harris</b>						
Initial Shortage	-51,413	-194,925	-270,301	-323,711	-375,414	-458,509
Expanded GW	0	15,481	27,659	27,693	27,727	27,560
Municipal Conservation	37,292	46,836	51,902	56,748	61,656	66,947
Contract Expansions	0	108,852	66,039	51,840	42,538	31,971
<b>Net Shortage</b>	<b>-14,121</b>	<b>-23,756</b>	<b>-124,701</b>	<b>-187,430</b>	<b>-243,493</b>	<b>-332,031</b>
New Contract from Existing Supply	23,008	31,264	38,732	54,777	54,805	54,849
NHCRWA GRP	0	0	0	0	0	0
WHCRWA GRP	-65	-258	-409	-566	-751	-968
COH GRP	0	0	0	0	0	0
Missouri City GRP	0	386	386	386	386	386
Wastewater Reclamation for Mun. Irrigation	0	0	3,268	6,616	10,027	13,431
Reallocate Existing Supply	18,253	15,276	7,308	19,232	30,220	96,881
Interim Strategies	15	0	0	0	0	0
Allens Creek Lake/Reservoir	0	15	83	336	384	622
TRA to Houston Contract	0	0	93,744	86,519	75,164	75,164
NHCRWA Indirect Reuse	0	0	0	7,300	16,300	16,300
Wastewater Reuse for Industry	0	0	0	0	0	67,200
Houston Indirect Reuse	0	0	0	66,420	114,679	128,801
<b>Total after Recommendations</b>	<b>27,090</b>	<b>22,927</b>	<b>18,411</b>	<b>53,590</b>	<b>57,721</b>	<b>120,635</b>

**Region H**  
**Table 4A-5: Recommended WMS by County (ac-ft/yr)**

	2010	2020	2030	2040	2050	2060
<b>Leon</b>						
Initial Shortage	0	-376	-614	-707	-779	-908
Expanded GW	0	376	614	707	779	908
Municipal Conservation	0	126	140	124	107	116
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>126</b>	<b>140</b>	<b>124</b>	<b>107</b>	<b>116</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>126</b>	<b>140</b>	<b>124</b>	<b>107</b>	<b>116</b>
<b>Liberty</b>						
Initial Shortage	-11,846	-15,142	-18,687	-22,539	-27,061	-32,363
Expanded GW	0	2,537	4,590	6,809	9,399	12,544
Municipal Conservation	0	539	641	744	868	995
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-11,846</b>	<b>-12,066</b>	<b>-13,456</b>	<b>-14,986</b>	<b>-16,794</b>	<b>-18,824</b>
Irrigation Conservation	20,876	20,876	20,876	20,876	20,876	20,876
Reallocate Existing Supply	6,657	6,697	6,732	6,767	6,805	6,833
<b>Total after Recommendations</b>	<b>15,687</b>	<b>15,507</b>	<b>14,152</b>	<b>12,657</b>	<b>10,887</b>	<b>8,885</b>
<b>Madison</b>						
Initial Shortage	-1	-130	-228	-239	-323	-450
Expanded GW	0	130	228	239	323	450
Municipal Conservation	1	91	110	112	116	119
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>91</b>	<b>110</b>	<b>112</b>	<b>116</b>	<b>119</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>91</b>	<b>110</b>	<b>112</b>	<b>116</b>	<b>119</b>
<b>Montgomery</b>						
Initial Shortage	-17,728	-47,619	-69,513	-81,350	-120,398	-165,162
Expanded GW	0	5,615	4,471	5,614	9,034	11,820
Municipal Conservation	4,460	6,007	7,384	8,838	10,795	13,089
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-13,268</b>	<b>-35,997</b>	<b>-57,658</b>	<b>-66,898</b>	<b>-100,569</b>	<b>-140,253</b>
MUD 8 AND 9 Reuse	0	657	816	1,120	1,120	1,120
Wastewater Reclamation for Mun. Irrigation	0	0	1,752	3,838	6,787	10,215
SJRA WRAP	0	36,377	55,538	54,582	53,581	52,534
Interim Strategies	13,268	0	0	0	0	0
TRA To SJRA Contract	0	0	0	7,935	39,096	76,476
<b>Total after Recommendations</b>	<b>0</b>	<b>1,037</b>	<b>448</b>	<b>577</b>	<b>15</b>	<b>92</b>
<b>Polk</b>						
Initial Shortage	0	-117	-205	-272	-384	-513
Expanded GW	0	117	205	272	384	513
Municipal Conservation	0	158	173	180	187	198
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>158</b>	<b>173</b>	<b>180</b>	<b>187</b>	<b>198</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>158</b>	<b>173</b>	<b>180</b>	<b>187</b>	<b>198</b>
<b>San Jacinto</b>						
Initial Shortage	0	-300	-533	-695	-793	-869
Expanded GW	0	542	928	984	1,007	1,060
Municipal Conservation	19	148	163	174	181	184
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>19</b>	<b>390</b>	<b>558</b>	<b>463</b>	<b>395</b>	<b>375</b>
<b>Total after Recommendations</b>	<b>19</b>	<b>390</b>	<b>558</b>	<b>463</b>	<b>395</b>	<b>375</b>

**Region H**  
**Table 4A-5: Recommended WMS by County (ac-ft/yr)**

	2010	2020	2030	2040	2050	2060
<b>Trinity</b>						
Initial Shortage	0	0	0	0	0	0
Expanded GW	0	36	36	21	0	0
Municipal Conservation	0	2	1	0	0	0
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>38</b>	<b>37</b>	<b>21</b>	<b>0</b>	<b>0</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>38</b>	<b>37</b>	<b>21</b>	<b>0</b>	<b>0</b>
<b>Walker</b>						
Initial Shortage	0	-815	-1,655	-1,973	-2,384	-2,853
Expanded GW	0	816	1,651	1,963	2,374	2,843
Municipal Conservation	0	68	74	89	90	92
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>0</b>	<b>69</b>	<b>70</b>	<b>79</b>	<b>80</b>	<b>82</b>
<b>Total after Recommendations</b>	<b>0</b>	<b>69</b>	<b>70</b>	<b>79</b>	<b>80</b>	<b>82</b>
<b>Waller</b>						
Initial Shortage	-82	-1,926	-2,940	-4,579	-8,177	-12,355
Expanded GW	0	1,447	2,231	3,644	5,382	7,431
Municipal Conservation	17	392	497	592	708	849
Contract Expansions	0	0	0	0	0	0
<b>Net Shortage</b>	<b>-65</b>	<b>-87</b>	<b>-212</b>	<b>-343</b>	<b>-2,087</b>	<b>-4,075</b>
Irrigation Conservation	0	0	0	0	6,606	6,606
WHCRWA GRP	65	258	409	566	751	968
<b>Total after Recommendations</b>	<b>0</b>	<b>171</b>	<b>197</b>	<b>223</b>	<b>5,270</b>	<b>3,499</b>

**Notes:**

<sup>1</sup>Lines for reallocation of existing supplies include only the positive portions of reallocations, as negative portions remove surpluses from some WUGs. Shortage values reflect the sum of all WUG shortages without offsets for other WUG surpluses.

**Attachment F:**

Amended Table 4A-6: Decadal WMS Summary









**Attachment G:**

Amended Table 4A-7: WMS Supply Allocations by WUG



Table 4A-7: WMS Supply Allocations by WUG

Table with columns: WUG Name, WUG RWPG, WUG Basin, WUG County, WUG ID, WUG-County-Basin ID, Wholesale Water Provider, Water Source, Source RWPG, Source Basin, Source County, Source-Basin ID, 2010, 2020, 2030, 2040, 2050, 2060, Non-Recursive Volume?, Major WMS Project Name, WUG-Level WMS Name. The table lists various water utility groups and their associated supply allocations across different years and categories.





















**Attachment H:**

Amended Table 4A-8: WUG-Level Contracts









**Region H**  
**Table 4A-8: WUG-Level Contracts**

WWP	WWP ID	WUG	WUG Basin	WUG County	WUG ID	2010	2020	2030	2040	2050	2060
GULF COAST WATER AUTHORITY	325	COUNTY-OTHER	SAN JACINTO-BRAZOS	FORT BEND	08075707907911	0	0	0	1,950	1,950	1,950
GULF COAST WATER AUTHORITY	325	COUNTY-OTHER	SAN JACINTO-BRAZOS	GALVESTON	08075708408411	0	3,887	3,872	3,850	3,823	3,789
GULF COAST WATER AUTHORITY	325	CLEAR LAKE SHORES	SAN JACINTO-BRAZOS	GALVESTON	08076400008411	0	188	190	188	186	183
GULF COAST WATER AUTHORITY	325	TIKI ISLAND	SAN JACINTO-BRAZOS	GALVESTON	08097300008411	0	1,067	1,062	1,054	1,044	1,033
GULF COAST WATER AUTHORITY	325	MANUFACTURING	SAN JACINTO-BRAZOS	GALVESTON	08100108408411	0	28,631	28,291	27,776	27,129	26,352
GULF COAST WATER AUTHORITY	325	MANUFACTURING	SAN JACINTO-BRAZOS	BRAZORIA	08100102002011	0	0	1,580	1,580	1,580	1,580
GULF COAST WATER AUTHORITY	325	MANUFACTURING	BRAZOS	BRAZORIA	08100102002012	13,694	13,694	51,614	51,614	51,614	51,614
GULF COAST WATER AUTHORITY	325	STEAM ELECTRIC POWER	SAN JACINTO-BRAZOS	GALVESTON	08100208408411	0	2,893	3,738	4,869	6,231	7,864
GULF COAST WATER AUTHORITY	325	MINING	SAN JACINTO-BRAZOS	FORT BEND	08100307907911	0	86	703	717	729	739
GULF COAST WATER AUTHORITY	325	MINING	SAN JACINTO-BRAZOS	GALVESTON	08100308408411	0	21	24	28	31	34
GULF COAST WATER AUTHORITY	325	IRRIGATION	SAN JACINTO-BRAZOS	BRAZORIA	08100402002011	82,741	71,681	62,691	62,777	62,970	64,614
GULF COAST WATER AUTHORITY	325	IRRIGATION	BRAZOS	BRAZORIA	08100402002012	1,754	1,384	1,243	1,157	1,157	1,157
GULF COAST WATER AUTHORITY	325	IRRIGATION	SAN JACINTO-BRAZOS	GALVESTON	08100408408411	6,788	6,788	6,788	6,788	6,788	6,788
GULF COAST WATER AUTHORITY	325	BACLIFF MUD	SAN JACINTO-BRAZOS	GALVESTON	08401200008411	0	1,468	1,458	1,443	1,424	1,402
GULF COAST WATER AUTHORITY	325	BAYOU VISTA	SAN JACINTO-BRAZOS	GALVESTON	08075900008411	0	217	215	211	206	200
GULF COAST WATER AUTHORITY	325	GALVESTON COUNTY WCID #12	SAN JACINTO-BRAZOS	GALVESTON	08413600008411	0	3,579	3,563	3,540	3,511	3,476
GULF COAST WATER AUTHORITY	325	SANTA FE	SAN JACINTO-BRAZOS	GALVESTON	08074300008411	0	483	477	469	458	445
GULF COAST WATER AUTHORITY	325	SAN LEON MUD	SAN JACINTO-BRAZOS	GALVESTON	08432900008411	0	2,649	2,632	2,607	2,576	2,538
<b>WWP Total</b>						<b>104,977</b>	<b>173,508</b>	<b>206,117</b>	<b>210,630</b>	<b>214,202</b>	<b>220,166</b>
LOWER NECHES VALLEY AUTHORITY	140	MINING	NECHES-TRINITY	GALVESTON	08100308408407	16	23	26	29	33	37
<b>WWP Total</b>						<b>16</b>	<b>23</b>	<b>26</b>	<b>29</b>	<b>33</b>	<b>37</b>
MISSOURI CITY	999903	MISSOURI CITY	SAN JACINTO	FORT BEND	08040900007910	0	715	1,195	1,794	1,794	2,517
MISSOURI CITY	999903	MISSOURI CITY	SAN JACINTO-BRAZOS	FORT BEND	08040900007911	0	2,595	5,342	8,051	7,983	11,503
MISSOURI CITY	999903	MISSOURI CITY	BRAZOS	FORT BEND	08040900007912	0	508	665	822	890	905
MISSOURI CITY	999903	MISSOURI CITY	SAN JACINTO	HARRIS	08040900010110	0	386	454	707	707	862
MISSOURI CITY	999903	COUNTY-OTHER	SAN JACINTO-BRAZOS	FORT BEND	08075707907911	0	26	85	594	778	829
MISSOURI CITY	999903	COUNTY-OTHER	BRAZOS	FORT BEND	08075707907912	0	172	859	929	946	959
MISSOURI CITY	999903	FIRST COLONY MUD #9	BRAZOS	FORT BEND	08411300007912	0	342	793	831	879	926
MISSOURI CITY	999903	FORT BEND COUNTY MUD #23	SAN JACINTO-BRAZOS	FORT BEND	08412100007911	0	464	1,069	1,069	1,070	1,070
MISSOURI CITY	999903	SIENNA PLANTATION MUD #2	SAN JACINTO-BRAZOS	FORT BEND	08433400007911	0	292	655	651	651	651
<b>WWP Total</b>						<b>0</b>	<b>5,500</b>	<b>11,117</b>	<b>15,448</b>	<b>15,698</b>	<b>20,222</b>
NFBWA	999901	FULSHEAR	SAN JACINTO-BRAZOS	FORT BEND	08086900007911	0	0	0	0	45	112
NFBWA	999901	FULSHEAR	BRAZOS	FORT BEND	08086900007912	0	0	0	0	76	178
NFBWA	999901	ARCOLA	SAN JACINTO-BRAZOS	FORT BEND	08098900007911	0	106	258	295	345	397
NFBWA	999901	NFBWA	SAN JACINTO	FORT BEND	NFBWA07910	0	0	7,700	11,775	13,327	13,887
NFBWA	999901	NFBWA	SAN JACINTO-BRAZOS	FORT BEND	NFBWA07911	0	6,334	12,704	22,026	29,994	37,709
NFBWA	999901	NFBWA	BRAZOS	FORT BEND	NFBWA07912	0	150	892	1,905	3,313	5,103
NFBWA	999901	NFBWA	SAN JACINTO	HARRIS	NFBWA10110	0	444	732	865	926	939
<b>WWP Total</b>						<b>0</b>	<b>7,034</b>	<b>22,286</b>	<b>36,866</b>	<b>48,026</b>	<b>58,325</b>
NHCRWA	999904	TOMBALL	SAN JACINTO	HARRIS	08060800010110	620	2,102	2,830	3,760	4,441	5,442
NHCRWA	999904	JERSEY VILLAGE	SAN JACINTO	HARRIS	08070900010110	0	364	767	1,043	1,315	1,600
NHCRWA	999904	NORTHWEST HARRIS COUNTY MUD	SAN JACINTO	HARRIS	08428600010110	141	467	646	770	908	1,046
NHCRWA	999904	NHCRWA	SAN JACINTO	HARRIS	08800000010110	0	53,520	80,393	87,241	90,563	94,527
<b>WWP Total</b>						<b>761</b>	<b>56,453</b>	<b>84,636</b>	<b>92,814</b>	<b>97,227</b>	<b>102,615</b>
NORTH CHANNEL WATER AUTHORITY	607473	HARRIS COUNTY FWSD #47	SAN JACINTO	HARRIS	08414900010110	25	14	4	3	3	3
NORTH CHANNEL WATER AUTHORITY	607473	HARRIS COUNTY FWSD #51	SAN JACINTO	HARRIS	08415000010110	363	266	250	213	211	211
NORTH CHANNEL WATER AUTHORITY	607473	HARRIS COUNTY FWSD #6	SAN JACINTO	HARRIS	08415100010110	103	145	184	236	281	334
NORTH CHANNEL WATER AUTHORITY	607473	HARRIS COUNTY MUD #53	SAN JACINTO	HARRIS	08418600010110	587	920	1,231	1,652	2,029	2,454
NORTH CHANNEL WATER AUTHORITY	607473	HARRIS COUNTY WCID #21	SAN JACINTO	HARRIS	08419600010110	272	313	349	389	443	513
NORTH CHANNEL WATER AUTHORITY	607473	HARRIS COUNTY WCID #36	SAN JACINTO	HARRIS	08419700010110	190	268	338	438	540	660
NORTH CHANNEL WATER AUTHORITY	607473	HARRIS COUNTY WCID #84	SAN JACINTO	HARRIS	08420000010110	199	200	201	201	206	216
NORTH CHANNEL WATER AUTHORITY	607473	PINE TRAILS UTILITY	SAN JACINTO	HARRIS	08430200010110	215	266	312	379	444	521
<b>WWP Total</b>						<b>1,954</b>	<b>2,392</b>	<b>2,869</b>	<b>3,511</b>	<b>4,157</b>	<b>4,912</b>
NRG	398300	STEAM ELECTRIC POWER	BRAZOS	FORT BEND	08100207907912	0	0	0	0	0	8,500
<b>WWP Total</b>						<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>8,500</b>
RICHMOND-ROSENBERG	999905	RICHMOND	BRAZOS	FORT BEND	08050000007912	0	0	0	0	0	248
RICHMOND-ROSENBERG	999905	ROSENBERG	BRAZOS	FORT BEND	08051800007912	0	0	0	1,091	3,060	5,397
<b>WWP Total</b>						<b>0</b>	<b>0</b>	<b>0</b>	<b>1,091</b>	<b>3,060</b>	<b>5,645</b>
SAN JACINTO RIVER AUTHORITY	240	CONROE	SAN JACINTO	MONTGOMERY	08013000017010	0	5,256	8,550	8,377	14,027	20,630
SAN JACINTO RIVER AUTHORITY	240	WILLIS	SAN JACINTO	MONTGOMERY	08065500017010	0	236	380	377	635	941
SAN JACINTO RIVER AUTHORITY	240	OAK RIDGE NORTH	SAN JACINTO	MONTGOMERY	08072600017010	0	272	418	392	637	911
SAN JACINTO RIVER AUTHORITY	240	PANORAMA VILLAGE	SAN JACINTO	MONTGOMERY	08073200017010	0	251	334	277	384	475
SAN JACINTO RIVER AUTHORITY	240	PATTON VILLAGE	SAN JACINTO	MONTGOMERY	08073400017010	0	32	47	64	84	113
SAN JACINTO RIVER AUTHORITY	240	SHENANDOAH	SAN JACINTO	MONTGOMERY	08074500017010	0	737	1,098	1,002	1,570	2,200
SAN JACINTO RIVER AUTHORITY	240	COUNTY-OTHER	SAN JACINTO	HARRIS	08075710110110	0	0	5,299	19,014	16,041	17,533
SAN JACINTO RIVER AUTHORITY	240	COUNTY-OTHER	SAN JACINTO	MONTGOMERY	08075717017010	0	10,308	16,497	23,807	34,448	48,756
SAN JACINTO RIVER AUTHORITY	240	ROMAN FOREST	SAN JACINTO	MONTGOMERY	08080100017010	0	306	561	860	1,283	1,809
SAN JACINTO RIVER AUTHORITY	240	WOODBANCH	SAN JACINTO	MONTGOMERY	08080700017010	0	74	107	138	177	225
SAN JACINTO RIVER AUTHORITY	240	CUT AND SHOOT	SAN JACINTO	MONTGOMERY	08085400017010	0	86	134	130	212	309
SAN JACINTO RIVER AUTHORITY	240	MAGNOLIA	SAN JACINTO	MONTGOMERY	08090700017010	0	221	380	561	812	1,118

**Region H**  
**Table 4A-8: WUG-Level Contracts**

WWP	WWP ID	WUG	WUG Basin	WUG County	WUG ID	2010	2020	2030	2040	2050	2060
SAN JACINTO RIVER AUTHORITY	240	SPLENDORA	SAN JACINTO	MONTGOMERY	08096200017010	0	83	141	212	313	435
SAN JACINTO RIVER AUTHORITY	240	MANUFACTURING	TRINITY-SAN JACINTO	HARRIS	08100110110109	23,008	27,754	31,791	35,763	38,736	37,244
SAN JACINTO RIVER AUTHORITY	240	MANUFACTURING	SAN JACINTO	MONTGOMERY	08100117017010	0	988	1,384	1,756	2,129	2,504
SAN JACINTO RIVER AUTHORITY	240	STEAM ELECTRIC POWER	SAN JACINTO	MONTGOMERY	08100217017010	0	0	0	0	1,593	4,307
SAN JACINTO RIVER AUTHORITY	240	MINING	SAN JACINTO	MONTGOMERY	08100317017010	0	216	279	331	382	425
SAN JACINTO RIVER AUTHORITY	240	CONSUMERS WATER INC	SAN JACINTO	MONTGOMERY	08407200017010	0	89	143	204	291	395
SAN JACINTO RIVER AUTHORITY	240	CRYSTAL SPRNGS WATER COMPAN	SAN JACINTO	MONTGOMERY	08408100017010	0	257	439	663	982	1,371
SAN JACINTO RIVER AUTHORITY	240	EAST PLANTATION UD	SAN JACINTO	MONTGOMERY	08409800017010	0	203	344	354	613	923
SAN JACINTO RIVER AUTHORITY	240	H M W SUD	SAN JACINTO	MONTGOMERY	08414700017010	0	672	1,055	1,011	1,670	2,425
SAN JACINTO RIVER AUTHORITY	240	HARRIS COUNTY MUD #50	SAN JACINTO	HARRIS	08418500010110	0	0	0	0	28	72
SAN JACINTO RIVER AUTHORITY	240	MONTGOMERY COUNTY MUD #18	SAN JACINTO	MONTGOMERY	08426100017010	0	865	1,655	1,788	3,251	5,046
SAN JACINTO RIVER AUTHORITY	240	MONTGOMERY COUNTY MUD #19	SAN JACINTO	MONTGOMERY	08426200017010	0	167	211	165	220	260
SAN JACINTO RIVER AUTHORITY	240	MONTGOMERY COUNTY MUD #8	SAN JACINTO	MONTGOMERY	08426300017010	0	399	624	720	861	964
SAN JACINTO RIVER AUTHORITY	240	MONTGOMERY COUNTY MUD #9	SAN JACINTO	MONTGOMERY	08426400017010	0	395	650	790	951	1,075
SAN JACINTO RIVER AUTHORITY	240	MONTGOMERY COUNTY UD #2	SAN JACINTO	MONTGOMERY	08426500017010	0	203	259	298	337	369
SAN JACINTO RIVER AUTHORITY	240	MONTGOMERY COUNTY UD #3	SAN JACINTO	MONTGOMERY	08426600017010	0	184	264	233	358	493
SAN JACINTO RIVER AUTHORITY	240	MONTGOMERY COUNTY UD #4	SAN JACINTO	MONTGOMERY	08426700017010	0	353	452	351	467	554
SAN JACINTO RIVER AUTHORITY	240	MONTGOMERY COUNTY WCID #1	SAN JACINTO	MONTGOMERY	08426800017010	0	189	272	358	470	600
SAN JACINTO RIVER AUTHORITY	240	NEW CANEY MUD	SAN JACINTO	MONTGOMERY	08427200017010	0	546	944	1,396	2,058	2,854
SAN JACINTO RIVER AUTHORITY	240	POINT AQUARIUS MUD	SAN JACINTO	MONTGOMERY	08430500017010	0	331	613	966	1,472	2,091
SAN JACINTO RIVER AUTHORITY	240	PORTER WSC	SAN JACINTO	MONTGOMERY	08430700017010	0	777	1,260	1,826	2,047	2,239
SAN JACINTO RIVER AUTHORITY	240	RAYFORD ROAD MUD	SAN JACINTO	MONTGOMERY	08431200017010	0	826	1,050	831	1,110	1,316
SAN JACINTO RIVER AUTHORITY	240	RIVER PLANTATION MUD	SAN JACINTO	MONTGOMERY	08432200017010	0	0	0	76	272	398
SAN JACINTO RIVER AUTHORITY	240	SOUTHERN MONTGOMERY COUNTY	SAN JACINTO	MONTGOMERY	08433900017010	0	866	1,118	911	1,231	1,493
SAN JACINTO RIVER AUTHORITY	240	SOUTHWEST UTILITIES	SAN JACINTO	MONTGOMERY	08434300017010	0	102	166	237	336	457
SAN JACINTO RIVER AUTHORITY	240	SPRING CREEK UD	SAN JACINTO	MONTGOMERY	08434400017010	0	224	372	377	653	982
SAN JACINTO RIVER AUTHORITY	240	STANLEY LAKE MUD	SAN JACINTO	MONTGOMERY	08434700017010	0	329	423	329	439	521
SAN JACINTO RIVER AUTHORITY	240	THE WOODLANDS	SAN JACINTO	MONTGOMERY	08800100017010	0	13,616	14,985	10,275	13,658	16,196
SAN JACINTO RIVER AUTHORITY	240	MONTGOMERY	SAN JACINTO	MONTGOMERY	MONTGOMERY170	0	374	710	1,087	1,199	1,701
SAN JACINTO RIVER AUTHORITY	240	STAGECOACH	SAN JACINTO	MONTGOMERY	STAGECOACH170	0	39	68	107	165	249
<b>WWP Total</b>						<b>23,008</b>	<b>68,826</b>	<b>95,477</b>	<b>118,414</b>	<b>148,602</b>	<b>184,979</b>
SUGAR LAND	999906	SUGAR LAND	SAN JACINTO	FORT BEND	08058500007910	0	0	35	35	35	35
SUGAR LAND	999906	SUGAR LAND	SAN JACINTO-BRAZOS	FORT BEND	08058500007911	0	0	440	404	404	1,304
SUGAR LAND	999906	SUGAR LAND	BRAZOS	FORT BEND	08058500007912	0	155	3,496	3,267	3,508	3,719
SUGAR LAND	999906	COUNTY-OTHER	SAN JACINTO-BRAZOS	FORT BEND	08075707907911	0	29	60	536	814	814
SUGAR LAND	999906	COUNTY-OTHER	BRAZOS	FORT BEND	08075707907912	0	102	919	1,293	1,291	1,183
SUGAR LAND	999906	FORT BEND COUNTY MUD #106	BRAZOS	FORT BEND	08411700007912	0	235	523	521	521	521
SUGAR LAND	999906	FORT BEND COUNTY MUD #108	BRAZOS	FORT BEND	08411800007912	0	141	312	312	312	312
SUGAR LAND	999906	FORT BEND COUNTY MUD #111	BRAZOS	FORT BEND	08411900007912	0	250	524	519	468	446
SUGAR LAND	999906	FORT BEND COUNTY MUD #67	BRAZOS	FORT BEND	08412600007912	0	266	556	549	495	472
SUGAR LAND	999906	FORT BEND COUNTY MUD #68	BRAZOS	FORT BEND	08412700007912	0	194	398	404	364	347
SUGAR LAND	999906	FORT BEND COUNTY MUD #69	BRAZOS	FORT BEND	08412800007912	0	157	311	323	292	278
SUGAR LAND	999906	PLANTATION MUD	SAN JACINTO-BRAZOS	FORT BEND	08430300007911	0	133	294	288	286	286
<b>WWP Total</b>						<b>0</b>	<b>1,662</b>	<b>7,868</b>	<b>8,451</b>	<b>8,790</b>	<b>9,717</b>
THE DOW CHEMICAL CO.	237200	MANUFACTURING	SAN JACINTO-BRAZOS	BRAZORIA	08100102002011	0	2,752	2,752	2,752	2,752	2,752
THE DOW CHEMICAL CO.	237200	MANUFACTURING	BRAZOS	BRAZORIA	08100102002012	0	19,048	19,048	19,048	19,048	19,048
<b>WWP Total</b>						<b>0</b>	<b>21,800</b>	<b>21,800</b>	<b>21,800</b>	<b>21,800</b>	<b>21,800</b>
TRINITY RIVER AUTHORITY	187	IRRIGATION	NECHES-TRINITY	LIBERTY	08100414614607	0	0	0	0	0	0
TRINITY RIVER AUTHORITY	187	IRRIGATION	TRINITY-SAN JACINTO	LIBERTY	08100414614609	0	0	0	0	0	1,091
TRINITY RIVER AUTHORITY	187	MANUFACTURING	TRINITY-SAN JACINTO	CHAMBERS	08100103603609	8,264	9,230	10,252	11,284	12,240	13,445
TRINITY RIVER AUTHORITY	187	MINING	TRINITY	CHAMBERS	08100303603608	4,344	6,494	7,816	9,116	10,411	11,550
TRINITY RIVER AUTHORITY	187	MINING	TRINITY-SAN JACINTO	CHAMBERS	08100303603609	1,215	1,359	1,904	2,488	3,081	3,677
<b>WWP Total</b>						<b>13,823</b>	<b>17,083</b>	<b>19,972</b>	<b>22,888</b>	<b>25,732</b>	<b>29,763</b>
WHCRWA	999907	KATY	SAN JACINTO	FORT BEND	08031200007910	68	238	356	462	601	764
WHCRWA	999907	KATY	SAN JACINTO	HARRIS	08031200010110	756	2,462	3,347	3,989	4,619	5,276
WHCRWA	999907	KATY	SAN JACINTO	WALLER	08031200023710	65	258	409	566	751	968
WHCRWA	999907	HARRIS COUNTY MUD #132	SAN JACINTO	HARRIS	08415700010110	421	1,393	1,909	2,292	2,667	3,058
WHCRWA	999907	HARRIS COUNTY MUD #151	SAN JACINTO	HARRIS	08415900010110	306	811	932	925	925	925
WHCRWA	999907	HARRIS COUNTY MUD #152	SAN JACINTO	HARRIS	08416000010110	189	650	909	1,112	1,324	1,536
WHCRWA	999907	HARRIS COUNTY MUD #180	SAN JACINTO	HARRIS	08417000010110	148	475	640	758	874	998
WHCRWA	999907	HARRIS COUNTY MUD #46	SAN JACINTO	HARRIS	08418300010110	201	526	598	593	593	593
WHCRWA	999907	TRAIL OF THE LAKES MUD	SAN JACINTO	HARRIS	08435500010110	334	876	1,005	986	986	986
WHCRWA	999907	WHCRWA	SAN JACINTO	FORT BEND	08800200007910	0	0	1,445	2,010	2,490	2,983
WHCRWA	999907	WHCRWA	SAN JACINTO	HARRIS	08800200010110	0	24,167	35,508	40,356	41,271	42,001
<b>WWP Total</b>						<b>2,488</b>	<b>31,856</b>	<b>47,058</b>	<b>54,049</b>	<b>57,101</b>	<b>60,088</b>

Notes:  
Table includes summation of all WMS supplies provided by a WWP to a WUG. In cases where a WUG is also a WWP, supply volumes for the WWP and WUG are still listed in the contracts table for consistency

**Attachment I:**

Amended Technical Memorandum 4B-07: WWP Contracts



# REGION H WATER MANAGEMENT STRATEGY ANALYSIS TECHNICAL MEMORANDUM

**STRATEGY TITLE: WWP Contracts**

**DATE: November 14, 2009 (rev. October 2014)**

**SUMMARY**

STRATEGY DESCRIPTION: Contractual agreements for water between WWPs. Water for contracts would come from multiple sources, including other water management strategies (WMS).

SUPPLY QUANTITY: Varies

SUPPLY SOURCE: Varies

IMPLEMENTATION DECADE: Varies

TOTAL STRATEGY COST: Varies by conveyance

UNIT WATER COST: NA – based on contractual agreement

Water Management Strategy Analysis Description

**Introduction:**

Previous RWPs have reflected major WMS largely at the end-user (WUG) level. However, water reaching the WUG level from major management strategies may involve the facilities and services of one or more wholesale water providers (WWPs). A series of contractual agreements is necessary for water from WMSs to move from the sourer location to ultimate user. For example, the TRA to Houston Transfer strategy may involve the contractual transfer of water from TRA to the City of Houston, from the City of Houston to a smaller WWP, and finally from the smaller WWP to the WUG. Thus, WWP contracts necessary to facilitate other WMS are included as a management strategy with no yield of its own. Note that WWP and WUGs are not obligated by the RWP to increase existing contracts or enter into new contracts. Any additional contract amounts will require negotiation between the WWPs.

**Analysis:**

Contracts between WWPs required to facilitate other WMS are shown in Table 1 below. Note that this list does not include contracts from WWPs directly to WUGs.

**Table 1  
WWP Contracts (ac-ft/yr)**

Contracts by WWP and Supply Source	2010	2020	2030	2040	2050	2060
<b>BRA to Brazosport Water Authority</b>						
<i>ALLENS CREEK</i>	0	116	124	1,557	3,183	5,435
<i>TOTAL</i>	0	116	124	1,557	3,183	5,435

<b>Contracts by WWP and Supply Source</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
<b>BRA to GCWA</b>						
<i>ALLENS CREEK</i>	0	12,165	27,627	31,782	37,777	42,624
<i>BRA SYSTEM OPERATIONS PERMIT</i>	0	1,290	8,057	14,099	14,099	14,099
<i>FORT BEND OCR</i>	0	0	0	0	0	4,517
<i>BRAZOS RIVER AUTHORITY MAIN STEM STYSTEM<sup>1</sup></i>	0	4,324	4,324	4,324	4,324	4,324
<b>TOTAL</b>	<b>0</b>	<b>17,779</b>	<b>40,008</b>	<b>50,205</b>	<b>56,200</b>	<b>65,564</b>
<b>BRA to NRG</b>						
<i>FORT BEND OCR</i>	0	0	0	0	0	8,500
<b>TOTAL</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>8,500</b>
<b>BRA to Richmond-Rosenberg</b>						
<i>ALLENS CREEK</i>	0	0	0	1,091	2,970	1,848
<i>FORT BEND OCR</i>	0	0	0	0	90	3,797
<b>TOTAL</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,091</b>	<b>3,060</b>	<b>5,645</b>
<b>BRA to Sugar Land</b>						
<i>BRA SYSTEM OPERATIONS PERMIT</i>	0	1,027	2,947	3,385	3,385	3,385
<i>ALLENS CREEK</i>	0	0	0	231	490	449
<i>FORT BEND OCR</i>	0	0	0	0	0	922
<b>TOTAL</b>	<b>0</b>	<b>1,027</b>	<b>2,947</b>	<b>3,616</b>	<b>3,875</b>	<b>4,756</b>
<b>COH to Baytown Area Water Authority</b>						
<i>LIVINGSTON-WALLISVILLE SYSTEM</i>	0	26	262	398	535	692
<b>TOTAL</b>	<b>0</b>	<b>26</b>	<b>262</b>	<b>398</b>	<b>535</b>	<b>692</b>
<b>COH to BRA</b>						
<i>ALLENS CREEK</i>	0	27,498	25,201	57,886	69,755	69,755
<b>TOTAL</b>	<b>0</b>	<b>27,498</b>	<b>25,201</b>	<b>57,886</b>	<b>69,755</b>	<b>69,755</b>
<b>COH to CHCRWA</b>						
<i>HOUSTON LAKE/RESERVOIR</i>	0	977	862	720	631	546
<i>LIVINGSTON-WALLISVILLE SYSTEM</i>	0	794	1,552	1,711	1,800	1,885
<b>TOTAL</b>	<b>0</b>	<b>1,771</b>	<b>2,414</b>	<b>2,431</b>	<b>2,431</b>	<b>2,431</b>
<b>COH to GCWA</b>						
<i>INDIRECT REUSE HARRIS COUNTY</i>	0	56,896	56,896	56,896	56,896	56,896
<b>TOTAL</b>	<b>0</b>	<b>56,896</b>	<b>56,896</b>	<b>56,896</b>	<b>56,896</b>	<b>56,896</b>
<b>COH to City of Pasadena</b>						
<i>LIVINGSTON-WALLISVILLE SYSTEM</i>	1,865	2,278	2,665	3,153	3,579	4,068
<b>TOTAL</b>	<b>1,865</b>	<b>2,278</b>	<b>2,665</b>	<b>3,153</b>	<b>3,579</b>	<b>4,068</b>

<b>Contracts by WWP and Supply Source</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
<b>COH to North Channel Water Authority</b>						
<i>LIVINGSTON-WALLISVILLE SYSTEM</i>	1,954	2,392	2,869	3,511	4,157	4,912
<b>TOTAL</b>	1,954	2,392	2,869	3,511	4,157	4,912
<b>COH to NFBWA</b>						
<i>LIVINGSTON-WALLISVILLE SYSTEM</i>	0	444	17,971	31,161	41,172	50,442
<b>TOTAL</b>	0	444	17,971	31,161	41,172	50,442
<b>COH to NHCRWA</b>						
<i>HOUSTON LAKE/RESERVOIR</i>	0	30,880	30,880	32,734	29,030	25,398
<i>HOUSTON INDIRECT REUSE</i>	0	0	0	18,130	31,629	0
<i>LIVINGSTON-WALLISVILLE SYSTEM</i>	0	25,573	52,161	32,177	17,382	57,643
<b>TOTAL</b>	0	56,453	83,041	83,041	78,041	83,041
<b>COH to SJRA</b>						
<i>CONROE LAKE/RESERVOIR</i>	0	36,377	55,538	54,582	53,581	52,534
<b>TOTAL</b>	0	36,377	55,538	54,582	53,581	52,534
<b>COH to WHCRWA</b>						
<i>LIVINGSTON-WALLISVILLE SYSTEM</i>	1,241	31,837	46,324	52,759	55,549	58,402
<b>TOTAL</b>	1,241	31,837	46,324	52,759	55,549	58,402
<b>GCWA to City of Galveston</b>						
<i>SAN JACINTO-BRAZOS RIVER RUN-OF-RIVER</i>	0	677	677	677	677	677
<i>BRAZOS RIVER RUN-OF-RIVER</i>	0	5,360	5,360	5,360	5,360	5,360
<i>BRAZOS RIVER AUTHORITY MAIN STEM SYSTEM</i>	0	1,225	1,225	1,225	1,225	1,225
<b>TOTAL</b>	0	7,262	7,262	7,262	7,262	7,262
<b>GCWA to Fort Bend County WCID #2</b>						
<i>BRA SYSTEM OPERATIONS PERMIT</i>	0	491	1,092	1,092	1,092	1,092
<b>TOTAL</b>	0	491	1,092	1,092	1,092	1,092
<b>GCWA to Galveston County WCID #1</b>						
<i>SAN JACINTO-BRAZOS RIVER RUN-OF-RIVER</i>	0	59	59	59	59	59
<i>BRAZOS RIVER RUN-OF-RIVER</i>	0	469	469	469	469	469
<i>BRAZOS RIVER AUTHORITY MAIN STEM SYSTEM</i>	0	107	107	107	107	107
<i>ALLENS CREEK</i>	0	131	274	305	340	379
<i>FORT BEND OCR</i>	0	0	0	0	0	0
<b>TOTAL</b>	0	766	909	940	975	1,014

<b>Contracts by WWP and Supply Source</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
<b>GCWA to Missouri City</b>						
<i>ALLENS CREEK</i>	0	0	68	321	571	594
<i>BRA SYSTEM OPERATIONS PERMIT</i>	0	713	6,262	10,340	10,340	10,340
<i>FORT BEND OCR</i>	0	0	0	0	0	4,501
<b>TOTAL</b>	0	713	6,330	10,661	10,911	15,435
<b>SJRA to COH</b>						
<i>HOUSTON LAKE/RESERVOIR</i>	0	0	1,356	5,300	3,872	2,428
<b>TOTAL</b>	0	0	1,356	5,300	3,872	2,428
<b>TRA to COH</b>						
<i>LIVINGSTON-WALLISVILLE SYSTEM</i>	0	0	116,738	123,524	123,524	123,524
<b>TOTAL</b>	0	0	116,738	123,524	123,524	123,524
<b>TRA to SJRA</b>						
<i>LIVINGSTON-WALLISVILLE SYSTEM</i>	0	0	0	7,935	39,096	76,476
<b>TOTAL</b>	0	0	0	7,935	39,096	76,476

<sup>1</sup>Reflects water already contracted but unused prior to water treatment expansion

#### **Water User Group Application:**

Contracts facilitate transfer of water among WWPs for ultimate delivery to WUGs.

#### **Issues and Considerations:**

The proper functioning of other WMS is contingent on contracts between the proper WWPs.



**Attachment J:**

New Technical Memorandum: 4B-54: Gulf Coast Water Authority Reclaimed Water from City of Houston



# REGION H WATER MANAGEMENT STRATEGY ANALYSIS TECHNICAL MEMORANDUM

**STRATEGY TITLE:** Gulf Coast Water Authority Reclaimed Water from City of Houston<sup>1</sup>

**DATE:** December 14, 2014

## SUMMARY

**STRATEGY DESCRIPTION:** Transfer of reclaimed water from the City of Houston Southwest Wastewater Plant and other treatment facilities upstream along Brays Bayou.

**SUPPLY QUANTITY:** Direct Intake: 30.1 MGD average  
Combined Intake: 50.8 MGD average

**SUPPLY SOURCE:** Effluent from as many as five City of Houston wastewater treatment plants as listed below.

**IMPLEMENTATION DECADE:** 2020 (Online date in 2018)

**TOTAL STRATEGY COST:** Direct Intake: \$53,857,800  
(Costs rounded to nearest \$100) Combined Intake: \$66,840,500

**UNIT WATER COST:** Direct Intake: \$112 per ac-ft  
Combined Intake: \$80 per ac-ft

## WATER MANAGEMENT STRATEGY ANALYSIS DESCRIPTION

### INTRODUCTION

In 2004, the City of Houston (COH) applied for a water right permit to utilize the effluent from 32 wastewater treatment plants (WWTPs) in the greater-Houston area. This permit, number 5827, allows for the use of 580,923 ac-ft of water at various locations around Houston assuming several criteria are met:

- 50% of the permitted volume is to be dedicated to bay and estuary inflows and is to be retained in the channels for discharge to Galveston Bay,
- Permitted discharge and diversion rates at WWTP outfall locations and diversion points are maintained, and
- Instream flow targets are met for the diversion of any water from the bayous.

Of the potential diversion points associated with this permit, the Southwest WWTP (SWWWTP) provides a unique opportunity to provide supply outside of the immediate COH service area by way of a right-of-way owned by CenterPoint Energy that runs from the vicinity of the SWWWTP south to a point in the area of McHard Road and Farm to Market 521. This terminus is also near the GCWA American Canal which provides water to customers in Brazoria and Galveston Counties. Please see *Figure 1* for an overview of these locations.

The SWWWTP is identified in Permit 5827 as both a source of effluent and a diversion point for use of treated water discharged upstream and conveyed through the bed and banks of Brays Bayou. Four additional WWTPs (Beltway, Keegans Bayou, Upper Brays, and WCID 111 WWTPs) lie upstream of the SWWWTP and their effluent is made available at the SWWWTP through Permit 5827. For that reason and for the opportunity presented by the existing CenterPoint corridor, the SWWWTP presents a prime opportunity for water supply development for GCWA's long-term water needs.

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<sup>1</sup> This memorandum was prepared using information from Long Range Water Supply Study prepared by Freese and Nichols, Inc.

## ANALYSIS

The potential supply available from the SWWWTP is limited by a number of different factors including:

- Actual discharge from the SWWWTP,
- Discharge rate of upstream WWTPs as varying over the course of the planning horizon,
- Consideration for bay and estuary inflows as stipulated by WR 5827,
- The instantaneous diversion rate as specified by WR 5827 and infrastructure in place to capture flows,
- Instream flow requirements as specified by WR 5827, and
- Basin hydrology.

In order to evaluate these factors and their impacts on the options presented above, a model was developed based on existing data sources in order to predict availability over time. Plant discharge records from the SWWWTP were reviewed to determine the potential yield that could be diverted directly from the plant. This supply would be limited by the overall terms of the permit related to bay and estuary inflows but not the instream flow requirements associated with diversions from Brays Bayou.

Naturalized flows from the Texas Commission on Environmental Quality (TCEQ) San Jacinto Basin Water Availability Model (WAM) were extracted to provide a basis for natural stream flows on a monthly basis for a historic period from January 1940 through December 1996. These flows represent naturalized conditions without diversions and discharges made following development of the basin. Daily streamflow data was investigated as a basis with which to disaggregate these monthly flow values into daily flow records. The Southwest WWTP diversion point, was found to have nearby sources of daily streamflow records that provided an adequate data set for assessment.

Flows from WWTPs associated with WR 5827 were identified for the year 2010 using information from Environmental Protection Agency (EPA) Discharge Monitoring Report (DMR) data. These discharges were compared against the discharges permitted in WR 5827 to determine the remaining capacity remaining in each plant. The COH population for the decades from 2010 through 2070 were used to scale the total wastewater flow from these WWTPs over time and the total increase in flow was apportioned to the individual WWTPs based on their remaining capacity in 2010. In that way, plants with larger shares of the remaining WWTP capacity were assumed to bear more of the burden as wastewater flows increased over time. These discharges for plants upstream of a diversion point could be added to the naturalized flows identified above to represent actual flow in the channels.

Finally, diversions were assumed to be limited by a number of factors including the maximum diversion rate at the identified diversion point, a limit of 50 percent of the upstream diversions to protect bay and estuary inflows, and the instream flow limits associated with each diversion point. Diversions of effluent from upstream were limited in such a way that diversions could not cause the downstream instream flow targets to not be met on any given day.

Output from the model provided the potential yield that could be developed from two scenarios. One alternative diverted effluent directly from the SWWWTP and was not subject to instream flow requirements associated with the bed and banks transfer of Permit 5827. The other alternative utilized a combined intake configuration that would divert flow from Brays Bayou when those diversions were allowed under permit and revert to direct diversions from the SWWWTP when conditions prevented the use of this water. These options were identified as the Direct and Combined Intake Alternatives, respectively.

Proposed pump station and pipeline configurations were developed in order to provide for adequate capacity to convey flows from the SWWWTP to the GCWA canal system. To fulfill the Direct diversion scenario, a 35 million gallons per day (MGD) pump station was recommended along with approximately 52,000 feet (9.85 miles) miles of 42-inch pipeline to provide for delivery of an average 30.1 MGD to GCWA. The Combined alternative would be accomplished with a 60 MGD pump station conveying an average of 50.8 MGD through a 48-inch pipeline of the same length. Approximately 39,000 feet of this corridor would be developed through the identified CenterPoint corridor. As part of the preliminary

investigation for this strategy, coordination as performed with CenterPoint to determine the extent of design and construction consideration, development costs, and annual fees would be associated with such a project. These costs were then factored into annual operation and maintenance (O&M) costs for the project. Project costs for each option are shown below in *Tables 1* (Direct alternative) and *2* (Combined alternative).

Costs are also included for improvements to the Thomas Mackey Water Treatment Plant to add ultra-violet disinfection to the treatment process. This is provided based on preliminary conversations with TCEQ related to the use of reclaimed water in the GCWA canal system upstream of the plant.

#### WATER USER GROUP APPLICATION

GCWA serves several municipal, industrial and agricultural customers in Brazoria, Galveston, and Fort Bend Counties. Although supply improvements benefit the entire system, overall, this strategy may potentially provide supply directly to the following WUGs:

- Brazoria County Municipal
  - Pearland
- Galveston County Industrial
  - Industrial Pump Station Manufacturing customers
  - Direct canal Manufacturing customers
  - Steam Electric Power
- Galveston County Municipal (by way of Thomas Mackey Water Treatment Plant)
  - Bacliff MUD
  - Bayou Vista
  - Clear Lake Shores
  - Galveston County WCID #12
  - Hitchcock
  - Kemah
  - La Marque
  - League City
  - San Leon MUD
  - Santa Fe
  - Texas City
  - Tiki Island
  - Galveston County Other

Development of the project will require amendments to contracts with each municipal and industrial customer associated with the system. This may add an additional 12 to 24 months of time to project development in order to allow for this.

**Table 1  
Reclaimed Water from COH - Direct Alternative Cost Estimate**

OPINION OF PROBABLE CONSTRUCTION COST						December 14, 2014
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	
<b>PROJECT COST SUMMARY</b>						
1	CONSTRUCTION (CAPITAL) COST	1	LS	\$32,507,000	\$32,507,000	
2	ENGINEERING, FINANCIAL, AND LEGAL SERVICES AND CONTINGENCIES	1	LS	\$10,251,350	\$10,251,350	
3	LAND AND EASEMENTS	1	LS	\$4,715,000	\$4,715,000	
4	ENVIRONMENTAL - STUDIES AND MITIGATION	1	LS	\$4,715,000	\$4,715,000	
5	INTEREST DURING CONSTRUCTION	1	LS	\$1,669,474	\$1,669,474	
<b>PROJECT COST</b>					<b>\$53,857,824</b>	

ITEM	DESCRIPTION	ANNUAL TOTAL					
ANNUAL COST SUMMARY		2010	2020	2030	2040	2050	2060
1	DEBT SERVICE	\$0	\$4,506,787	\$4,506,787	\$0	\$0	\$0
2	OPERATION AND MAINTENANCE (O&M)	\$0	\$1,460,920	\$1,460,920	\$1,460,920	\$1,460,920	\$1,460,920
3	PUMPING ENERGY COSTS	\$0	\$500,082	\$500,082	\$500,082	\$500,082	\$500,082
4	PURCHASE COST OF WATER	\$0	\$0	\$0	\$0	\$0	\$0
<b>TOTAL ANNUAL COST</b>		<b>\$0</b>	<b>\$6,467,789</b>	<b>\$6,467,789</b>	<b>\$1,961,002</b>	<b>\$1,961,002</b>	<b>\$1,961,002</b>

ITEM	DESCRIPTION	ANNUAL TOTAL					
ANNUAL COST SUMMARY		2010	2020	2030	2040	2050	2060
1	ANNUAL COST	\$0	\$6,467,789	\$6,467,789	\$1,961,002	\$1,961,002	\$1,961,002
2	YIELD	-	33,712	33,712	33,712	33,712	33,712
3	UNIT COST	\$0	\$192	\$192	\$58	\$58	\$58
<b>TOTAL UNIT COST</b>							<b>\$112</b>

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
<b>CONSTRUCTION COST SUMMARY</b>					
1	PUMP STATIONS	1	LS	\$4,348,000	\$4,348,000
2	PIPELINES	1	LS	\$22,522,000	\$22,522,000
3	WATER TREATMENT PLANTS	1	LS	\$5,637,000	\$5,637,000
<b>PROJECT COST</b>					<b>\$32,507,000</b>

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
<b>OPERATION AND MAINTENANCE (O&amp;M) COST SUMMARY</b>					
1	PUMP STATIONS	2.5	%	\$4,348,000	\$108,700
2	PIPELINES	1.0	%	\$22,522,000	\$225,220
3	WATER TREATMENT PLANTS	1.0	LS	\$1,127,000	\$1,127,000
<b>ANNUAL OPERATION AND MAINTENANCE COST</b>					<b>\$1,460,920</b>

**Table 2  
Reclaimed Water from COH - Combined Alternative Cost Estimate**

<b>OPINION OF PROBABLE CONSTRUCTION COST</b>						<b>December 14, 2014</b>
<b>ITEM</b>	<b>DESCRIPTION</b>	<b>QUANTITY</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>TOTAL</b>	
<b>PROJECT COST SUMMARY</b>						
1	CONSTRUCTION (CAPITAL) COST	1	LS	\$41,193,000	\$41,193,000	
2	ENGINEERING, FINANCIAL, AND LEGAL SERVICES AND CONTINGENCIES	1	LS	\$13,155,150	\$13,155,150	
3	LAND AND EASEMENTS	1	LS	\$5,210,000	\$5,210,000	
4	ENVIRONMENTAL - STUDIES AND MITIGATION	1	LS	\$5,210,000	\$5,210,000	
5	INTEREST DURING CONSTRUCTION	1	LS	\$2,071,894	\$2,071,894	
<b>PROJECT COST</b>					<b>\$66,840,044</b>	

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>ANNUAL TOTAL</b>					
<b>ANNUAL COST SUMMARY</b>		<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
1	DEBT SERVICE	\$0	\$5,593,130	\$5,593,130	\$0	\$0	\$0
2	OPERATION AND MAINTENANCE (O&M)	\$0	\$1,637,180	\$1,637,180	\$1,637,180	\$1,637,180	\$1,637,180
3	PUMPING ENERGY COSTS	\$0	\$681,871	\$681,871	\$681,871	\$681,871	\$681,871
4	PURCHASE COST OF WATER	\$0	\$0	\$0	\$0	\$0	\$0
<b>TOTAL ANNUAL COST</b>		<b>\$0</b>	<b>\$7,912,181</b>	<b>\$7,912,181</b>	<b>\$2,319,051</b>	<b>\$2,319,051</b>	<b>\$2,319,051</b>

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>ANNUAL TOTAL</b>					
<b>ANNUAL COST SUMMARY</b>		<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
1	ANNUAL COST	\$0	\$7,912,181	\$7,912,181	\$2,319,051	\$2,319,051	\$2,319,051
2	YIELD	-	56,896	56,896	56,896	56,896	56,896
3	UNIT COST	\$0	\$139	\$139	\$41	\$41	\$41
<b>TOTAL UNIT COST</b>							<b>\$80</b>

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>QUANTITY</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>TOTAL</b>
<b>CONSTRUCTION COST SUMMARY</b>					
1	PUMP STATIONS	1	LS	\$10,308,000	\$10,308,000
2	PIPELINES	1	LS	\$25,248,000	\$25,248,000
3	WATER TREATMENT PLANTS	1	LS	\$5,637,000	\$5,637,000
<b>PROJECT COST</b>					<b>\$41,193,000</b>

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>QUANTITY</b>	<b>UNIT</b>	<b>UNIT PRICE</b>	<b>TOTAL</b>
<b>OPERATION AND MAINTENANCE (O&amp;M) COST SUMMARY</b>					
1	PUMP STATIONS	2.5	%	\$10,308,000	\$257,700
2	PIPELINES	1.0	%	\$25,248,000	\$252,480
3	WATER TREATMENT PLANTS	1.0	LS	\$1,127,000	\$1,127,000
<b>ANNUAL OPERATION AND MAINTENANCE COST</b>					<b>\$1,637,180</b>

## ISSUES AND CONSIDERATIONS

A preliminary environmental review of the project was conducted to identify possible obstacles to project development. Based on a review of the United States Fish and Wildlife Service (USFWS) Online Endangered Species list, five species may be present in the vicinity of the project area. These include the whooping crane (*Grus americana*), Texas prairie dawn-flower (*Hymenoxys texana*), West Indian Manatee (*Trichechus manatus*), Least tern (*Sterna antillarum*), and Piping Plover (*Charadrius melodus*). Care would be required in development of the project to protect these resources during construction and operation.

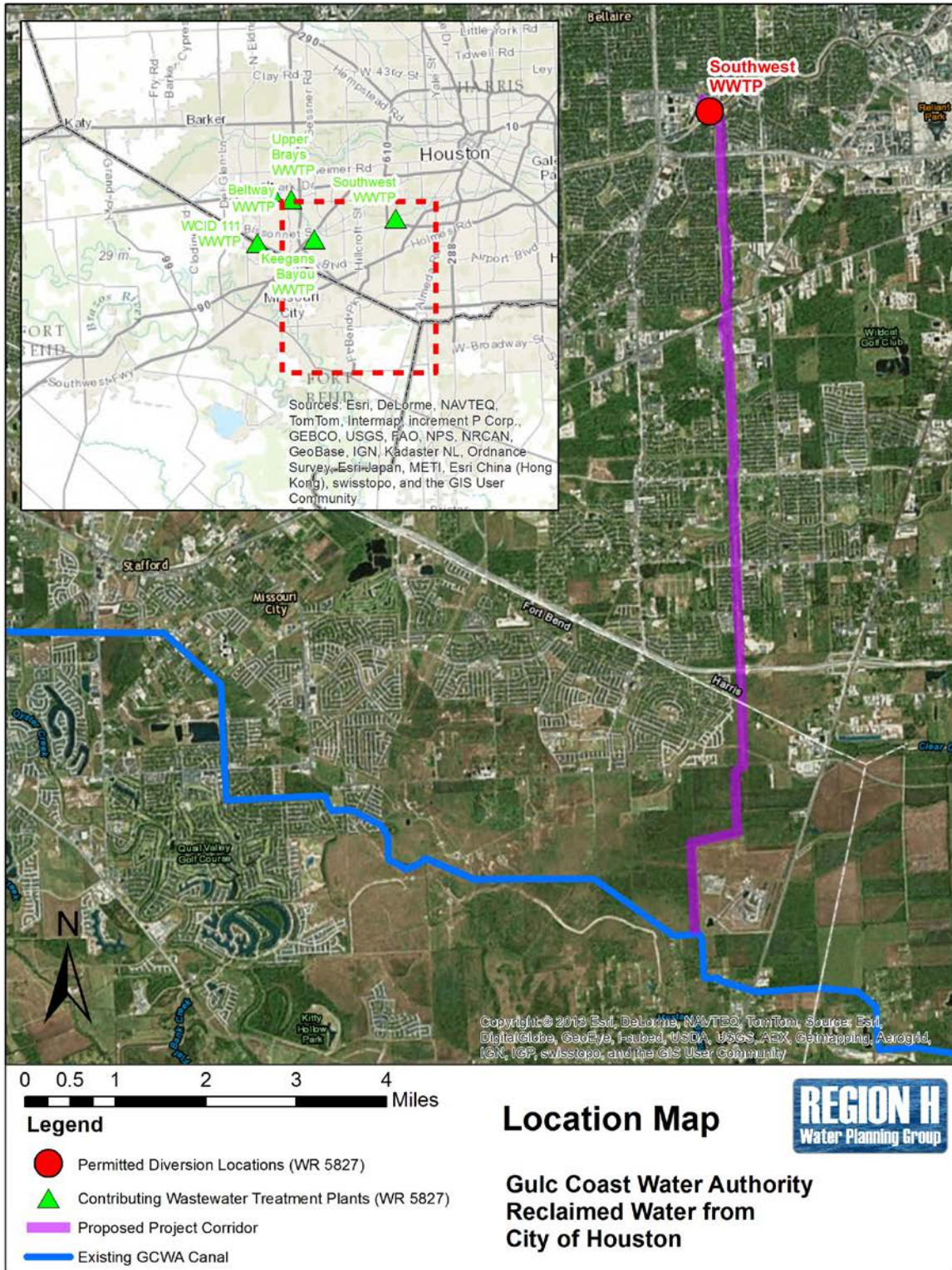
Three water bodies (Brays Bayou, Sims Bayou, and Clear Creek) were identified as waters of the United States (US) and would be regulated by the US Army Corps of Engineers (USACE) and this determination may possibly apply to others, smaller water sources within the scope of the project as well as numerous wetlands identified in the proposed corridor. Construction of an intake in Brays Bayou as well as the various crossings identified may be covered under Nationwide Permit (NWP) 12. A determination will be required in order to assess the need for a pre-construction notification (PCN) for activities related to the conveyance system. Furthermore, the named streams may also be State owned riverbeds, which may also require an easement from the General Land Office (GLO) prior to proceeding with construction.

Projects sponsored by public entities that affect a cumulative area greater than five acres or that disturb more than 5,000 cubic yards require advance consultation with the THC according to Section 191.0525 (d) of the Antiquities Code of Texas. Because the proposed project may exceed these thresholds, coordination with THC is likely required.

Proposed project activities at the project site would all occur within Floodways and Zone X and Zone AE of existing floodplains (Flood Insurance Rate Map {FIRM} 48201C1005L and 48201C0865L). Activities within these areas may require a permit from or coordination with the local floodplain administrator and must comply with applicable FEMA-approved state or local floodway and floodplain requirements.



**Figure 1  
Location Map**





**Attachment K:**

Amended Table 4C-1: WWP-Level Project Costs







**Attachment L:**

Amended Table 4C-2: WUG-Level Project Costs







Table with columns: WUG Name, WUG County, Year (2010-2060), and Annual Costs for Municipal Conservation, Irrigation Conservation, Project-Specific Annual Costs, and Total Annual Cost. The table lists various WUGs like ALVIN, AMES, ANAHUAC, ANGLETON, etc., with their respective costs over time.







Region H  
Table 4C-2: WUG-Level Project Costs

WUG Name	WUG Assn	WUG County	Annual Costs for Municipal Conservation						Annual Costs for Irrigation Conservation						Project-Specific Annual Costs						Total Annual Cost						
			2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060	
			\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
MONTGOMERY COUNTY MUD #1	SAN JACINTO	MONTGOMERY	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	
MONTGOMERY COUNTY MUD #8	SAN JACINTO	MONTGOMERY	\$15,562	\$20,212	\$24,562	\$29,212	\$33,562	\$38,212	\$42,562	\$47,212	\$51,562	\$56,212	\$60,562	\$65,212	\$69,562	\$74,212	\$78,562	\$83,212	\$87,562	\$92,212	\$96,562	\$101,212	\$105,562	\$110,212	\$114,562	\$119,212	\$123,562

**Attachment M:**

Amended Appendix 4E: Environmental Flows Modeling for New WMS





# Section 1- Introduction

The *Environmental Flows Study* completed during the 1<sup>st</sup> biennium of the 2011 Regional Water plan (RWP) planning process revealed impacts to volume, timing, and location of bay and estuary inflows caused by water management strategy (WMS) implementation. Model results indicated that implementation of individual WMS would not have a substantial impact on net bay and estuary (B&E) inflow; however, the combined effect of multiple WMS resulted in some impacts to B&E flows in terms of volume.

The 1<sup>st</sup> biennium study examined strategies recommended by the 2006 Region H RWP and the 2007 State water Plan (SWP); the 2011 RWP contains 37 WMS strategies which were not included in the 2006 RWP. As such, the Region H Regional Planning Group elected to re-run the water availability models from the 1<sup>st</sup> biennium *Environmental Flows Study* to test the environmental impacts of new WMS on environmental flows. In order to determine the effects of WMS implementation, WAM models were developed for each WMS for any basin in which the WMS was active. Strategies were modeled in a manner similar to that used in the *Environmental Flows Study*, with WMS simulated using the Water Rights Analysis Package (WRAP) software package. Strategies were modeled on an individual basis and results were examined to determine attainment of B&E inflow targets and impacts of individual WMS to instream flows.

## Section 2- Model Development

The Water Rights Analysis Package (WRAP [Wurbs 2007]) was developed as a tool for modeling water rights allocations and river and reservoir operations on a monthly time-step. In addition to this basic objective, the nature of the application allows for the modeling of various environmental conditions, especially the determination of instream flows and bay and estuary (B&E) flows as a result of operations within the basin. This process is made simpler by the constant maintenance of Water Availability Models (WAMs) for each basin in the State of Texas by the Texas Commission on Environmental Quality (TCEQ). These WAMs can then be modified as necessary and executed by WRAP to determine impacts from various changes. Currently, TCEQ maintains two versions of the WAMs for permitting purposes: 1) a full-diversion model with no return flows, known as the WAM Run 3, and 2) a current conditions model based on historical water use, known as the WAM Run 8. The period of record for both models contains the critical drought period for each basin.

### 2.1 Base Model

Models carried out for this study were based on the Scenario D model from the first biennium *Environmental Flows Study*. In order to develop the original D<sub>0</sub> base model in the 1<sup>st</sup> biennium study, changes were made to the TCEQ Run 3 model. Because the Run 3 model includes almost no return flows, Constant Inflow (CI) and Return Flow (RF) cards for each basin were imported from the Run 8 model if present in the Run 8. CI cards imported from Run 8 reflect flows from a current conditions diversion level. However, since the majority of CI cards represent groundwater inputs to the system, no adjustment was required. The exception was the San Jacinto Basin, which includes considerable surface water inflows. For the San Jacinto model, CI cards were scaled up to represent Full Authorized Diversion conditions.

In order to create a Full Authorized Diversions With Return Flows model, a program was developed to extract Run 8 return flows and insert them into the Run 3 model. The program scanned the Run 8 and Run 3 models and, for each model, developed a table of several parameters included on the WR (Water Right) cards. These included the control point, use, priority number, return flow parameters (Run 8 only), and water right identifier. The two tables were then compared and, for diversions with matching parameters, the Run 8 return flow data was copied into the corresponding Run 3 diversion. Non-matching records, or records for which no change was necessary, were not altered.

Year 2060 SV/SA (Storage Volume/Surface Area) records (if available) giving surface area and volume relationships for reservoirs replaced the existing Year 2000 SV/SA records to account for the loss of reservoir storage volume from the effects of sedimentation over time. For the Neches Trinity, Trinity-San Jacinto, and San Jacinto models, no other changes required consideration. Two of the basins, the Trinity and the Brazos/San Jacinto-Brazos, required modification due to the presence of WMS in portions of the basins located in areas outside of Region H.

For the Trinity model, upstream strategies from Region C were included. Sections of code related to these strategies were copied from a file representing Region C's WMS for the TWDB Streamflow Assessment Study found in the 2007 SWP. This file was provided by TWDB. In addition to altering the Strategy D DAT file, changes were also made to the DIS file due to the addition of several control points. For the Brazos/San Jacinto-Brazos model, changes were made based on Region G's 2001 WMS (Brazos G Regional Water Planning Group 2001) as modeled in the same TWDB study. As with the Trinity model, changes for Strategy D were made to both the DAT and DIS files. The resultant models, identified as D<sub>0</sub> models, represent Year 2060 conditions with Full Authorized Diversions and expected return flows, upstream WMS, and no term water rights. However, the D<sub>0</sub> model contained no Region H strategies.

## 2.2 2011 RWP WMS Models

Nineteen of the new WMS for the 2011 RWP were deemed suitable for modeling. The primary reason for a majority of unmodeled strategies was that the WMS generated no new yield but rather simply facilitated implementation of another strategy (either from the 2006 or 2011 RWP). Examples of this situation include major WWP treatment and transmission projects. The 19 strategies which were modeled are listed in Table 2-1 below, which describes the modeling methodology used for each WMS.

**Table 1-1.**  
**WMS Methodology**

<b>Model ID</b>	<b>WMS Name</b>	<b>Modeling Methodology</b>
IGW	Interim Strategies	Add CI cards to reflect return flows from points of use.
NWL	New Groundwater Wells for Livestock	Add CI cards to reflect return flows from points of use.
FRU	Fulshear Reuse	Reduce return flows (CI cards) at participating WUGs.
COH	COH GRP	Return flows from WUGs getting more groundwater. No change at converting WUGs (change return flow source from GW to SW only)
CMC	City of Missouri City GRP	Return flows from WUGs getting more groundwater or ASR. For reuse divert WWTP discharge with appropriate return flow.
M25	Fort Bend MUD 25 GRP	For direct reuse reduce CI card for WWTP discharge.
NFB	NFBWA GRP	Return flows from WUGs getting more groundwater. No change at converting WUGs (change return flow source from GW to SW only)
NHC	NHCRWA GRP	Return flows from WUGs getting more groundwater. No change at converting WUGs (change return flow source from GW to SW only)
SJW	SJRA WRAP	Return flows from WUGs getting more groundwater or Lake Conroe water.
SLG	Sugar Land GRP	Return flows from WUGs getting more groundwater. For reuse divert WWTP discharge with appropriate return flow.
WHC	WHCRWA GRP	Return flows from WUGs getting more groundwater. No change at converting WUGs (change return flow source from GW to SW only)
WCS	CLCND West Chambers System	Reflect return flows from points of use.
GOC	GCWA Off-channel Reservoir	Add off-channel diversion and reservoir
MCR	Montgomery MUD 8/9 Indirect Reuse	Reuse diversion with appropriate return flows.
GCR	GCWA Reclaimed Water from COH	Add CI cards to reflect return flows from points of use.
RMI	Wastewater Reclamation for Mun. Irrigation	Reduce return flows (CI cards) at participating WUGs.
FBO	Fort Bend County Off-Channel Reservoir	Add off-channel diversion and reservoir.
BSW	BWA Brackish Groundwater	Add CI cards to reflect return flows from points of use.
BCO	Brazoria County Off-Channel Reservoir	Add off-channel diversion and reservoir.
BII	Brazoria Co Interruptible Supplies for Irrigation	Add interruptible diversions

# Section 3 – WMS Impacts to Environmental Flows

## 3.1 B&E Inflows

WRAP strategy model output was used to determine effects of WMS implementation on B&E flows into Galveston Bay for the Year 2060 condition. Targets were examined primarily in terms of frequency of target attainment (FTA) for B&E inflow targets recommended by the TWDB and Texas Parks and Wildlife Department. There are three sets of targets designed for maintaining fisheries. These are:

- Max H – sequence of monthly inflows for maximum B&E fisheries harvest
- Min Q – sequence of monthly inflows that minimizes the annual volume needed to maintain the B&E fisheries harvest
- Min Q-Sal – sequence of monthly inflows that maintains B&E salinity constraint

Monthly values for all three annual targets for the Galveston Bay system are given in *Table ES-2* below. In general, Max H represents a target condition for ultimate production while Min Q-Sal represents a base condition that must be maintained on a more reliable basis.

**Table 3-1**  
**Monthly Galveston Bay Inflow Targets**

Month	Max H	Min Q	Min Q-Sal
1	150,500	150,500	150,490
2	155,200	216,700	216,700
3	652,800	363,900	363,900
4	632,500	352,600	267,270
5	1,273,700	679,700	309,970
6	839,700	448,100	413,560
7	211,500	232,700	211,500
8	140,000	154,000	140,000
9	103,000	330,200	102,960
10	78,600	251,900	78,600
11	351,500	351,500	164,390
12	626,800	626,800	93,870
<b>TOTAL</b>	<b>5,215,800</b>	<b>4,158,600</b>	<b>2,513,210</b>

Region H formally adopted GBFIG-proposed frequencies for meeting TWDB flow targets during the 2001 cycle of Regional Water Planning. GBFIG proposed a 50 percent frequency of attainment for Max H, 60 percent for Min Q, and 75 percent for Min Q-Sal (2006 Region H RWP). GBFIG-proposed frequencies were presented to the Region H Planning Group during the 2001 Regional Water Planning cycle and were adopted by the Region H Planning Group for the 2001 RWP. For additional information and documentation, please see the 2001 and 2006 Region H RWPs. However, the

GBFIG recommendations do not explicitly address how to measure frequency of attaining these targets, nor do they define a desired frequency for the seasonality (i.e., monthly distribution) of freshwater inflows. For this study, the recommended annual frequency was used as a placeholder for the evaluation of seasonal variations (i.e., monthly distribution). Targets were assumed to be attained for a time period in which the flow met or exceeded the target.

There are several considerations that should be taken into account when interpreting the FTA results. A concern with the approach taken is the validity of assuming that annual GBFIG targets are applicable on a seasonal or monthly basis. Sub-annual time scales are clearly of importance; it is mathematically possible to meet an annual flow target while flows for one or more months could be low enough to be ecologically inadequate. Whether FTA is more critical for some seasons or months than others has not yet been established. The application of the annual GBFIG FTA to monthly targets was made due to a lack of a more reasonable alternative and should be studied further.

While the purpose of this study is not to evaluate B&E needs or develop new flow targets or FTA, the underlying assumption that B&E flow needs are met if the desired FTA is achieved must be considered critically. One potential concern is that this approach does not consider a bracket of flows, but only if the flow equals or exceeds the desired B&E flow. This does not account for the possibility that, in some circumstances, excessive flows may also result in less than optimum conditions. It is important to remember that the State's Max H, Min Q, and Min Q-Sal flow regimes are not made up of individual flow targets but rather represent optimal harvest when all 12 months in a year are at or near the monthly target. However, Espey Consultants (2008) has noted that the pattern of flows defined by Max H does not occur historically; in order to meet the 50% frequency on Max H, the monthly Max H targets would have to be bracketed by  $\pm 1,045$  percent.

Seasonal FTA is shown in *Table 3-2* below, with monthly FTA shown in *Table 3-3*. Changes from the base model are shown in bold text.

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**Table 3-2**  
**Seasonal Frequency of Target Attainment for B&E Flow Targets**

<b>Max H</b>																					
<b>Season</b>	<b>Base</b>	<b>BCO</b>	<b>BII</b>	<b>BSW</b>	<b>CMC</b>	<b>COH</b>	<b>FBO</b>	<b>FRU</b>	<b>GCR</b>	<b>GOC</b>	<b>IGW</b>	<b>M25</b>	<b>MCR</b>	<b>NFB</b>	<b>NHC</b>	<b>NWL</b>	<b>RMI</b>	<b>SJW</b>	<b>SLG</b>	<b>WCS</b>	<b>WHC</b>
Spring	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%
Summer	70%	70%	70%	70%	70%	71%	70%	70%	71%	70%	70%	70%	71%	70%	70%	70%	71%	70%	70%	71%	70%
Winter	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%

<b>Min Q</b>																					
<b>Season</b>	<b>Base</b>	<b>BCO</b>	<b>BII</b>	<b>BSW</b>	<b>CMC</b>	<b>COH</b>	<b>FBO</b>	<b>FRU</b>	<b>GCR</b>	<b>GOC</b>	<b>IGW</b>	<b>M25</b>	<b>MCR</b>	<b>NFB</b>	<b>NHC</b>	<b>NWL</b>	<b>RMI</b>	<b>SJW</b>	<b>SLG</b>	<b>WCS</b>	<b>WHC</b>
Spring	64%	64%	64%	64%	64%	65%	64%	64%	65%	65%	64%	64%	65%	65%	64%	64%	65%	64%	64%	65%	64%
Summer	40%	40%	40%	40%	40%	41%	40%	40%	41%	40%	40%	40%	41%	40%	40%	40%	41%	40%	40%	41%	40%
Winter	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%

<b>Min Q-Sal</b>																					
<b>Season</b>	<b>Base</b>	<b>BCO</b>	<b>BII</b>	<b>BSW</b>	<b>CMC</b>	<b>COH</b>	<b>FBO</b>	<b>FRU</b>	<b>GCR</b>	<b>GOC</b>	<b>IGW</b>	<b>M25</b>	<b>MCR</b>	<b>NFB</b>	<b>NHC</b>	<b>NWL</b>	<b>RMI</b>	<b>SJW</b>	<b>SLG</b>	<b>WCS</b>	<b>WHC</b>
Spring	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%
Summer	70%	70%	70%	70%	70%	71%	70%	70%	71%	70%	70%	70%	71%	70%	70%	70%	71%	70%	70%	71%	70%
Winter	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%

**Table 3-3a**  
**Monthly Frequency of Target Attainment for B&E Flow Targets – Max H**

Max H																					
Month	Base	BCO	BII	BSW	CMC	COH	FBO	FRU	GCR	GOC	IGW	M25	MCR	NFB	NHC	NWL	RMI	SJW	SLG	WCS	WHC
Jan	84%	84%	84%	84%	84%	85%	84%	84%	85%	84%	84%	84%	84%	84%	84%	84%	84%	85%	84%	84%	84%
Feb	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%
Mar	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Apr	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%
May	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%	48%
Jun	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%	37%
Jul	47%	47%	47%	47%	47%	47%	47%	47%	48%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%
Aug	65%	65%	65%	65%	65%	66%	65%	65%	66%	65%	65%	65%	65%	65%	65%	65%	64%	65%	65%	65%	65%
Sep	91%	91%	91%	91%	91%	92%	91%	91%	92%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	92%
Oct	78%	78%	78%	78%	78%	80%	79%	78%	81%	78%	78%	78%	78%	78%	78%	78%	78%	80%	78%	78%	79%
Nov	47%	47%	47%	47%	47%	48%	48%	47%	48%	47%	48%	47%	47%	47%	48%	47%	47%	48%	47%	47%	48%
Dec	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	46%	47%	47%	47%	47%



**Table 3-3b**  
**Monthly Frequency of Target Attainment for B&E Flow Targets – Min Q**

Min Q																					
Month	Base	BCO	BII	BSW	CMC	COH	FBO	FRU	GCR	GOC	IGW	M25	MCR	NFB	NHC	NWL	RMI	SJW	SLG	WCS	WHC
Jan	84%	84%	84%	84%	84%	85%	84%	84%	85%	84%	84%	84%	84%	84%	84%	84%	84%	84%	85%	84%	84%
Feb	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Mar	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%
Apr	69%	69%	69%	69%	69%	70%	69%	69%	70%	69%	70%	69%	69%	70%	69%	69%	69%	69%	70%	69%	69%
May	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%	64%
Jun	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	56%	55%	56%	56%	56%
Jul	44%	44%	44%	44%	44%	45%	44%	44%	45%	44%	44%	44%	44%	45%	44%	44%	44%	44%	44%	44%	44%
Aug	51%	51%	51%	51%	51%	53%	51%	51%	54%	51%	51%	51%	51%	52%	51%	51%	51%	50%	53%	51%	51%
Sep	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%
Oct	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
Nov	47%	47%	47%	47%	47%	48%	48%	47%	48%	47%	48%	47%	47%	48%	47%	48%	47%	47%	48%	47%	47%
Dec	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	46%	47%	47%	47%

**Table 3-3c**  
**Monthly Frequency of Target Attainment for B&E Flow Targets – Min Q-Sal**

Min Q-Sal																					
Month	Base	BCO	BII	BSW	CMC	COH	FBO	FRU	GCR	GOC	IGW	M25	MCR	NFB	NHC	NWL	RMI	SJW	SLG	WCS	WHC
Jan	84%	84%	84%	84%	84%	85%	84%	84%	85%	84%	84%	84%	84%	84%	84%	84%	84%	84%	85%	84%	84%
Feb	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Mar	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%	69%
Apr	75%	75%	75%	75%	75%	76%	75%	75%	76%	75%	75%	75%	75%	75%	75%	75%	75%	75%	76%	75%	75%
May	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
Jun	58%	58%	58%	58%	58%	59%	58%	58%	59%	58%	58%	58%	58%	58%	58%	58%	58%	58%	59%	58%	58%
Jul	47%	47%	47%	47%	47%	47%	47%	47%	48%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%
Aug	65%	65%	65%	65%	65%	66%	65%	65%	66%	65%	65%	65%	65%	65%	65%	65%	65%	64%	65%	65%	65%
Sep	91%	91%	91%	91%	91%	92%	91%	91%	92%	91%	91%	91%	91%	92%	91%	91%	91%	91%	91%	91%	91%
Oct	78%	78%	78%	78%	78%	80%	79%	78%	81%	78%	78%	78%	78%	79%	78%	78%	78%	78%	80%	78%	78%
Nov	73%	73%	73%	73%	73%	74%	74%	73%	74%	73%	73%	73%	73%	74%	73%	73%	73%	73%	73%	73%	73%
Dec	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%

As can be seen from the tables above, the WMS modeled have very little impact on frequency of target attainment. For the adopted goal frequencies of attainment (50 percent for Max H, 60 percent for Min Q, and 75 percent for Min Q-sal), the base model itself fails to reach the desired FTA for a number of months and seasons. At a seasonal level, none of the new WMS examined alters FTA more than 0.7 percent. At the monthly level, changes were noted in greatest amounts for COH GRP, Wastewater Reuse for Municipal Irrigation, GCWA Reclaimed Water from COH, SJRA WRAP, and WHCRWA GRP; these changes were shown to occur primarily between August and October. However, FTA changes by less than four percent from the base model (typically no change). This indicates that on an individual basis the WMS have little impact on B&E flows. A similar conclusion was drawn from the results of the first biennium *Environmental Flows Study*.

## 3.2 Instream Flows

A list of 26 segments with the potential to be impacted by Region H WMS was developed from a compilation of segments studied in the TWDB Streamflow Assessment found in the 2002 SWP. Regulated flows at the 26 segments were determined for the base ( $D_0$ ) models as well as for all WMS models. Based on monthly results for the model simulation period, 10th percentile flows were calculated to investigate low flow conditions. For each WMS, 10th percentile flows at each of the 26 segments were compared to the  $D_0$  models. For each WMS, the stream segment with the greatest (absolute) percentage difference from the base model was considered to be the most critical segment for that strategy (see *Exhibit 2*). For the 18 strategy models, six segments were identified in the Brazos, San Jacinto-Brazos and San Jacinto Basins as being particularly influenced by Region H WMS. A summary of the most impacted segments is presented in *Table 4-1*.

**Table 4-1**  
**Impacts of WMS Implementation on Critical Stream Segments**

WRAP Identifier	Basin	Strategy	10th Percentile Flows		
			$D_0$ (ac-ft)	Strategy (ac-ft)	Change (%)
CON111	Brazos	Braz. Int. Irrigation	47,571	44,972	-5.5
		GCWA Off-Channel		44,972	-5.5
		BWA Brackish GW		45,510	-4.3
		Sugar Land GRP		44,623	-6.2
BRBR59	Brazos	Brazoria OCR	49,304	47,695	-3.3
		Missouri City GRP		46,698	-5.3
		Fulshear Reuse		47,854	-2.9
		FBC MUD 25 Reuse		48,063	-2.5
		GCWA Reclaimed		46,088	6.5
		NFBWA GRP		47,213	-4.2
		New Wells for Livestock		46,424	-5.8
		Reclamation Mun. Irr.		47,248	-4.2
532801	Brazos	Fort Bend OCR	41,101	40,513	-1.4
SJGBC3	San Jacinto-Brazos	Interim Strategies	1,955	2,113	8.0
A5191P	San Jacinto	WHCRWA GRP	59,845	60,532	1.2
SPSP	San Jacinto	NHCRWA GRP	1,460	1,727	18.2
		SJRA WRAP		3,311	126.3
1009	San Jacinto	COH GRP	1,996	2,116	6.1

In the San Jacinto and San Jacinto-Brazos basins, the WMS showed increases in 10<sup>th</sup> percentile flow at critical segments, primarily due to increased return flows from points of use from WUGs increasing their usage of groundwater over time. Note that at the same time that these WUGs are increasing their groundwater use, other WUGs participating in the same GRPs will be converting to surface water, so that the total percentage of water usage in the GRP group will be within subsidence district limits. Increased return flows from WUGs converting from groundwater to surface water were not modeled as return flows would for those WUGs would simply shift from groundwater-based to surface water-based. Ultimately, the changes in 10<sup>th</sup> percentile flow caused by GRPs is largely an artifact of increasing demand. The increase in 10<sup>th</sup> percentile flows for Interim Strategies is also caused by increased groundwater-based return flows from point-of-use WUGs.

The most highly impacted segments in the Brazos basin all showed decreases in 10<sup>th</sup> percentile flows, although changes tended to be relatively small (6.2 percent or less). This reduction in flows is not surprising for reclamation / reuse strategies, as flows that would formerly move downstream are reduced. The reduction in flow caused by Brazoria County Interruptible Supplies for Irrigation is also reasonable, as a greater volume of water is being diverted beyond the firm yield of existing permits (possibly during lower-flow periods). Similarly, the GCWA Off-Channel Reservoir, Fort Bend OCR, and Brazoria County OCR would firm up interruptible portions of flow, resulting in greater total diversions from the stream system. The reduction in flow caused by the Missouri City and Sugar Land GRPs may initially seem counterintuitive, as the remaining GRPs listed resulted in positive increases in streamflow. However, please note that these two GRPs also include a reuse component which could lower 10<sup>th</sup> percentile flows at some locations.

## Section 4 - Conclusions

As shown in the sections above, the impacts of new individual WMS as detailed in the 2011 Region H RWP are not anticipated to create major impacts to B&E flows, nor to substantially reduce low (10<sup>th</sup> percentile) flows at critical stream segments. Frequencies of attaining B&E flow targets at GBFIG-established frequencies was almost unchanged, with changes noted for only a few strategies; even for those strategies, changes were within two percentage points of the base model. Both positive and negative changes to 10th percentile flows at critical segments were found, with positive changes occurring in the San Jacinto and San Jacinto-Brazos basins and negative changes in the Brazos basin. Overall, the negative changes were relatively small, ranging from 2.5 to 6.2 percent reduction in 10<sup>th</sup> percentile flow at the critical segments. The impact to critical stream segment low flows should be considered when evaluating WMS, particularly for projects consisting wholly or partly of reuse. Overall, however, the small magnitude of change for critical segments and the limited impacts on B&E inflow suggests that the seventeen WMS are not likely to individually create substantial alterations to B&E inflows or critical stream segment low flows.

Whether these strategies will have an additive effect when implemented together is unknown; based on the results of the 1<sup>st</sup> biennium *Environmental Flows Study*, it is possible that greater impacts would be realized with when the projects are operating simultaneously. More study would be required to determine if this is the case for new WMS.

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**Attachment N:**

Amended excerpts from Chapter 5: Impacts of Management Strategies on Water Quality and Impacts of Moving Water from Rural and Agricultural Areas





- LLWSSSC Surface Water Project
- Luce Bayou Transfer
- NFBWA Internal Distribution
- NFBWA Shared Transmission Line
- NHCRWA Internal 2010 Distribution
- NHCRWA Internal 2020 Distribution
- NHCRWA Internal 2030 Distribution
- NHCRWA Transmission 2010
- NHCRWA Transmission 2020
- NHCRWA Transmission 2030
- Pearland SWTP
- Sealy GW Treatment Expansion
- WHCRWA Internal Distribution
- WHCRWA Transmission Line

**Reservoir Strategies:**

- Allens Creek Reservoir
- Brazoria County Off-channel Reservoir
- Dow Off-Channel Reservoir
- Fort Bend County Off-channel Reservoir
- GCWA Off-channel Reservoir

**Reuse Strategies:**

- Fulshear Reuse
- GCWA Reclaimed Water from City of Houston
- Houston Indirect Reuse
- Montgomery MUD 8/9 Indirect Reuse
- NHCRWA Indirect Reuse
- Wastewater Reuse for Industry
- Wastewater Reclamation for Mun. Irrigation

**Permit Strategies:**

- BRA System Operations Permit
- Houston Bayous Permit

**Other Strategies:**

- Brazoria Co. Interruptible Supplies for Irr.
- Freeport Desalination Plant
- Brazos Saltwater Barrier

**Alternative Water Management Strategies**

- Montgomery MUD 8/9 Brackish Water Desalination
- Sabine to Region H Transfer
- Little River Off-channel Reservoir

The following paragraphs discuss the impacts of each management strategy on the chosen water quality parameters.

Increased Groundwater Usage, including Expanded Use of Groundwater, Interim Groundwater, and New Groundwater Wells, is not expected to have significant environmental effects. Groundwater within the Region is generally of good quality and available at the point of use. Increases in well pumping will also contribute to return flows in all river basins in Region H. The return flows will increase in proportion to increased groundwater use and significantly contribute to flows into Galveston Bay. Increased and interim groundwater pumping in the region will continue to be monitored by groundwater regulatory agencies since excessive pumping can lead to land subsidence and exacerbate flooding and drainage problems.

operated as “scalping reservoirs”. During times of high flow, water quality in the Brazos River is often poor in terms of suspended solids due to increased sediment loads. At the same time, that water is of better quality in terms of dissolved solids concentrations since the salt being introduced into the Brazos in its upper reaches is diluted. The water that is diverted and stored in reservoirs would allow sediments to settle and accordingly water released from the reservoir would potentially have less sediment concentration. However, reduced sediment loads may have negative impacts on habitats relying on sediments downstream of the proposed reservoirs. Nutrients such as nitrogen and phosphorous are often attached to fine sediment particles that settle in reservoirs reducing nutrient loads to downstream aquatic species. Water that is released from the reservoirs during low flow conditions would have a beneficial effect by diluting the low flow salt concentration in the river. The GCWA Off-channel Reservoir is not expected to create any new water quality issues. The reservoir will allow the GCWA to use supplies from existing water right permits more efficiently.

New Contracts from Existing Supplies, including Expand/Increase Current Contracts, Reallocation of Existing Supplies, CLCND West Chambers System, Brazoria County Interruptible Irrigation, the TRA to Houston Contract, the TRA to SJRA Contract, and Groundwater Reduction Plans (GRPs) are not expected to create any new water quality issues. Fully utilizing existing water supplies may amplify some existing concerns, particularly contaminant concentrations due to reduced opportunities for in-stream dilution. The continued return of flows via wastewater treatment facility discharges will provide some mitigation of that effect. Typical municipal return flows are 60 percent of the total quantity diverted for use.

The Luce Bayou Interbasin Transfer will potentially improve the quality of Lake Houston, due to the blending with water from the Trinity River. However, recent studies performed by the Luce Bayou program have not indicated that this will be the case. Transfers such as this allow an increased opportunity for invasive species migration from the source to receiving waters. Additionally, the transfer will potentially reduce flow in the Trinity River below Dayton, because the Lake Livingston water rights are not fully utilized today. The effects of this reduced flow in the Trinity are mitigated by the existence of the Wallisville Saltwater Barrier at the mouth of the river, which maintains a minimum river level for navigation and prevents the migration of brackish water upstream.

Wastewater Reuse by Houston, GCWA, NHCRWA and Fort Bend MUD 25, Montgomery County MUDs 8&9, Wastewater Reuse for Industry, and reuse strategies implemented as part of a Groundwater Reduction Plan (GRP) will potentially reduce in-stream flows, thus concentrating any in-stream contaminants. However, the reuse process should remove a portion of the waste load discharged from these facilities, either through the secondary treatment process or simply by the rerouting of effluent. A concern for this strategy would be the disposal method for any liquid wastes from the secondary treatment. In the case of industrial reuse, the reverse-osmosis discharge water would be injected into the bottom of the Houston Ship Channel, into an already brackish zone. The Houston Ship Channel is dredged to a depth of 45-feet (five times the depth of Galveston Bay) with fresh water flowing to the bay at the top and salt water returning on the tides at the bottom. The reverse-osmosis discharge and resultant mixing would be in the salt water layer at the bottom of this channel, increasing the salinity in the brackish zone. Further investigation will be required to determine the full environmental impacts of the reverse osmosis discharge. This reuse is not projected to occur until a time when the overall water use of the region has increased. Wastewater return flows will increase proportionally, so that the reuse of this portion will not constitute a significant reduction below current return flows.

Infrastructure and transmission line expansions including the COH infrastructure expansion, CHCRWA, NFBWA, NHCRWA, and WHCRWA transmission lines, SJRA WRAP and Water Treatment Plant strategies for Brazosport Water Authority, Pearland, Huntsville, Harris County MUD #50, Sealy and the Lake Livingston Water Supply and Sewer Service Company (LLWSSSC) are not expected to create any new water quality issues. The water management strategies are associated with the transmission of existing supplies to new and increased contractual demands of each wholesale water provider.

**Attachment O:**

Summary of database entries anticipated for DB12



**DB12 Entries: GCWA Reclaimed Water from City of Houston**

**WMS Project**

<b>Sponsor Region:</b>	H
<b>WMS Project ID:</b>	
<b>WMS Project Name:</b>	GCWA RECLAIMED WATER FROM COH
<b>WMS Description:</b>	Reclaimed wastewater from the COH Southwest WWTP.
<b>WMS Type:</b>	R : REUSE
<b>WMS Infrastructure:</b>	PIPELINE
<b>Additional RWPGs:</b>	None
<b>Included in State Water Plan:</b>	Y

**Source(s)**

Source Region	Source Name	County Name	Basin Name	Source ID	Source Type
H	ECT REUSE HARRIS CO	HARRIS	SAN JACINTO	3510101	R
<b>Is Source Supply selected for Rollup?</b>				Y	
<b>Is Source Cost selected for Rollup?</b>				Y	

<b>County Name:</b>	HARRIS	<b>Water Quality Improvements</b>	WATER QUALITY IMPRO
<b>County ID:</b>	101	<b>Online Data</b>	2020
<b>Basin Name:</b>	SAN JACINTO	<b>WMS Funding Date</b>	2020
<b>Basin ID:</b>	10		
<b>Include in State Water Plan?</b>			Y
<b>Include WMS Source Total Yield numbers in WMS Project Total Yield Rollup?</b>			Y
<b>Include WMS Source Cost numbers in WMS Project Cost Rollup?</b>			Y

1.	<b>Sponsor Region:</b>	H					
	<b>WWP Name:</b>	GULF COSAT WATER AUTHORITY					
	<b>Total Strategy Supply Volume for this WWP:</b>	2010:	2020:	2030:	2040:	2050:	2060:
		0	56,896	56,896	56,896	56,896	56,896

<b>Recommendation Type?</b>	Recommended					<b>Is Used to Meet Need?</b>	Y					<b>IBT?</b>	Y
<b>Include WWP WMS Cost numbers in WMS Source Cost Rollup?</b>	Y												
<b>WWP WMS Annual Cost:</b>	2010:	2020:	2030:	2040:	2050:	2060:	\$0	\$7,912,181	\$7,912,181	\$2,319,051	\$2,319,051	\$2,319,051	
<b>WWP Capital Costs:</b>	\$66,840,044												
<b>Term of Debt Service:</b>	20												

DB12 Entries: COH to GCWA Contract

WMS Project

Sponsor Region:	H
WMS Project ID:	
WMS Project Name:	COH TO GCWA CONTRACT
WMS Description:	COH to GCWA contract
WMS Type:	R : REUSE
WMS Infrastructure:	NO INFRASTRUCTURE
Additional RWPGs:	None
Included in State Water Plan:	Y

Source(s)

Source Region	Source Name	County Name	Basin Name	Source ID	Source Type
H	ECT REUSE HARRIS CO	HARRIS	SAN JACINTO	3510101	R
Is Source Supply selected for Rollup?				Y	
Is Source Cost selected for Rollup?				Y	

County Name:	HARRIS	Water Quality Improvements	: NO WATER QUALITY IMPROVEME
County ID:	101	Online Data	2020
Basin Name:	SAN JACINTO	WMS Funding Date	2020
Basin ID:	10		
Include in State Water Plan?			Y
Include WMS Source Total Yield numbers in WMS Project Total Yield Rollup?			Y
Include WMS Source Cost numbers in WMS Project Cost Rollup?			Y

1.	Sponsor Region:	WWP Name:					
	H	GULF COAST WATER AUTHORITY					
		2010:	2020:	2030:	2040:	2050:	2060:
	Total Strategy Supply Volume for this WWP:	0	56,896	56,896	56,896	56,896	56,896

Recommendation Type?	Is Used to Meet Need?						IBT?
Recommended	Y						Y
Include WWP WMS Cost numbers in WMS Source Cost Rollup?		Y					
	2010:	2020:	2030:	2040:	2050:	2060:	
WWP WMS Annual Cost:	\$0	\$0	\$0	\$0	\$0	\$0	\$0
WWP Capital Costs:							\$0
Term of Debt Service:							0

DB12 Entries: GCWA to WUG Contracts

WMS Project

Sponsor Region:	H
WMS Project ID:	H07-WUGC10
WMS Project Name:	BGC
WMS Description:	Contract with Gulf Coast Water Authority
WMS Type:	R : REUSE
WMS Infrastructure:	PIPELINE
Additional RWPGs:	None
Included in State Water Plan:	Y

Source(s)

Source Region	Source Name	County Name	Basin Name	Source ID	Source Type
H	ECT REUSE HARRIS CO	HARRIS	SAN JACINTO	3510101	R
Is Source Supply selected for Rollup?				Y	
Is Source Cost selected for Rollup?				Y	

County Name:	HARRIS	Water Quality Improvements	WATER QUALITY IMPRO
County ID:	101	Online Data	2020
Basin Name:	SAN JACINTO	WMS Funding Date	2020
Basin ID:	10		
Includes in State Water Plan			Y
Include WMS Source Total Yield numbers in WMS Project Total Yield Rollup?			Y
Include WMS Source Cost numbers in WMS Project Cost Rollup?			Y

WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:	Basin Name:			
H	ALVIN	NONE	080013000	BRAZORIA	SAN JACINTO-BRAZOS			
			2010:	2020:	2030:	2040:	2050:	2060:
Total Strategy Supply Volume for this WUG:			0	0	41	84	152	229
Is WUG selected for Rollup?			Y					
Is WUG Cost selected for Rollup?			Y					

Recommendation Type?	Is Used to Meet Need?	IBT?				
Recommended	Y	Y				
Seller's Name:	Seller's Alpha:	WWP ID:	WUG ID:			
GULF COAST WATER AUTHORITY	325	120108170	N/A			
Recursive WMS Supply?:	Recursive WMS Project ID:					
N						
Include WUG WMS Cost numbers in WMS Source Cost Rollup?						
Y						
WUG WMS Annual Cost:	2010:	2020:	2030:	2040:	2050:	2060:
	\$0	\$0	\$56,995	\$116,753	\$171,891	\$237,423
WUG Capital Costs:	\$2,498,222					
Term of Debt Service:	20					

WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:	Basin Name:			
H	BACLIFF MUD	NONE	084012000	GALVESTON	SAN JACINTO-BRAZOS			
			2010:	2020:	2030:	2040:	2050:	2060:
Total Strategy Supply Volume for this WUG:			0	838	828	813	794	772
Is WUG selected for Rollup?			Y					
Is WUG Cost selected for Rollup?			Y					

Recommendation Type?	Is Used to Meet Need?	IBT?				
Recommended	Y	Y				
Seller's Name:	Seller's Alpha:	WWP ID:	WUG ID:			
GULF COAST WATER AUTHORITY	325	120108170	N/A			
Recursive WMS Supply?:	Recursive WMS Project ID:					
N						
Include WUG WMS Cost numbers in WMS Source Cost Rollup?						
Y						
WUG WMS Annual Cost:	2010:	2020:	2030:	2040:	2050:	2060:
	\$0	\$158,825	\$158,579	\$39,705	\$39,238	\$38,698
WUG Capital Costs:	\$1,359,254					
Term of Debt Service:	20					

WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:	Basin Name:			
H	BAYOU VISTA	NONE	080759000	GALVESTON	SAN JACINTO-BRAZOS			
			2010:	2020:	2030:	2040:	2050:	2060:
Total Strategy Supply Volume for this WUG:			0	217	215	211	206	200
Is WUG selected for Rollup?			Y					
Is WUG Cost selected for Rollup?			Y					

Recommendation Type?	Is Used to Meet Need?	IBT?				
Recommended	Y	Y				
Seller's Name:	Seller's Alpha:	WWP ID:	WUG ID:			
GULF COAST WATER AUTHORITY	325	120108170	N/A			
Recursive WMS Supply?:	Recursive WMS Project ID:					
N						
Include WUG WMS Cost numbers in WMS Source Cost Rollup?						
Y						
WUG WMS Annual Cost:	2010:	2020:	2030:	2040:	2050:	2060:
	\$0	\$51,861	\$51,812	\$10,510	\$10,387	\$10,240
WUG Capital Costs:	\$472,601					
Term of Debt Service:	20					

DB12 Entries: GCWA to WUG Contracts

4	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>		<b>Basin Name:</b>	
	H	CLEAR LAKE SHORES	NONE	080764000	GALVESTON		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>
				0	101	101	99	97
	<b>Total Strategy Supply Volume for this WUG:</b>							94
	<b>Is WUG selected for Rollup?</b>			Y				
	<b>Is WUG Cost selected for Rollup?</b>			Y				

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>			<b>IBT?</b>		
Recommended		Y			Y		
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>		
GULF COAST WATER AUTHORITY		325	120108170		N/A		
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>					
N							
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y					
		<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
		\$0	\$29,073	\$29,073	\$4,918	\$4,869	\$4,795
	<b>WUG WMS Annual Cost:</b>						
	<b>WUG Capital Costs:</b>		\$276,494				
	<b>Term of Debt Service:</b>		20				

5	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>		<b>Basin Name:</b>	
	H	COUNTY-OTHER	NONE	080757084	GALVESTON		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>
				0	1,228	1,213	1,191	1,164
	<b>Total Strategy Supply Volume for this WUG:</b>							1,130
	<b>Is WUG selected for Rollup?</b>			Y				
	<b>Is WUG Cost selected for Rollup?</b>			Y				

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>			<b>IBT?</b>		
Recommended		Y			Y		
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>		
GULF COAST WATER AUTHORITY		325	120108170		N/A		
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>					
N							
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y					
		<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
		\$0	\$246,029	\$245,660	\$58,741	\$58,078	\$57,243
	<b>WUG WMS Annual Cost:</b>						
	<b>WUG Capital Costs:</b>		\$2,137,743				
	<b>Term of Debt Service:</b>		20				

6	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>		<b>Basin Name:</b>	
	H	VESTON COUNTY WCID	NONE	084136000	GALVESTON		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>
				0	1,292	1,276	1,253	1,224
	<b>Total Strategy Supply Volume for this WUG:</b>							1,189
	<b>Is WUG selected for Rollup?</b>			Y				
	<b>Is WUG Cost selected for Rollup?</b>			Y				

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>			<b>IBT?</b>		
Recommended		Y			Y		
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>		
GULF COAST WATER AUTHORITY		325	120108170		N/A		
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>					
N							
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y					
		<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
		\$0	\$258,054	\$257,661	\$61,757	\$61,045	\$60,186
	<b>WUG WMS Annual Cost:</b>						
	<b>WUG Capital Costs:</b>		\$2,240,523				
	<b>Term of Debt Service:</b>		20				

7	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>		<b>Basin Name:</b>	
	H	HITCHCOCK	NONE	080279000	GALVESTON		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>
				0	801	791	777	759
	<b>Total Strategy Supply Volume for this WUG:</b>							737
	<b>Is WUG selected for Rollup?</b>			Y				
	<b>Is WUG Cost selected for Rollup?</b>			Y				

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>			<b>IBT?</b>		
Recommended		Y			Y		
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>		
GULF COAST WATER AUTHORITY		325	120108170		N/A		
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>					
N							
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y					
		<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
		\$0	\$164,988	\$164,742	\$38,501	\$38,059	\$37,519
	<b>WUG WMS Annual Cost:</b>						
	<b>WUG Capital Costs:</b>		\$1,444,037				
	<b>Term of Debt Service:</b>		20				



**DB12 Entries: GCWA to WUG Contracts**

8	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>		<b>Basin Name:</b>	
	H	KEMAH	NONE	080316000	GALVESTON		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>
				0	114	122	122	121
	<b>Total Strategy Supply Volume for this WUG:</b>							120
	<b>Is WUG selected for Rollup?</b>			Y				
	<b>Is WUG Cost selected for Rollup?</b>			Y				

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>		
Recommended		Y				Y		
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>			
GULF COAST WATER AUTHORITY		325	120108170		N/A			
<b>Recursive WMS Supply?:</b>			<b>Recursive WMS Project ID:</b>					
N								
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>			Y					
			<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>WUG WMS Annual Cost:</b>			\$0	\$22,301	\$23,880	\$7,159	\$5,776	\$5,579
<b>WUG Capital Costs:</b>			\$201,986					
<b>Term of Debt Service:</b>			20					

9	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>		<b>Basin Name:</b>	
	H	LA MARQUE	NONE	080342000	GALVESTON		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>
				0	1,342	1,326	1,302	1,272
	<b>Total Strategy Supply Volume for this WUG:</b>							1,235
	<b>Is WUG selected for Rollup?</b>			Y				
	<b>Is WUG Cost selected for Rollup?</b>			Y				

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>		
Recommended		Y				Y		
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>			
GULF COAST WATER AUTHORITY		325	120108170		N/A			
<b>Recursive WMS Supply?:</b>			<b>Recursive WMS Project ID:</b>					
N								
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>			Y					
			<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>WUG WMS Annual Cost:</b>			\$0	\$267,428	\$267,035	\$64,125	\$63,388	\$62,479
<b>WUG Capital Costs:</b>			\$2,320,604					
<b>Term of Debt Service:</b>			20					

10	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>		<b>Basin Name:</b>	
	H	LEAGUE CITY	NONE	080350000	GALVESTON		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>
				0	2,890	3,001	2,975	2,940
	<b>Total Strategy Supply Volume for this WUG:</b>							2,894
	<b>Is WUG selected for Rollup?</b>			Y				
	<b>Is WUG Cost selected for Rollup?</b>			Y				

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>		
Recommended		Y				Y		
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>			
GULF COAST WATER AUTHORITY		325	120108170		N/A			
<b>Recursive WMS Supply?:</b>			<b>Recursive WMS Project ID:</b>					
N								
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>			Y					
			<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>WUG WMS Annual Cost:</b>			\$0	\$466,357	\$487,946	\$144,327	\$121,252	\$116,035
<b>WUG Capital Costs:</b>			\$3,886,338					
<b>Term of Debt Service:</b>			20					

11	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>		<b>Basin Name:</b>	
	H	MANUFACTURING	NONE	081001084	GALVESTON		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>
				0	28,631	28,291	27,776	27,129
	<b>Total Strategy Supply Volume for this WUG:</b>							26,352
	<b>Is WUG selected for Rollup?</b>			Y				
	<b>Is WUG Cost selected for Rollup?</b>			Y				

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>		
Recommended		Y				Y		
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>			
GULF COAST WATER AUTHORITY		325	120108170		N/A			
<b>Recursive WMS Supply?:</b>			<b>Recursive WMS Project ID:</b>					
N								
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>			Y					
			<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>WUG WMS Annual Cost:</b>			\$0	#####	#####	#####	#####	#####
<b>WUG Capital Costs:</b>			\$124,034,330					
<b>Term of Debt Service:</b>			20					

**DB12 Entries: GCWA to WUG Contracts**

12	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>	<b>Basin Name:</b>	
	H	MANVEL	NONE	080721000	BRAZORIA	SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>
				0	21	18	18
	<b>Total Strategy Supply Volume for this WUG:</b>					19	20
	<b>Is WUG selected for Rollup?</b>			Y			
	<b>Is WUG Cost selected for Rollup?</b>			Y			

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>
Recommended		Y				Y
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>	
GULF COAST WATER AUTHORITY		325	120108170		N/A	
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>				
N						
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y				
	<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>WUG WMS Annual Cost:</b>	\$0	\$29,222	\$29,123	\$9,052	\$9,084	\$7,757
<b>WUG Capital Costs:</b>	\$219,256					
<b>Term of Debt Service:</b>	20					

13	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>	<b>Basin Name:</b>	
	H	PEARLAND	NONE	080457000	BRAZORIA	SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>
				0	6,342	6,498	7,004
	<b>Total Strategy Supply Volume for this WUG:</b>					7,655	8,470
	<b>Is WUG selected for Rollup?</b>			Y			
	<b>Is WUG Cost selected for Rollup?</b>			Y			

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>
Recommended		Y				Y
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>	
GULF COAST WATER AUTHORITY		325	120108170		N/A	
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>				
N						
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y				
	<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>WUG WMS Annual Cost:</b>	\$0	\$6,476,402	\$6,693,386	\$3,679,428	\$4,424,868	\$5,058,080
<b>WUG Capital Costs:</b>	\$65,464,844					
<b>Term of Debt Service:</b>	20					

14	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>	<b>Basin Name:</b>	
	H	SAN LEON MUD	NONE	084329000	GALVESTON	SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>
				0	1,389	1,372	1,347
	<b>Total Strategy Supply Volume for this WUG:</b>					1,316	1,278
	<b>Is WUG selected for Rollup?</b>			Y			
	<b>Is WUG Cost selected for Rollup?</b>			Y			

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>
Recommended		Y				Y
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>	
GULF COAST WATER AUTHORITY		325	120108170		N/A	
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>				
N						
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y				
	<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>WUG WMS Annual Cost:</b>	\$0	\$253,721	\$253,304	\$64,493	\$63,732	\$62,799
<b>WUG Capital Costs:</b>	\$2,158,601					
<b>Term of Debt Service:</b>	20					

15	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>	<b>Basin Name:</b>	
	H	SANTA FE	NONE	080743000	GALVESTON	SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>
				0	483	477	469
	<b>Total Strategy Supply Volume for this WUG:</b>					458	445
	<b>Is WUG selected for Rollup?</b>			Y			
	<b>Is WUG Cost selected for Rollup?</b>			Y			

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>
Recommended		Y				Y
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>	
GULF COAST WATER AUTHORITY		325	120108170		N/A	
<b>Recursive WMS Supply?:</b>		<b>Recursive WMS Project ID:</b>				
N						
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>		Y				
	<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>WUG WMS Annual Cost:</b>	\$0	\$103,718	\$103,571	\$23,309	\$23,039	\$22,720
<b>WUG Capital Costs:</b>	\$918,341					
<b>Term of Debt Service:</b>	20					

**DB12 Entries: GCWA to WUG Contracts**

16	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>		<b>Basin Name:</b>	
	H	TEAM ELECTRIC POWE	NONE	081002084	GALVESTON		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>
				0	1,512	1,746	2,050	2,403
	<b>Total Strategy Supply Volume for this WUG:</b>							
								2,807
	<b>Is WUG selected for Rollup?</b>			Y				
	<b>Is WUG Cost selected for Rollup?</b>			Y				

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>		
Recommended		Y				Y		
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>			
GULF COAST WATER AUTHORITY		325	120108170		N/A			
<b>Recursive WMS Supply?:</b>			<b>Recursive WMS Project ID:</b>					
N								
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>			Y					
			<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>WUG WMS Annual Cost:</b>			\$0	\$299,155	\$345,202	\$179,005	\$213,747	\$248,156
<b>WUG Capital Costs:</b>			\$4,779,876					
<b>Term of Debt Service:</b>			20					

17	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>		<b>Basin Name:</b>	
	H	TEXAS CITY	NONE	080602000	GALVESTON		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>
				0	9,258	9,148	8,981	8,773
	<b>Total Strategy Supply Volume for this WUG:</b>							
								8,521
	<b>Is WUG selected for Rollup?</b>			Y				
	<b>Is WUG Cost selected for Rollup?</b>			Y				

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>		
Recommended		Y				Y		
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>			
GULF COAST WATER AUTHORITY		325	120108170		N/A			
<b>Recursive WMS Supply?:</b>			<b>Recursive WMS Project ID:</b>					
N								
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>			Y					
			<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>WUG WMS Annual Cost:</b>			\$0	\$974,509	\$971,808	\$329,931	\$324,823	\$318,635
<b>WUG Capital Costs:</b>			\$7,315,253					
<b>Term of Debt Service:</b>			20					

18	<b>WUG Region:</b>	<b>WUG Name:</b>	<b>WUG Detail:</b>	<b>WUG ID:</b>	<b>County Name:</b>		<b>Basin Name:</b>	
	H	TIKI ISLAND	NONE	080973000	GALVESTON		SAN JACINTO-BRAZOS	
				<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>
				0	437	432	424	414
	<b>Total Strategy Supply Volume for this WUG:</b>							
								403
	<b>Is WUG selected for Rollup?</b>			Y				
	<b>Is WUG Cost selected for Rollup?</b>			Y				

<b>Recommendation Type?</b>		<b>Is Used to Meet Need?</b>				<b>IBT?</b>		
Recommended		Y				Y		
<b>Seller's Name:</b>		<b>Seller's Alpha:</b>	<b>WWP ID:</b>		<b>WUG ID:</b>			
GULF COAST WATER AUTHORITY		325	120108170		N/A			
<b>Recursive WMS Supply?:</b>			<b>Recursive WMS Project ID:</b>					
N								
<b>Include WUG WMS Cost numbers in WMS Source Cost Rollup?</b>			Y					
			<b>2010:</b>	<b>2020:</b>	<b>2030:</b>	<b>2040:</b>	<b>2050:</b>	<b>2060:</b>
<b>WUG WMS Annual Cost:</b>			\$0	\$94,791	\$94,668	\$21,092	\$20,847	\$20,577
<b>WUG Capital Costs:</b>			\$841,650					
<b>Term of Debt Service:</b>			20					

## Agenda Item 8

Consider authorizing the San Jacinto River Authority to use funds from the Region H Local Contribution Account to pay for a single audit report on 2014 Region H expenses.

# Sandersen Knox & Co, L.L.P.

Certified Public Accountants

130 Industrial Blvd., Suite 130 • Sugar Land, Texas 77478 • 281/242-3232 • Fax 281/242-3252 • www.sktx.com

San Jacinto River Authority  
P.O. Box 329  
Conroe, TX 77305

Date: 11/30/2014  
Invoice No: 18139

Reg # 4994  
PO# 15-0250

Final billing for professional services rendered in connection with the audit of the Authority's financial statements for the year ended August 31, 2014, including procedures for single audit. \$12,250.00

Requesting  
Break out

Invoice Total: \$12,250.00

RECEIVED  
DEC 03 2014

BY: ACCOUNTS PAYABLE

GF  
\$7,500

Region H \$4,750

Single Audit  
pr. John Cox  
12/8/14

RH. 14.92020

CHRISTINA -  
Please do req  
for \$4,750  
to RH. 14.92020  
Comment - ADD to  
PO 15-0250

#### W-9 Information

Entity Type: Partnership  
EIN: 26-2656371

Visa or MasterCard Accepted

Members: American Institute of Certified Public Accountants

**San Jacinto River Authority**

***STATE SINGLE AUDIT REPORT***

Year Ended  
August 31, 2014



# San Jacinto River Authority

## STATE SINGLE AUDIT REPORT

Year Ended August 31, 2014

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130 Industrial Blvd, Suite 130 • Sugar Land, Texas 77478 • 281/242-3232 • fax 281/242-3252 • www.sktx.com

**INDEPENDENT AUDITORS' REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING AND ON COMPLIANCE AND OTHER MATTERS BASED ON AN AUDIT OF FINANCIAL STATEMENTS PERFORMED IN ACCORDANCE WITH GOVERNMENT AUDITING STANDARDS**

To the Board of Directors  
San Jacinto River Authority  
Montgomery County, Texas

We have audited, in accordance with the auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards* issued by the Comptroller General of the United States, the financial statements of the business-type activities and each major fund of the San Jacinto River Authority (the "Authority") as of and for the year ended August, 31, 2014, and the related notes to the financial statements, which collectively comprise the Authority's basic financial statements, and have issued our report thereon dated November 21, 2014.

**Internal Control Over Financial Reporting**

In planning and performing our audit of the financial statements, we considered the Authority's internal control over financial reporting (internal control) to determine the audit procedures that are appropriate in the circumstances for the purpose of expressing our opinions on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of the Authority's internal control. Accordingly, we do not express an opinion on the effectiveness of the Authority's internal control.

A *deficiency in internal control* exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, misstatements on a timely basis. A *material weakness* is a deficiency, or a combination of deficiencies, in internal control, such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented, or detected and corrected on a timely basis. A *significant deficiency* is a deficiency, or a combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance.

Our consideration of internal control was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control that might be material weaknesses or, significant deficiencies. Given these limitations, during our audit we did not identify any deficiencies in internal control that we consider to be material weaknesses. However, material weaknesses may exist that have not been identified.

**Compliance and Other Matters**

As part of obtaining reasonable assurance about whether the Authority's financial statements are free from material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements, noncompliance with which could have a direct and material effect on the determination of financial statement amounts. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed no instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards*.

**Purpose of this Report**

The purpose of this report is solely to describe the scope of our testing of internal control and compliance and the results of that testing, and not to provide an opinion on the effectiveness of the entity's internal control or on compliance. This report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the entity's internal control and compliance. Accordingly, this communication is not suitable for any other purpose.

A handwritten signature in black ink, appearing to read "Grant & Co.", is written in a cursive style.

Sugar Land, Texas  
November 21, 2014



130 Industrial Blvd, Suite 130 • Sugar Land, Texas 77478 • 281/242-3232 • fax 281/242-3252 • www.sktx.com

**INDEPENDENT AUDITORS' REPORT ON COMPLIANCE FOR EACH MAJOR PROGRAM  
AND ON INTERNAL CONTROL OVER COMPLIANCE REQUIRED BY OMB CIRCULAR A-133 AND THE  
UNIFORM GRANT MANAGEMENT STANDARDS CHAPTER IV STATE OF TEXAS SINGLE AUDIT  
CIRCULAR**

To the Board of Directors  
San Jacinto River Authority  
Montgomery County, Texas

**Report on Compliance for Each Major State Program**

We have audited the San Jacinto River Authority's (the "Authority") compliance with the types of compliance requirements described in the *OMB Circular A-133 Compliance Supplement* and *Uniform Grant Management Standards Chapter IV State of Texas Single Audit Circular* that could have a direct and material effect on each of the Authority's major state programs for the year ended August 31, 2014. The Authority's major state programs are identified in the summary of auditor's results section of the accompanying schedule of findings and questioned costs.

***Management's Responsibility***

Management is responsible for compliance with the requirements of laws, regulations, contracts, and grants applicable to its state programs.

***Auditors' Responsibility***

Our responsibility is to express an opinion on compliance for each of the Authority's major state programs based on our audit of the types of compliance requirements referred to above. We conducted our audit of compliance in accordance with auditing standards generally accepted in the United States of America; the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States; *OMB Circular A-133, Audits of States, Local Governments, and Non-Profit Organizations*; and, *Uniform Grant Management Standards Chapter IV State of Texas Single Audit Circular*. Those standards and OMB Circular A-133 require that we plan and perform the audit to obtain reasonable assurance about whether noncompliance with the types of compliance requirements referred to above that could have a direct and material effect on a major state program occurred. An audit includes examining, on a test basis, evidence about the Authority's compliance with those requirements and performing such other procedures as we considered necessary in the circumstances.

We believe that our audit provides a reasonable basis for our opinion on compliance for each major state program. However, our audit does not provide a legal determination of the Authority's compliance.

***Opinion on Each Major State Program***

In our opinion, the Authority complied, in all material respects, with the types of compliance requirements referred to above that could have a direct and material effect on each of its major state programs for the year ended August 31, 2014.

## **Report on Internal Control Over Compliance**

Management of the Authority is responsible for establishing and maintaining effective internal control over compliance with the types of compliance requirements referred to above. In planning and performing our audit of compliance, we considered the Authority's internal control over compliance with the types of requirements that could have a direct and material effect on each major state program to determine the auditing procedures that are appropriate in the circumstances for the purpose of expressing an opinion on compliance for each major state program and to test and report on internal control over compliance in accordance with *OMB Circular A-133* and *Uniform Grant Management Standards Chapter IV State of Texas Single Audit Circular*, but not for the purpose of expressing an opinion on the effectiveness of internal control over compliance. Accordingly, we do not express an opinion on the effectiveness of the Authority's internal control over compliance.

*A deficiency in internal control over compliance* exists when the design or operation of a control over compliance does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, noncompliance with a type of compliance requirement of a state program on a timely basis. A *material weakness in internal control over compliance* is a deficiency, or combination of deficiencies, in internal control over compliance, such that there is a reasonable possibility that material noncompliance with a type of compliance requirement of a state program will not be prevented, or detected and corrected, on a timely basis. A *significant deficiency in internal control over compliance* is a deficiency, or a combination of deficiencies, in internal control over compliance with a type of compliance requirement of a state program that is less severe than a material weakness in internal control over compliance, yet important enough to merit attention by those charged with governance.

Our consideration of internal control over compliance was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control over compliance that might be material weaknesses or significant deficiencies. We did not identify any deficiencies in internal control over compliance that we consider to be material weaknesses. However, material weaknesses may exist that have not been identified.

## **Report on Schedule of Expenditures of State Awards Required by *OMB Circular A-133* and *Uniform Grant Management Standards Chapter IV State of Texas Single Audit Circular***

We have audited the financial statements of the business-type activities and each major fund of the Authority, as of and for the year ended August 31, 2014, and the related notes to the financial statements, which collectively comprise the Authority's basic financial statements. We issued our report thereon dated November 21, 2014, which contained unmodified opinions on those financial statements. Our audit was conducted for the purpose of forming opinions on the financial statements that collectively comprise the basic financial statements. The accompanying schedule of expenditures of state awards is presented for purposes of additional analysis as required by *OMB Circular A-133* and *Uniform Grant Management Standards Chapter IV State of Texas Single Audit Circular* and is not a required part of the basic financial statements. Such information is the responsibility of management and was derived from and relates directly to the underlying accounting and other records used to prepare the basic financial statements. The information has been subjected to the auditing procedures applied in the audit of the financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the basic financial statements or to the basic financial statements themselves, and other additional procedures in accordance with auditing standards generally accepted in the United States of America. In our opinion, the schedule of expenditures of state awards is fairly stated in all material respects in relation to the basic financial statements as a whole.

The purpose of this report on internal control over compliance is solely to describe the scope of our testing of internal control over compliance and the results of that testing based on the requirements of *OMB Circular A-133* and Uniform Grant Management Standards *Chapter IV State of Texas Single Audit Circular*. Accordingly, this report is not suitable for any other purpose.

A handwritten signature in black ink, appearing to read "Sanborn & Co.", written in a cursive style.

Sugar Land, Texas  
November 21, 2014

**SCHEDULE OF EXPENDITURES OF STATE AWARDS**

# San Jacinto River Authority

## SCHEDULE OF EXPENDITURES OF STATE AWARDS

For the Year Ended August 31, 2014

<u>STATE GRANTOR/PROGRAM TITLE</u>	<u>CONTRACT NUMBER</u>	<u>CONTRACT TERM</u>	<u>PROGRAM EXPENDITURES</u>
<b>STATE AWARDS:</b>			
<b>Texas Water Development Board</b>			
<u>Direct Program</u>			
Research and Planning Fund			
Regional Water Planning Grant	1148301319	6/22/11-3/31/15	\$ 518,619
<b>Total Texas Water Development Board</b>			<u>518,619</u>
<b>Total State Awards</b>			<u>\$ 518,619</u>



# San Jacinto River Authority

## NOTES TO SCHEDULE OF EXPENDITURES OF STATE AWARDS

### For the Year Ended August 31, 2014

#### NOTE 1 – BASIS OF ACCOUNTING

The accompanying schedule of expenditures of state awards includes the state grant activity of the San Jacinto River Authority, and is presented on the modified accrual basis of accounting. The information in this schedule is presented in accordance with the requirements of *OMB Circular A-133, Audits of States, Local Governments, and Non-Profit Organizations* and the *Uniform Grant Management Standards Chapter IV State of Texas Single Audit Circular*. Therefore, some amounts presented in this schedule may differ from amounts presented in, or used in the preparation of the financial statements.

The expenditures of state awards are reported in the San Jacinto River Authority Comprehensive Annual Financial Report, within the statement of revenues, expenditures and changes in net position. Expenditures are recorded when the liability is incurred.

State grant funds are considered to be earned to the extent of expenditures made under the provisions of the grant and, accordingly, when such funds are received, they are recorded as unearned revenues until earned. Generally, unused balances are returned to the grantor at the close of specified projects.

#### NOTE 2 – RECONCILIATION TO FINANCIAL STATEMENTS

The following is a reconciliation of state awards per the Schedule of Expenditures of State Awards ("Schedule of FFA") to Exhibit A-4 of the Comprehensive Annual Financial Report:

Expenditures of state awards per Schedule of FFA	\$	518,619
<b>Total State Awards per Schedule of FFA</b>	<b>\$</b>	<b>518,619</b>
<b>Related Expenditures per Exhibit A-4 of Comprehensive Annual Financial Report</b>	<b>\$</b>	<b>518,619</b>

**San Jacinto River Authority**  
**SCHEDULE OF FINDINGS AND QUESTIONED COSTS**  
For the Year Ended August 31, 2014

**PART I - SUMMARY OF AUDITORS' RESULTS**

**Financial Statement Section:**

Type of auditors' report issued	Unmodified
Internal control over financial reporting:	
• Material weaknesses identified?	No
• Significant deficiencies identified, but not considered to be material weaknesses?	No
• Noncompliance material to financial statements noted?	No

**State Awards Section:**

Internal control over major programs:	
• Material weaknesses identified?	No
• Significant deficiencies identified, but not considered to be material weaknesses?	No

Type of auditor's report on compliance for major programs Unmodified

Any audit findings disclosed that are required to be reported in accordance with section 501(a) OMB Circular A-133? No

Identification of Major Programs:

<u>Name of State Program</u>	<u>Contract Number</u>
Research and Planning Fund Regional Water Planning Grant	1148301319

Dollar threshold used to distinguish between Type A and Type B programs: \$300,000

Auditee qualified as a low-risk auditee? No

**PART II - FINANCIAL STATEMENT FINDINGS**

No financial statement findings were noted.

**PART III - STATE AWARD FINDINGS AND QUESTIONED COSTS**

No state award findings or questioned costs were noted.

**PART IV - STATUS OF PRIOR YEAR FINDINGS AND QUESTIONED COSTS**

No prior year findings or questioned costs were reported.

**San Jacinto River Authority**  
***SCHEDULE OF FINDINGS AND QUESTIONED COSTS***  
**For the Year Ended August 31, 2014**

**PART V - CORRECTIVE ACTION PLAN**

No corrective action plan is required to be reported.

## Agenda Item 9

Consider authorizing the San Jacinto River Authority to use funds from the Region H Local Contribution Account to pay for renewal of Directors and Officers Liability Insurance for Region H Planning Group members.



## **GREATAMERICAN. Adding to our Financial Strength!**



Great American Insurance Company receives a ratings upgrade from A.M. Best!

---

The Financial Strength Rating (FSR) of Great American Insurance Company and its pooling affiliates has been upgraded to “A+” (**Superior**).

The FSR serves as an indicator of A.M. Best’s opinion of our ability to meet ongoing insurance policy and contract obligations. That means in the unfortunate case of a claim, you can rest assured that we’ll be able to meet our obligations.

The ratings upgrade is based on A.M. Best’s opinion that Great American has sustained solid financial fundamentals, strong profitability and good market position in a diverse group of specialty niche industries.

**We’re proud of this upgrade, and Great American Insurance Company’s heritage as one of only four insurance companies that have earned an “A” or higher rating from A.M. Best for more than 100 consecutive years.**

**Want to deliver a financially strong and stable company to your clients? Give them Great American!**



Executive Liability Division  
1515 Woodfield Road, Suite 500  
Schaumburg, IL 60173-5437

**QUOTATION FOR INSURANCE**

Joanna K. Kanzia  
(847) 330-6757  
jtsergas@gaig.com

<b>Date:</b> January 6, 2015	<b>Quotation #:</b> AR9425817
<b>Proposed Insured:</b>	The Directors and Officers of: REGION H WATER PLANNING GROUP CONROE, TX 77305
<b>Agent/Broker:</b>	CRC DALLAS 13737 NOEL ROAD, 10TH FLOOR DALLAS, TX 75240 Attn: MS. CLAUDIA MARTINEZ

*Subject to the terms and conditions contained herein, GREAT AMERICAN INSURANCE CO. hereby offers to issue to the above proposed Insured:*

**Policy form:** D16100-G      Non-Profit Executive Protection and Employment Practices

**Endorsements:**

D0046TX	POLICYHOLDER NOTICE TEXAS
D16047TX	TEXAS AMENDATORY ENDORSEMENT
D16501	RATE MAKING EXCLUSION
D16518	INTERESTED PARTY EXCLUSION
DTCV_09P	COVERAGE FOR ACTS OF TERRORISM
DTDP_09P	AMENDMENT TO DECLARATIONS PAGE

**Conditions:**

*This quotation is subject to the following conditions:*  
None

Unless otherwise noted, this quote includes:  
-A \$10,000 Donor Data Loss Crisis Fund Sublimit.  
-A \$150,000 FLSA Defense Sublimit of Liability, except when EPL coverage is deleted by endorsement.

Non-Profit Executive Protection and Employment Practices

**Date:** January 6, 2015

**Quotation #:** AR9425817

<u>D &amp; O LIMIT</u>	<u>EPL LIMIT</u>	<u>FIDUCIARY LIMIT</u>	<u>RETENTION</u> (each loss) <u>D&amp;O/EPL</u>	<u>ANNUAL PREMIUM</u>
\$1,000,000	SHARED		\$2,500	\$911

**Options:**

1. PLEASE NOTE: This quote is null and void if there are any claims other than those previously disclosed.
2. \*\* A TWO-YEAR policy is available for two installments of the annual premium selected above. \*\*  
The two-year policy option must be selected prior to binding and it features:  
A fresh Limit of Liability for the second year.  
The premium is invoiced and payable in two equal annual installments  
(at the inception date and the first anniversary date).
3. Privacy and Security Coverage is available for an additional charge of \$133.

**Premium: \$911.00**  
**Broker Fee \$500.00**  
**Total: \$1,411.00**

---

**NOTE: THIS COVERAGE, SUBJECT TO ALL THE TERMS, CONDITIONS AND PROVISIONS STATED HEREIN, CAN ONLY BE BOUND BY AN AUTHORIZED EMPLOYEE OF THE EXECUTIVE LIABILITY DIVISION.**

This quotation expires at 12:01 A.M. Standard Time at the address of the company as of the end of the Policy Period of the expiring Policy. If subsequent to the date of quotation and the Effective date of the Binder there is a material change in the condition of the Proposed Insured or an occurrence of an event which could materially change the underwriting evaluation of the Proposed Insured, then, at the Insurer's option, this Quotation may be withdrawn by written notice thereof to the Proposed Insured.

---

\*\* Please note that coverage cannot be bound prior to the fulfillment of the aforementioned conditions. Only authorized employees of the Executive Liability Division can bind coverage.



## POLICYHOLDER NOTICE TEXAS

---

### IMPORTANT NOTICE

To obtain information or make a complaint:

You may call Great American's toll-free telephone number for information or to make a complaint at:

1 -800-972-3008

You may also write to Great American at:  
1515 Woodfield Road, Suite 500  
Schaumburg, Il 60173

You may contact the Texas Department of Insurance to obtain information on companies, coverages, rights or complaints at:

**1-800-252-3439**

You may write the Texas Department of Insurance:  
P. O. Box 149104  
Austin, TX 78714-9104  
Fax: (512) 475-1771  
Web: <http://www.tdi.state.tx.us>  
E-mail: [ConsumerProtection@tdi.state.tx.us](mailto:ConsumerProtection@tdi.state.tx.us)

### PREMIUM OR CLAIM DISPUTES:

Should you have a dispute concerning your premium or about a claim you should contact your insurance agent or Great American first. If the dispute is not resolved, you may contact the Texas Department of Insurance.

### ATTACH THIS NOTICE TO YOUR POLICY:

This notice is for information only and does not become a part or condition of the attached document.

### AVISO IMPORTANTE

Para obtener informacion o para someter una queja:

Usted puede llamar al numero de telefono gratis de Great American's para informacion o para someter una queja al:

1 -800-972-3008

Usted tambien puede escribir a Great American:  
1515 Woodfield Road, Suite 500  
Schaumburg, Il 60173

Puede comunicarse con el Departamento de Seguros de Texas para obtener informacion acerca de companias, coberturas, derechos o quejas al:

**1-800-252-3439**

Puede escribir al Departamento de Seguros de Texas:  
P. O. Box 149104  
Austin, TX 78714-9104  
Fax: (512) 475-1771  
Web: <http://www.tdi.state.tx.us>  
E-mail: [ConsumerProtection@tdi.state.tx.us](mailto:ConsumerProtection@tdi.state.tx.us)

### DISPUTAS SOBRE PRIMAS O RECLAMOS:

Si tiene una disputa concerniente a su prima o a un reclamo, debe comunicarse con el agente o Great American primero. Si no se resuelve la disputa, puede entonces comunicarse con el departamento (TDI).

### UNA ESTE AVISO A SU POLIZA:

Este aviso es solo para proposito de informacion y no se convierte en parte o condicion del documento adjunto.





## TEXAS AMENDATORY ENDORSEMENT

---

In compliance with the insurance regulations of the State of Texas, the Policy is amended as follows:

1. Section **IV.D.** of the Policy is deleted and replaced with the following:

**IV.** This Policy does not apply to any **Claim** made against the **Insured**:

**D.** based upon, arising out of, relating to, directly or indirectly resulting from or in consequence of, or in any way involving: (1) bodily injury, sickness, disease or death of any person, assault or battery; (2) damage to or destruction of any tangible property or the loss of use of any tangible property; or (3) humiliation, mental anguish, or emotional distress; provided, however, that part (3) of this exclusion shall not apply to any **Claim** for an **Employment Practices Wrongful Act, Personal Injury Wrongful Act, or Third Party Wrongful Act**;

2. Section **IX.A.** (2) and (3) of the Policy are deleted and replaced with the following:

(2) The Policy will only be cancelled by the **Insurer** if the **Organization** does not pay the premium when due. The **Insurer** shall provide the **Organization** with notice at least ten (10) days prior to the effective date of cancellation. The reason for cancellation shall be included in the notice of cancellation.

(3) If the **Insurer** elects not to renew this Policy, the **Insurer** shall deliver or mail written notice to the **Organization** at least sixty (60) days before the date on which the Policy expires. If the **Insurer** provides notice later than the sixtieth (60<sup>th</sup>) day before the Policy expires, the coverage shall remain in effect until the sixty-first (61<sup>st</sup>) day after the date on which **Insurer** provides written notice. The reason(s) for nonrenewal shall be included in the notice. The fact that an **Insured** is an elected official shall not be considered as a basis of nonrenewal of the Policy. Earned premium for any period of coverage that extends beyond the expiration date of the policy shall be computed pro rata based upon the premium of the expiring Policy.

Nothing herein contained shall be held to vary, alter, waive or extend any of the terms, conditions, provisions, agreements or limitations of the above mentioned Policy other than as above stated.

---

Insured: REGION H WATER PLANNING GROUP

Policy Period:

Policy Number:

Countersigned by: \_\_\_\_\_  
*Authorized Representative*

Endorsement Effective Date:



*ExecPro*<sup>sm</sup>  
Nonprofit Solution

## RATE MAKING EXCLUSION

---

It is understood and agreed that no coverage is available for any **Claim** based upon, arising out of, relating to, directly or indirectly resulting from, or in consequence of, or in any way involving any rate making proceeding, or any appeal therefrom, or any challenge brought in any forum to a rate decision or pricing structure of any **Insured**.

Nothing herein contained shall be held to vary, alter, waive or extend any of the terms, conditions, provisions, agreements or limitations of the above mentioned Policy other than as above stated.

---

Insured: REGION H WATER PLANNING GROUP

Policy Period:

Policy Number:

Countersigned by: \_\_\_\_\_  
*Authorized Representative*

Endorsement Effective Date:



*ExecPro*<sup>sm</sup>  
Nonprofit Solution

### INTERESTED PARTY EXCLUSION

---

It is understood and agreed that this Policy does not apply to any **Claim** made against any **Insured** by or for the benefit of, or at the behest of any Interested Party(ies) listed below, or any person or entity which controls, is controlled by, or is under common control with such Interested Party(ies).

Interested Party(ies)

The Texas Water Development Board and the San Jacinto River Authority

Nothing herein contained shall be held to vary, alter, waive or extend any of the terms, conditions, provisions, agreements or limitations of the above mentioned Policy other than as above stated.

---

Insured: REGION H WATER PLANNING GROUP

Policy Period:

Policy Number:

Countersigned by: \_\_\_\_\_  
*Authorized Representative*

Endorsement Effective Date:



## COVERAGE FOR ACTS OF TERRORISM

---

It is understood and agreed that the General Conditions of the Policy are amended by the addition of the following:

### **Act of Terrorism** Coverage

Subject to all other terms and conditions of this Policy, coverage is available for **Loss** caused by an **Act of Terrorism** as defined below.

“**Act of Terrorism**” means any act that is certified by the Secretary of the Treasury, in concurrence with the Secretary of State and the Attorney General of the United States –

- (i) to be an act of terrorism;
- (ii) to be a violent act or an act that is dangerous to –
  - (a) human life;
  - (b) property; or
  - (c) infrastructure;
- (iii) to have resulted in damage within the United States, or outside of the United States in the case of -
  - (a) an air carrier or vessel described in Section (5)(B) of the Terrorism Risk Insurance Act; or
  - (b) the premises of a United States mission; and
- (iv) to have been committed by an individual or individuals, as part of an effort to coerce the civilian population of the United States or to influence the policy or affect the conduct of the United States Government by coercion.

With respect to any one or more **Acts of Terrorism** under the Terrorism Risk Insurance Act, as amended in 2007, we will not pay any amounts for which we are not responsible under the terms of that Act (including subsequent action of Congress pursuant to the Act) due to the application of any clause which results in a cap on our liability for payments for terrorism losses.

No act shall be certified by the Secretary as an **Act of Terrorism** if (i) the act is committed as part of the course of a war declared by the Congress, except that this clause shall not apply with respect to any coverage for workers compensation; or (ii) property and casualty insurance losses resulting from the act, in the aggregate, do not exceed \$5,000,000.

Other than as stated above, nothing herein contained shall be held to vary, alter, waive or extend any of the terms, conditions, provisions, agreements or limitations of the Policy to

---

Insured: REGION H WATER PLANNING GROUP

Policy Period:

Policy Number:

Countersigned by: \_\_\_\_\_  
*Authorized Representative*

Endorsement Effective Date:



## AMENDMENT TO DECLARATIONS PAGE

---

It is understood and agreed that the Declarations is amended by the addition of the following:

**Act of Terrorism** Premium: \$ 0.00

It is further understood and agreed the Policyholder Disclosure of Terrorism Coverage is attached to and is to be considered as incorporated in and constituting a part of this Policy.

Other than as stated above, nothing herein contained shall be held to vary, alter, waive or extend any of the terms, conditions, provisions, agreements or limitations of the Policy to

---

Insured: REGION H WATER PLANNING GROUP

Policy Period:

Policy Number:

Countersigned by: \_\_\_\_\_  
*Authorized Representative*

Endorsement Effective Date:



## **POLICYHOLDER DISCLOSURE OF TERRORISM COVERAGE**

The Terrorism Risk Insurance Act establishes a program within the Department of the Treasury, under which the federal government shares, with the insurance industry, the risk of loss from future terrorist attacks. The Act applies when the Secretary of the Treasury certifies that an event meets the definition of an Act of Terrorism. The Act provides that, to be certified, an Act of Terrorism must cause losses of at least five million dollars and must have been committed by an individual or individuals as part of an effort to coerce the government or population of the United States.

The United States Government, Department of the Treasury, will pay a share of terrorism losses insured under the federal program. The federal share equals 85% of that portion of the amount of such insured losses that exceeds the applicable insurer retention.

The Terrorism Risk Insurance Act, as amended in 2007, contains a \$100 billion cap that limits U.S. Government reimbursement as well as insurers' liability for losses resulting from certified acts of terrorism when the amount of such losses in any one calendar year exceeds \$100 billion. If the aggregate insured losses for all insurers exceed \$100 billion, your coverage may be reduced.

In accordance with the Terrorism Risk Insurance Act, we are required to offer you coverage for losses resulting from an act of terrorism **that is certified under the federal program** as an Act of Terrorism. All other provisions of this policy will still apply to such an act. That is, a loss will not be excluded or covered just because it was caused by an Act of Terrorism.

The portion of the annual premium that is attributable to coverage for Acts of Terrorism that are certified under the Terrorism Risk Insurance Act is \$0.00.

All other terms and conditions of the policy remain unchanged.

***If you would like to reject the coverage for "certified" Acts of Terrorism, please provide Great American written confirmation of such, and an exclusion will be attached to your policy.***

## ExecPro<sup>®</sup> Nonprofit Solution

- Directors' & Officers'
- Employment Practices Liability
- Fiduciary Liability
- Employed Lawyers Coverage
- Workplace Violence Insurance

### Why Nonprofit D&O?

Nonprofit Directors and Officers have a personal liability exposure by virtue of their management of their organization and its financial assets. Employment related matters, breach of duty, and errors and omissions when making business decisions are hazards faced by Nonprofit organizations nationwide. Unfortunately, lawsuits from employees, customers, vendors and the government are becoming increasingly common against Nonprofit organizations.

### Are You Protected?

- First Dollar Defense for Qualifying Accounts
- Costs of Defense are in addition to the limit for no additional charge
- 22 types of EPL Wrongful Acts Covered
- Employed Lawyers Coverage
- Prior acts coverage
- Volunteers and Leased, Seasonal, and Part-Time employees are included as Insured Persons
- Definition of Claim includes non-monetary relief
- Third Party coverage
- Coverage for suits brought by Qualifying Independent Contractors for EPL Claims
- A \$150,000 sublimit for defense of Fair Labor Standards Acts (FLSA) Claims
- Personal Injury Coverage Backstop
- Copyright/Trademark Coverage
- Order of Payments wording
- Crisis Fund for reputational damage done due to lost or stolen donor data

### Risk Management can Prevent Future Losses

Through Jackson Lewis, a national law firm, Great American provides its policyholders:

- Access to a toll-free Hot line Service which provides complimentary telephone consultation pertaining to Employment Practices matters
- Sample workplace policies which provide guidance with respect to preserving employment-at-will status, complying with the Federal Family and Medical Leave Act, and prohibiting harassment in the workplace.
- A guide to avoiding workplace claims. The guide contains general information about employment claims, the hiring process, pre-employment testing, and other issues.
- Jackson Lewis will offer discounted billing rates to Great American insureds to assist in developing preventive practices, preparing employee handbooks and training supervisors.

### Great American Insurance Company

Great American Insurance Company is part of the Great American Insurance Group. Great American Insurance Company has been rated A (Excellent) by A.M. Best for over 100 Years. Great American Insurance Company's Nonprofit D&O primary policies are admitted in all 50 states and the District of Columbia.

Great American Insurance Group, 580 Walnut Street, Cincinnati, OH 45202. Coverage features described in this brochure are summarized. Refer to the actual policy for a full description of applicable terms, conditions, limits and exclusions. Coverage is underwritten by Great American Insurance Company. The underwriting insurers are authorized in the fifty states and the District of Columbia. Great American Insurance Company is the owner of the following registered service marks: the Great American Insurance eagle logo, and the word marks Great American<sup>®</sup>, ExecPro<sup>®</sup>, and Great American Insurance Group<sup>®</sup>. ©2008 Great American Insurance Company. All rights reserved. GAIC.2513 (1/09)

## Agenda Item 10

Receive update from Consultant Team regarding the schedule and milestones for the development of the 2016 Region H Regional Water Plan.



## Agenda Item 10 2016 RWP Schedule

Receive update from Consultant Team regarding the schedule and milestones for the development of the 2016 Region H Regional Water Plan.



## Agenda Item 10 2016 RWP Schedule

Date	Scheduled Events/Tasks
11/05/2014	RWPG Meeting: Review Chapter 4 and 7, Discuss Legislative Recommendations
12/09/2014	WMS Committee Meeting
<b>02/04/2015</b>	<b>RWPG Meeting: Review Chapters 5, 6, 8, 9, 10 (partial), and 11</b>
<b>03/04/2015</b>	<b>RWPG Meeting: Review Chapters 5, 6, 8, 9, 10 (partial), and 11</b>
04/01/2015	RWPG Meeting: Review / Approve Initially Prepared Plan
05/01/2015	DUE DATE: Initially Prepared Plan to TWDB
<b>PUBLIC PROCESS</b>	
10/07/2015	RWPG Meeting: Discuss comments to IPP
11/04/2015	RWPG Meeting: Review / Approve Final Plan
12/01/2015	DUE DATE: Final Adopted Plan to TWDB

## Agenda Item 10 2016 RWP Schedule

- Ongoing Activities
  - WMS data collection
  - Region H Database Development
  - WMS Documentation
  - Chapter Development
  - GIS Development



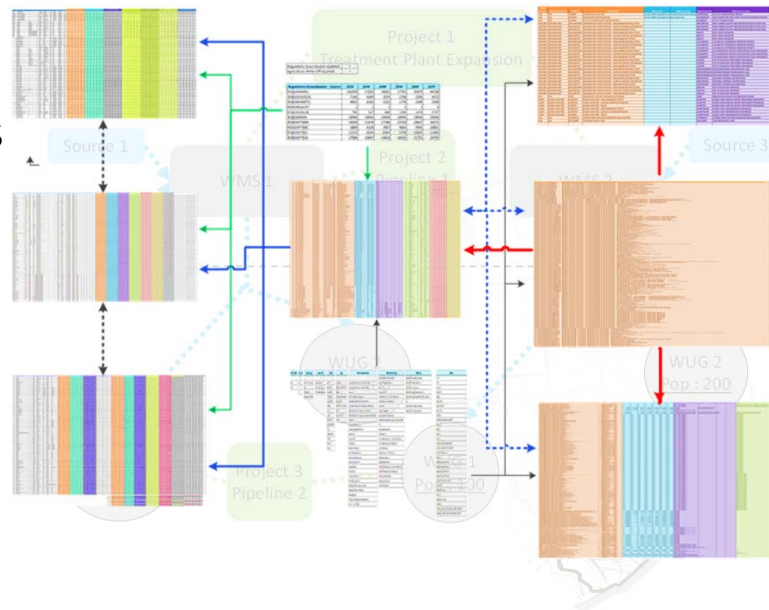
## Agenda Item 10 2016 RWP Schedule

- Data Collection
  - Suspended active data collection efforts
    - 2-year effort
  - Numerous requests not responded to or incomplete
  - Additional project on an as-available basis



## Agenda Item 10 2016 RWP Schedule

- Database Development
  - DB17 not ready for WMS entry until April
  - Interim tool to allow planning to progress
  - DB17 provides closer match to reality
  - Interim tool being developed to take advantage of new DB17 connectivity



## Agenda Item 10 2016 RWP Schedule

- WMS Documentation
  - Technical memoranda
  - Appendix 5B
  - Critical WMS and projects
  - Include ratings and WUG application information
  - Status:
    - 59 identified so far
    - 11 (19%) final
    - 41 (70%) in progress

CRITERIA	RATING	EXPLANATION
Cost	5	Low cost compared to other regional strategies but may be prohibitive compared to the current cost of water for agriculture.
Location	5	Conservation is applied at point of water use.
Water Quality	3	No known impacts to water quality.
Environmental Land and Habitat	4	Minimal impacts above existing agricultural operations.
Environmental Flows	3	Conservation may reduce return flows at the end of growing seasons but also reduces the necessary diversions for irrigation use.
Local Preference	3	Support by some proactive growers and those that own their own property and can invest in long-term improvements.
Institutional Constraints	5	Limited identified permitting obstacles.
Development Timeline	5	Projects can be implemented quickly and even off-farm methods have relatively short timelines.
Sponsorship	3	Projects may be sponsored by local farmers and irrigation water providers but interest level varies and is uncertain.
Vulnerability	5	Very limited risk to developed infrastructure.
Impacts on Other WMS	3	No known impacts to other strategies.

CRITERIA	WUG SUITABILITY
Proximity	WMS availability in the same location as irrigation water use for rice production and focused in Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, and Waller Counties.
Size	The nature of this WMS makes its yield relative to the size of irrigation operations.
Water Quality	This WMS does not produce new water but reduces need by conservation of other supplies.
Unit Cost	The unit cost for this strategy is relatively expensive for irrigation use but is one of the most cost-competitive alternatives for agriculture.
Other Factors	This strategy is suited only to irrigation demand. Actual implementation of strategies will be performed by growers or water suppliers. This process is complicated by the predominance of rice production in Region H being performed on land leased by the producer, often discouraging the long-term investment necessary to implement these programs.

## Agenda Item 10 2016 RWP Schedule

### Chapter Development

- Delivered as DRAFT
  - 1 – Description of Region
  - 2 – Projected Population and Water Demands
  - 3 – Analysis of Current Water Supplies
  - 4 – Analysis of Needs
  - 7 – Drought Response

### In Progress

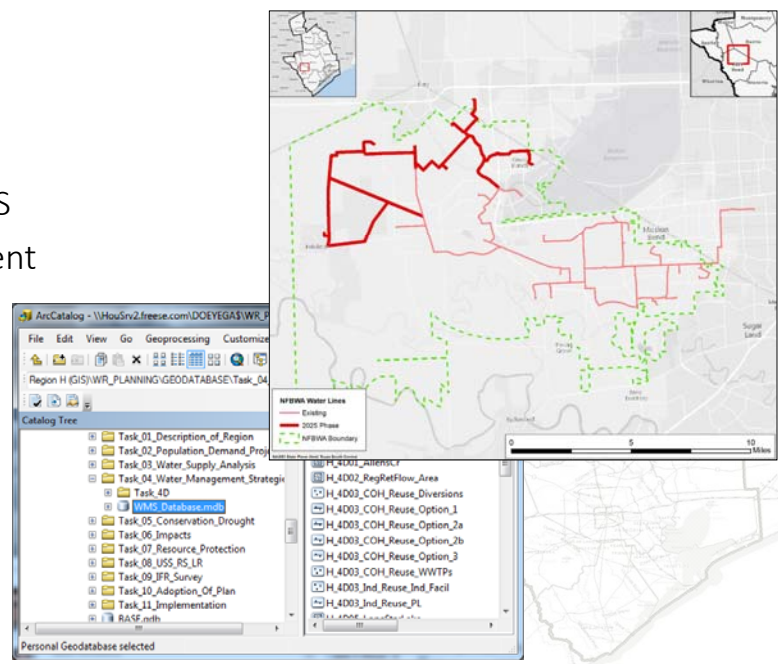
- ES – Executive Summary
- 5 – Water Management Strategies
- 5B – Conservation Recommendations
- 6 – Impacts of the Regional Water Plan
- 8 – Unique Stream Segments, Reservoir Sites, and Other Recommendations
- 9 – Reporting of Financing Mechanisms for Water Management Strategies
- 10 – Adoption
- 11 – Implementation and Comparison to the Previous Regional Water Plan



## Agenda Item 10 2016 RWP Schedule

### GIS Development

- Exhibits for projects/WMS
- GIS deliverable to represent projects

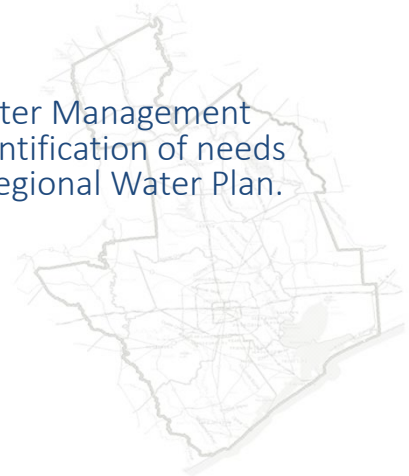


## Agenda Item 11

Receive update from Consultant Team and Water Management Strategies Committee regarding status of the identification of needs and potential strategies for the 2016 Region H Regional Water Plan.

## Agenda Item 11 WMS Progress

Receive update from Consultant Team and Water Management Strategies Committee regarding status of the identification of needs and potential strategies for the 2016 Region H Regional Water Plan.



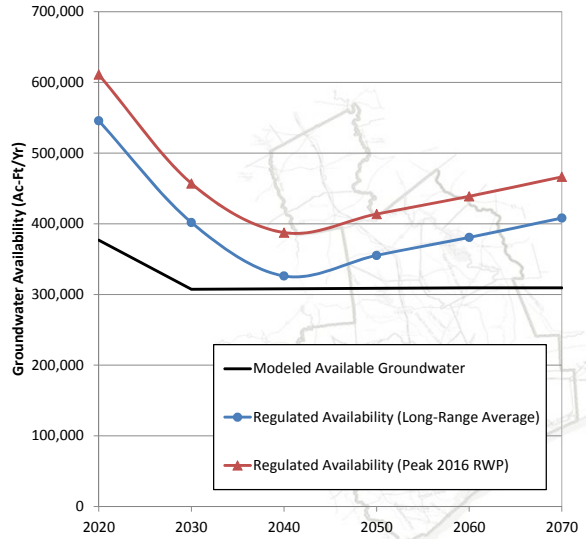
## Agenda Item 11 WMS Progress

- Ongoing Activities
  - Groundwater availability disparity
  - *Data collection*
  - *Database development*
  - Application of WMS



## Agenda Item 11 WMS Progress

- Region H availability limited by GMA Modeled Available Groundwater (MAGs)
  - Derived from Desired Future Conditions (DFCs)
  - Based on planning rules this round
  - Previous plans gave flexibility to RWPGs to adjust as appropriate
- MAGs allow for less water than regulatory plans
  - Artificial needs developed throughout
  - 200,000+ ac-ft/yr over planning horizon



## Agenda Item 11 WMS Progress

- Region H Letter: September 24
- TWDB Response: November 4

**REGION H WATER PLANNING GROUP**  
Senate Bill 1 - Texas Water Development Board  
c/o San Jacinto River Authority  
P. O. Box 329, Conroe, Texas 77305  
Telephone 936-588-1111, Facsimile 936-588-3043

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**Agricultural**  
Robert Bruner  
Pudge Wilcox

**Counties**  
John Bount  
Mark Evans, Chair  
Judge Art Hanson

**Electric Generating Utilities**  
Gene Frazier

**Environmental**  
John R. Bartos,  
Executive Committee

**Groundwater Management Areas**  
David Bailey  
Kathy Jones

**Industries**  
James Corns  
Gerald Matthews

**Municipalities**  
Jan Chang,  
Executive Committee  
Robert Nitze

**Public**  
Carl Masterson

**River Authorities**  
David Collumworth  
Jack Houston, Secretary  
Kevin Ward

September 24, 2014

Mr. Kevin Patteson  
Executive Administrator  
Texas Water Development Board  
1700 North Congress Avenue  
Austin, TX 78701

**Re: Groundwater Supplies in Region H**

Dear Mr. Patteson:

The Region H Water Planning Group (RHWP) has been working over the past two years to evaluate demands and supplies related to the 2016 Regional Water Plan (RWP) and is rapidly commencing the evaluation of needs and the process of identifying viable water management strategies (WMS) to fill these shortages and provide the Region with a reliable, long-term strategy for meeting its future water demands. In the course of this process, it has become apparent to the RHWP that changes in the TWDB guidance for the preparation of RWPs is creating some challenges for the development of an accurate and realistic plan for Region H. This topic was recently addressed during a meeting of the Region H WMS committee, which I chair.

[Approach to Groundwater Supplies in Region H](#)

As you are aware, groundwater use in Region H constitutes a substantial portion of the overall water supply both historically and throughout the planning horizon. In the year 2010, groundwater use constituted 650,988 acre-feet, or approximately 37 percent of the total water used in the Region. Of this groundwater supply, 516,014 acre-feet or approximately 79 percent of the total groundwater pumped in the Region was used in one of the four Region H counties with active groundwater reduction

P.O. Box 13221, 1700 N. Congress Ave.  
Austin, TX 78711-3221, www.twdb.texas.gov  
Phone (512) 463-7847, Fax (512) 475-2053

November 4, 2014

The Honorable Robert Hebert  
Judge, Fort Bend County  
Chair, Region H Water Management Strategy Committee  
c/o San Jacinto River Authority  
P.O. Box 329  
Conroe, Texas 77305

Re: Groundwater Supplies in Region H

Dear Judge Hebert:

We received your letter dated September 24, 2014 regarding the Region H Regional Water Planning Group's concerns over the impact that 31 Texas Administrative Code (TAC) § 357.32(d) is having on the development of the 2016 Region H Regional Water Plan.

We understand your views and concerns including that using the annual modeled available groundwater volumes for groundwater availability per 31 TAC § 357.32(d) is a limiting factor in the development of the regional water plans. We also understand your view that:

- groundwater management districts within each groundwater management area and subsidence districts may have greater flexibility to actually manage groundwater to meet the desired future conditions than may be suggested by 31 TAC § 357.32(d);
- stakeholders in the Region H regional water planning area face difficulties resulting from the asynchronous timelines of the groundwater management area, regional water planning, and subsidence district management plan development, processes; and,

## Agenda Item 11 WMS Progress

- Issues identified

Issue	TWDB Response
Groundwater managing districts need not manage to MAGs	✓
Differing perspectives of GMA and RWP processes	✓
Asynchronous timelines of GMA process and RWP demand development	✓

- Approaches proposed

Approach	TWDB Response
Variance to allow for regulatory levels of groundwater pumpage	✗
Provide for strategy volumes in excess of MAG availability	✗
Coordination with GMA 14	✓

## Agenda Item 11 WMS Progress

- What options are left?

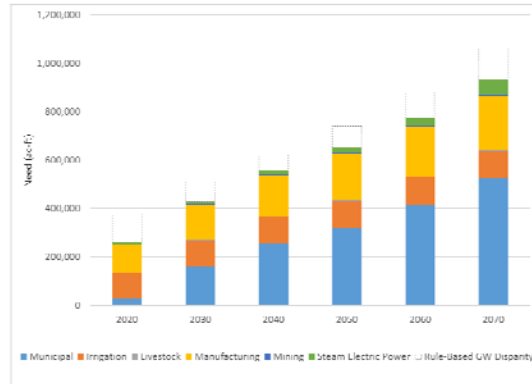
- Work with GMA 14
  - Ongoing (8-14 months?)
    - GMA must adopt draft DFCs and explanatory report
    - 90-day comment period
    - Revise DFCs and explanatory report (30-60 days?)
    - TWDB review for completeness (60 days?)
    - TWDB MAG development (30-180 days?)

- Leave unmet needs in the RWP
  - Includes unmet needs for all virtually all demand sectors, including municipal
  - Gives appearance of inadequate supply for region
- Accelerate/develop new strategies to meet needs
  - Projects in Fort Bend, Galveston, Harris
  - Unrealistic timelines for development
    - Where do correct/imaginary details appear in the RWP?
  - Additional need for long-term supply



## Agenda Item 11 WMS Progress

- Documenting the Issue
  - Chapter 3 – How it affects supplies
  - Chapter 4 – How it impacts needs
  - Chapter 8 – Recommendations to address



Region H Total	2020	2030	2040	2050	2060	2070
Irrigation	108,780	109,794	110,526	111,325	112,187	113,362
Livestock	1,531	2,049	2,397	2,477	2,609	2,729
Manufacturing	111,980	141,556	168,266	192,806	207,790	222,881
Mining	4,329	5,245	5,070	5,103	5,321	5,667
Municipal	26,141	158,885	254,865	319,171	416,178	525,031
Steam Electric Power	7,069	10,695	15,114	20,502	27,977	64,679
GW Disparity	115,910	86,679	63,077	88,407	107,552	127,046
<b>Total</b>	<b>259,830</b>	<b>428,224</b>	<b>556,238</b>	<b>651,384</b>	<b>772,062</b>	<b>934,349</b>
<i>Total + Disparity</i>	<i>375,740</i>	<i>514,903</i>	<i>619,315</i>	<i>739,791</i>	<i>879,614</i>	<i>1,061,395</i>

## Agenda Item 11 WMS Progress

- Application of WMS
  - General WMS
    - Conservation
    - Expanded Use of Groundwater
    - Expand/Increase Contracts
  - Known WMS
    - Groundwater Reduction Plans
    - Luce Bayou
    - NEWPP
    - Etc.



September 24, 2014

**Agricultural**

Robert Bruner  
Pudge Wilcox

**Counties**

John Blount  
Mark Evans, Chair  
Judge Art Henson

**Electric Generating Utilities**

Gene Fisseler

**Environmental**

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**Municipalities**

Jun Chang,  
Executive Committee  
Robert Istre

**Public**

Carl Masterson

**River Authorities**

David Collinsworth  
Jace Houston, Secretary  
Kevin Ward

**Small Businesses**

Judge Bob Hebert  
John Howard  
Steve Tyler

**Water Districts**

Marvin Marcell  
Ron Neighbors, Vice-Chair  
Jimmy Schindewolf

**Water Utilities**

James Morrison  
William Teer

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**TWDB Liaison**

Lann Bookout

Mr. Kevin Patteson  
Executive Administrator  
Texas Water Development Board  
1700 North Congress Avenue  
Austin, TX 78701

**Re: Groundwater Supplies in Region H**

Dear Mr. Patteson:

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**[Approach to Groundwater Supplies in Region H](#)**

As you are aware, groundwater use in Region H constitutes a substantial portion of the overall water supply both historically and throughout the planning horizon. In the year 2010, groundwater use constituted 650,988 acre-feet, or approximately 37 percent of the total water used in the Region. Of this groundwater supply, 516,014 acre-feet or approximately 79 percent of the total groundwater pumped in the Region was used in one of the four Region H counties with active groundwater reduction plans (GRPs) to responsibly limit and regulate the use of these resources. Entities within Region H have been pioneers of groundwater management in Texas with the creation of the Harris-Galveston Subsidence District (HGSD) in 1975 which set the first standards for defining and regulating responsible groundwater use in order to combat the threat of subsidence in those counties. The Fort Bend Subsidence District (FBSD) followed in 1989 with a similar mission, and the Lone Star Groundwater Conservation District (LSGCD) was created in 2001 to protect the groundwater resources of Montgomery County. It is the perspective of the RHWP that these entities, along with the four other Groundwater Conservation Districts (GCDs) active in Region H (Bluebonnet, Brazoria County, Lower Trinity, and Mid-East Texas GCDs), represent the undisputed authority over groundwater resources within their jurisdictions and the source of projections of groundwater availability for use in long-term planning. In past rounds of regional water planning, Region H has elected to develop groundwater availability estimates that are consistent with the management plans of these organizations.

### Groundwater Availability in the 2016 RWPs

In 2010, the Groundwater Management Areas (GMAs) across Texas submitted their first round of Desired Future Conditions (DFCs) to the TWDB for the purpose of developing estimates of Modeled Available Groundwater (MAG) as described under Section 36.108 of the Texas Water Code (TWC). The GCDs adopting DFCs are required to develop management plans that include goals that are consistent with achieving the DFCs, per Section 36.1085 of the TWC.

In the fourth cycle of regional water planning, TWDB has strived to bring the efforts of the Regional Water Planning Groups (RWPGs) and GMAs together through the addition of language in the planning rules. Whereas past RWPs have allowed for discretion of the RWPGs in assigning groundwater availability, the 2016 round of RWP development takes a different approach. Per Section 16.053(e)(2-a) of the TWC, regional plans must be “consistent with the desired future conditions...” as developed by the GMAs. Going a step further, Title 31 of the Texas Administrative Code (TAC) Section 357.32 (d) dictates that, for regional planning, RWPGs “shall use Modeled Available Groundwater volumes for groundwater availability” unless there is no MAG volume. Therefore, for the development of the 2016 RWP, Region H groundwater supplies for traditional formations are presently set at the MAG as developed by TWDB from DFCs submitted by the various GMAs in 2010.

### Issues in Applying Modeled Available Groundwater to Supply Availability

Although the RHWPG recognizes the reasoning behind this change to the planning process and appreciates the need to more closely tie together the planning efforts associated with groundwater and surface water supplies in the State of Texas, it is also recognized that the approach, as taken, presents several issues to the RHWPG as well as other RWPGs in other regions of the State. Several of these potential issues are described below for consideration by TWDB in guiding future implementation of the guidelines for RWP development.

**Although GCDs are bound to the DFCs adopted by GMAs, they are not required to use the MAG as a means of achieving that goal.** Section 36.1132 of the TWC states that “a district, to the extent possible, shall issue permits up to the point that the total volume of exempt and permitted groundwater production will achieve an applicable desired future condition.” Several considerations are also provided in this section including the MAG. This guides GCDs toward regulating to the DFC with consideration of the MAG in addition to other factors but does not necessarily limit GCDs to strict adherence to the MAG. This suggests there may be means to achieve the DFC outside of the MAG. The requirement of Title 31 of the TAC, Section 357.32(d) goes beyond the language in the TWC and requires that regions plan to the MAG even though it is not necessarily a binding limit for the GCDs. In effect, projects that may be developed within a GCD while still attaining the long-term goals of the DFC may be permitted but not included for the purposes of regional water planning. This is particularly an issue in GCDs that are just beginning their approach to groundwater regulation and will allow for near-term pumpage beyond the MAG and greater levels of pumpage reduction in future decades in order to achieve the adopted DFC.

**The perspectives of the GMA and RWP processes are inherently different.** Regional plans are intended to be built around “dry-year” demands for various water uses to create a worst-case scenario for planning purposes. For this reason, year 2011 per capita demands have been selected for development of the 2016 RWPs for much of the State. This approach is conservative and reasonable for the identification of potential water needs and projects that may be required under a drought-of-record scenario. However, this approach is inadequate for the study of groundwater resources which must be evaluated on the basis of long-term averages. To model peak, dry-year demands for the entire period considered in the Groundwater Availability Models (GAMs) used in developing DFCs would result in a gross and unrealistic over-estimation of drawdown in formations and would not provide useful information to the groundwater stakeholders involved in the GMA process. The *de facto* result is that GMAs are fundamentally required to plan in ways that produce average-year MAGs while RWPGs require peak groundwater supplies to be consistent with the peak demands they are obligated to meet. The difference between these two values produces a shortage in the RWP that is not expected to occur in reality and, therefore, requires the application of an unnecessary water management strategy (WMS) to make the plan whole.

The requirement that RWPs be developed using the MAGs as the sole source of groundwater supply information may create an undue burden to the GMA process. While the majority of entities that regulate groundwater in the State target a set volume of water for their pumpage limits, that is not the case for the largest of those entities in Region H: HGSD and FBSD. Due to the intrinsic nature of the way in which groundwater regulation functions in urbanized counties that already exceed their sustainable levels of pumpage compared to other counties that are below or are just approaching their sustainable production limits, these districts regulate allowable groundwater withdrawals to a percentage of the total demand within their jurisdictions. In effect, when demands change, the availability of groundwater changes within their boundaries. As these demands typically change with each RWP development cycle, GMA 14, which includes Fort Bend, Galveston, and Harris Counties, must reevaluate the pumpage related to their DFCs each round in order to maintain consistency between the GMA-developed supplies used in RWP development and the regulation of those districts. Furthermore, there is typically a narrow window of time between the finalization of water demands and the submittal of the RWPs during which time, the GMA would be required to compress its planning efforts in order to close the gap in supply. This approach is burdensome on a regional stakeholder process that has a number of its own considerations to address in addition to the issue of RWP consistency.

### Case Study: Harris-Galveston and Fort Bend Subsidence Districts

As an example of the issues identified above, consider the case of the two subsidence districts in Region H. Collectively, these two districts encompass over 81 percent of the Region’s population, and groundwater has typically served a crucial role in supplying the overall need of this area. Although HGSD and FBSD are not governed under Section 36 of the TWC and are therefore not formally part of the GMA process, the planning rules, as stated, limit groundwater availability in these jurisdictions just as in other areas covered by GCDs.

Figure 1, below, demonstrates three representations of supply for the three counties. The most recent MAGs for these counties were developed for the 2010 DFCs submitted by GMA 14 and, therefore, these supplies do not have the benefit of population and demand updates developed since that time and also does not include the HGSD’s updated regulatory plan adopted in 2013. This is illustrated with the black line. In addition, another dataset, represented by the blue line, demonstrates the pumpage that was factored into the long-range simulations for the analysis of the HGSD and FBSD regulatory plans. These are average-year demands that are appropriate for long-range study. Finally, the last dataset, shown in red, demonstrates the water that would be allocated to Region H WUGs in the three counties based on demands from the 2016 RWP and the regulatory plans of the two districts. This pumpage is consistent with the peak, dry-year demands captured in the RWPs.

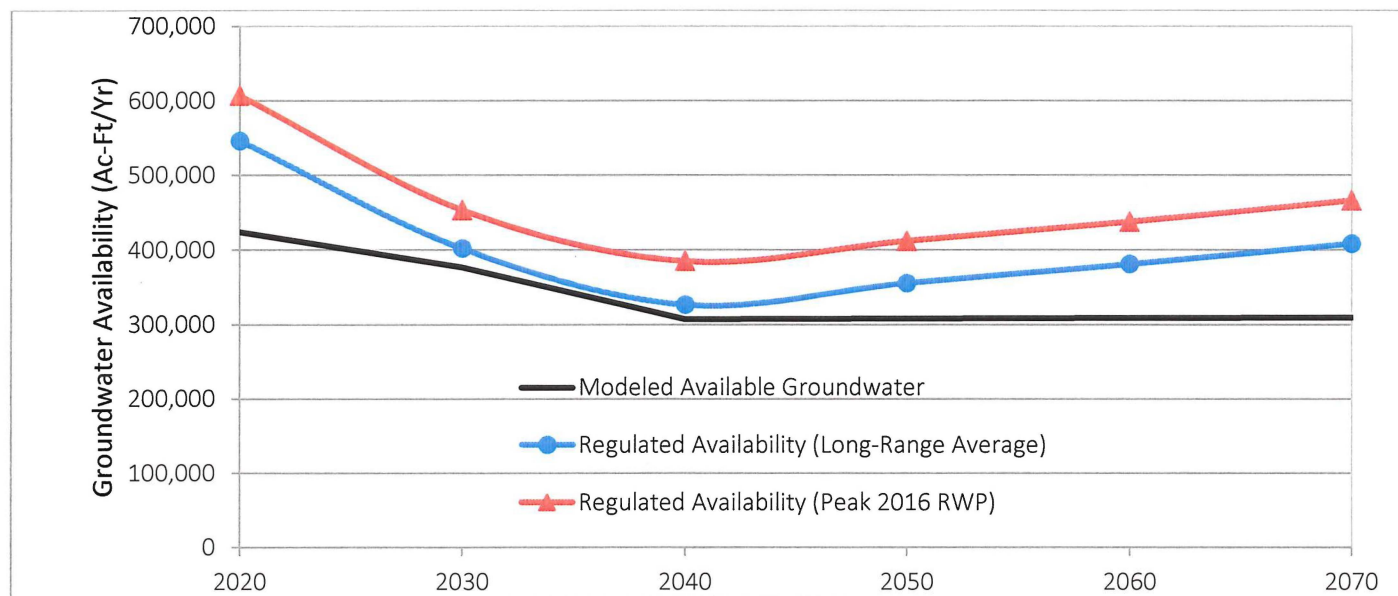


Figure 1: HGSD and FBSD Groundwater Availability Scenarios

The difference in the three perspectives of availability represent a combination of the issues described above. First, the delta between the MAG and the long-range average regulated availability is an artifact of the disconnection between the development of projections for the RWPG and the evaluation of new pumpage scenarios by GMA 14. As demands are updated by the RWPG, supplies, represented by the MAG, lag behind as the GMA must readdress the supplies for these three counties in context of the updated demands. Unless GMA 14 can accomplish this and other activities associated with their DFC review in a very narrow window during the course of RWP development, Region H will experience inconsistencies associated with this issue indefinitely as each planning cycle is forced to rely upon MAGs based on pumpage and demands from the previous round of planning. Addressing this issue in the current joint planning process of the RWPGs and GMAs places strain on both processes. This issue primarily impacts counties regulated in the manner of the HGSD and FBSD where availability is subject to change based on total demand.

Second, the difference is also due, in significant part, to the definition of peak and long-range average demands used for groundwater planning. The MAG presented here and the one that would be considered in the future by GMA 14 will not provide adequate supply for peak demand conditions as is it not realistic to model such a condition over 50 or more years. Doing such would over-state water-level declines and other undesired impacts. This issue is inherent to the very different objectives of the GMA and regional planning processes and not readily solved, even if GMAs are given adequate opportunity to address changing demands developed for the RWPs. Furthermore, this issue potentially persists in all counties where current supplies equal or approach the MAG. Where actual pumpage may occasionally, under extreme conditions, exceed the MAG but otherwise maintain a long-term average level below that limit, the RWPG is unnecessarily limited in ability to incorporate groundwater-based strategies. This is particularly true for conjunctive use strategies that rely on excess groundwater only during the most extreme drought conditions.

Combined, these issues represent a significant impact to the RWP process. In the three counties described above, the end result is that the shortages expressed in the RWP are artificially elevated by approximately 182,000 and 157,000 acre-feet per year in 2020 and 2070, respectively. In turn, this means that 182,000 acre-feet of additional, unneeded strategies must be incorporated into the RWP in order to meet needs that are not expected to occur in a real world scenario. This approach inflates the cost of water projects to meet unrealistic shortages and demonstrates environmental impacts from projects that are not actually required. The end result is a RWP that does not reflect the reality of water needs within Region H and overstates the need for WMS.

### Potential Solutions for Region H

In light of this issue, the RHWPG recognizes that effort must be taken to produce a RWP that portrays an appropriate appraisal of the region's water resources and accurately prescribes WMS for meeting long-term goals. To overlook this issue would result in the recommendation of a number of unnecessary strategies that will represent costs and impacts that are not necessary to achieve the long-term supply goals of Region H and an undermining of the bottom-up concept that regional planning is built around. To this end, the Region H WMS Committee recommends consideration of the following means to avoid this problematic situation and appreciates guidance from TWDB regarding the best way in which to address this concern.

**Provide a means for a variance from 31 TAC 357.32 (d) for Region H to amend groundwater supplies with values that are consistent with local regulation.** This approach would allow Region H to "manually" adjust groundwater supplies to levels that are consistent with local regulation. As a result, the need identified in the RWP would match the anticipated shortage that entities in the region are already planning for in their proactive response to developing future water supplies.

**Allow the inclusion of a strategy in excess of MAG availability to represent use of groundwater as allowed by local regulation.** The RHWPG proposes that one solution to the issue is to allow the incorporation of a strategy that will close the gap between MAG availability and the groundwater availability allowed through the appropriate local regulatory plans. This no-cost strategy would eliminate the non-existent needs shown in the RWP without proposing costly

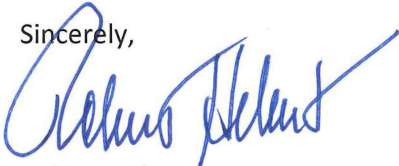
Mr. Kevin Patteson  
September 24, 2014

infrastructure that may suggest that actual financial, property, and social costs of the RWP are higher than they are in reality.

**Work with GMA 14 to produce DFCs that are more consistent with the groundwater availability required by the RWP.** GMA 14 is currently involved in this process along with the Region H consultant, Freese and Nichols. As you are aware, the GMA process is an intensive effort requiring many steps to allow for both technical and public review and GMA 14's current timeline is unlikely to be able to address the criteria for developing DFCs in a manner which will allow for TWDB's estimation of revised MAGs prior to the submittal of the 2016 RWP. Furthermore, as previously stated, this process will only be able to responsibly revise pumpage to a long-term average which is still inadequate to meet the peak level of groundwater pumpage that would be consistent with the demand scenario required in regional water planning.

The RHWPG appreciates the opportunity to voice these concerns to the TWDB and to seek guidance in pursuing a responsible, logical solution that is consistent with the intent of the regional planning process and will produce a RWP that will provide an accurate approach for the region's future. Please feel free to contact me regarding this matter. The RHWPG looks forward to working with you to come to an amenable solution to this issue on a timeline that is consistent with the development of the 2016 RWP.

Sincerely,



Robert Hebert  
Fort Bend County Judge  
Region H WMS Committee Chair

cc: Lann Bookout, TWDB

November 4, 2014

The Honorable Robert Hebert  
Judge, Fort Bend County  
Chair, Region H Water Management Strategy Committee  
c/o San Jacinto River Authority  
P.O. Box 329  
Conroe, Texas 77305

Re: Groundwater Supplies in Region H

Dear Judge Hebert:

We received your letter dated September 24, 2014 regarding the Region H Regional Water Planning Group's concerns over the impact that 31 Texas Administrative Code (TAC) § 357.32(d) is having on the development of the 2016 Region H Regional Water Plan.

We understand your views and concerns including that using the annual modeled available groundwater volumes for groundwater availability per 31 TAC § 357.32(d) is a limiting factor in the development of the regional water plans. We also understand your view that:

- groundwater management districts within each groundwater management area and subsidence districts may have greater flexibility to actually manage groundwater to meet the desired future conditions than may be suggested by 31 TAC § 357.32(d);
- stakeholders in the Region H regional water planning area face difficulties resulting from the asynchronous timelines of the groundwater management area, regional water planning, and subsidence district management plan development, processes; and,
- most of the modeled available groundwater values were developed for long-term averages, not necessarily short-term drought of record conditions.

We share your interest in developing realistic regional and state water plans that, as much as possible within the bounds of statute and rule, will reflect anticipated water shortages and projects required to meet them. However, under the current statute and planning rules, TWDB cannot allow regional water planning groups:

- to apply a "variance" to amend groundwater availability above the annual modeled available groundwater volume; or,
- to include recommended water management strategies to meet identified water needs that would rely on groundwater availability volumes in excess of the annual modeled available groundwater volumes.

#### Our Mission

To provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas

#### Board Members

Carlos Rubinstein, Chairman | Bech Bruun, Member | Kathleen Jackson, Member  
Kevin Patteson, Executive Administrator

Mr. Robert Hebert, Chair Region H WMS Committee

November 4, 2014

Page 2

TWDB staff will continue to work with and support groundwater management area 14, in whatever ways we are able, to support them in developing desired future conditions that the groundwater districts in groundwater management area 14 consider most appropriate for all purposes, including regional water planning.

I am interested in visiting with you to discuss ways in which these issues impacting Region H might be addressed during the next regional water planning cycle. If you are agreeable, please contact my office to arrange a meeting.

Thank you for your letter and your continued support of the regional water planning process. Our response is intended to provide you and the Region H Regional Water Planning Group with sufficient information to make any necessary regional water planning decisions. If you have any questions or wish to discuss any of these issues further concerning this response, please contact Lann Bookout, the TWDB's designated regional water planning project manager for this region.

Sincerely,



Kevin Patteson  
Executive Administrator

cc: Mr. Mark Evans, Region H Chair  
North Harris County Regional Water Authority  
3648 Cypress Creek Parkway #110, Houston, Texas 77068

Mr. Jace Houston, General Manager, San Jacinto River Authority  
PO Box 329, Conroe, Texas 77305

Lann Bookout, TWDB



## Agenda Item 12

Receive presentation from Consultant Team on the status of ecologically unique stream segments, unique reservoir sites, and legislative recommendations.

## Agenda Item 12

### Unique Stream Segments and Reservoir Sites, Recommendations

Receive presentation from Consultant Team on the status of ecologically unique stream segments, unique reservoir sites, and legislative recommendations



## Agenda Item 12

### Unique Stream Segments and Reservoir Sites, Recommendations

- Chapter 8
  - Unique Stream Segments
  - Unique Reservoir Sites
  - Recommendations
    - Administrative
    - Legislative
    - Funding



## Agenda Item 12 USS and URS, Rec.

### Unique Stream Segments

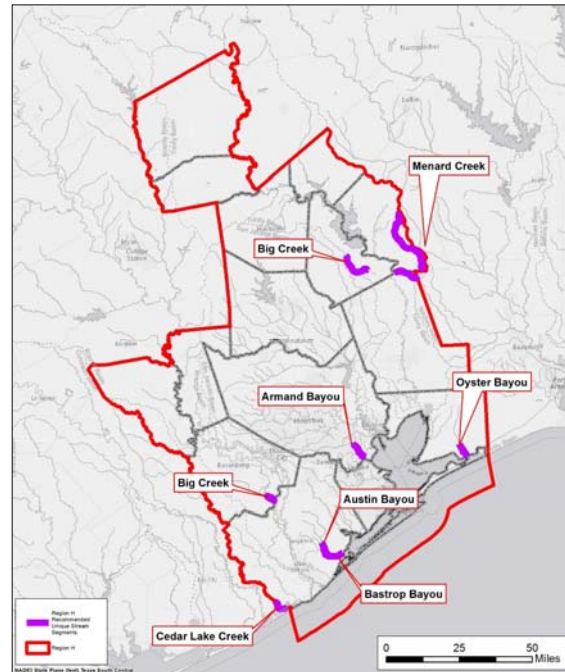
- Biological Function
- Hydrologic Function
- Riparian Conservation Areas
- High Water Quality / Exceptional Aquatic Life / High Aesthetic Value
- Threatened or Endangered Species / Unique Communities

River or Stream Segment	County	Biological Function	Hydrologic Function	Riparian Conservation Area	High Water Quality / Exceptional Aquatic Life / High Aesthetic Value	Threatened or Endangered Species	Conveyance Project / Hazardous Site	Water Rights	WW Outlet	Recommended in the 2011 Regional Plan
<b>Considered in 2001 Regional Plan:</b>										
Armand Bayou	Harris	•	••	••	•	••••		•	••	•
Austin Bayou	Brazoria	•	•	••		••••		••		•
Bastrop Bayou	Brazoria	•	•	••		••••		•		•
Big Creek	Fort Bend	•	•	••	••			•		•
Big Creek	San Jacinto	•	•	••	•			R		•
Brazos River	Austin/Waller/Braz.a/Ft Bend	•	••••	••••		••	•	••	••	•
Caney Creek <sup>1</sup>	Walker/Harris	•	•	••						•
Carpenters Bayou	Harris	•	••	•				•	••	
Cedar Lake Creek	Brazoria	•	•	••		••••		•		•
Clear Creek	Waller	•	••	•	•			R		
East Fork San Jacinto River	Walker/Harr./San J./Lib./Mont.	•	••	••	••••					•
East Sandy Creek	Walker	•	•	•						
Halls Bayou	Brazoria	•	•	•		•				
Harmon Creek	Walker	•	••	•	•			••	•	
Jones Creek	Brazoria	•	•	••				••		•
Lake Creek	Montgomery	•	•	•	••••	•		R		•
Luce Bayou	Harris/Liberty	•	••	•			•			
Menard Creek	Polk	•	••	•				R		•
Mill Creek	Austin	•	••	•	••	•			••	
Nelson Creek	Walker	•	•	•	••					••
Old River	Liberty	•	••	•	•					
Oyster Bayou	Chambers	•	•	••				••		•
Redfish Bayou	Brazoria	•	•	••				•	•	
San Bernard River	Brazoria/Fort Bend/Austin	•	••	••		••		••	••	•
Upper Trinity River	Walker/Leon/Houston	•	•	•		••		••		•
Lower Trinity River	Chambers/Liberty	•	••••	••••		••	E	••		•
Upper Keeschi Creek	Leon	•	•	•						
Whitstock Creek	Leon	•	•	•						
Winters Bayou <sup>1</sup>	San Jacinto/Walker	•	••	•	•					
<b>Recommended by Houston Sierra Club (2005):</b>										
Boswell Creek	Walker/San Jacinto	•	•	•	•	••				
Briar Creek	Walker	•	•	•						
East Bay Bayou	Chambers		•	•				••		
Henry Lake Branch	San Jacinto		•	•						•
Little Lake Creek <sup>1</sup>	Montgomery/Walker		•	•						
Lost River	Chambers/Liberty	•	•	•						
Onion Bayou West Fork San Jacinto	Chambers	•	•	•				••		
West Fork San Jacinto <sup>1</sup>	Walker	•	•	•						
West Sandy Creek	Walker	•	•	•						
<b>Recommended by RHWPG Members (2005):</b>										
Lone Oak Bayou	Chambers	•	•	•	•					
Whites Bayou, below IH-10	Chambers/Liberty	•	•	•	•					

## Agenda Item 12 USS and URS, Rec.

### Preliminary Recommendation

- Retain 2011 recommendations
  - Armand Bayou
  - Austin Bayou
  - Bastrop Bayou
  - Big Creek (Fort Bend)
  - Big Creek (San Jacinto)
  - Cedar Lake Creek
  - Menard Creek
  - Oyster Bayou



## Agenda Item 12 USS and URS, Rec.

- Unique Reservoir Sites

- Location
- Hydrology
- Geology
- Topography
- Water Availability
- Water Quality
- Environmental Qualities
- Cultural Values
- Development Characteristics

- 2011 Region H RWP

Recommended  
WMS

- Allens Creek Reservoir
- Bedias Reservoir

Alternative  
WMS

- Little River Off-Channel Reservoir
- Little River Reservoir

- Designated by Legislature

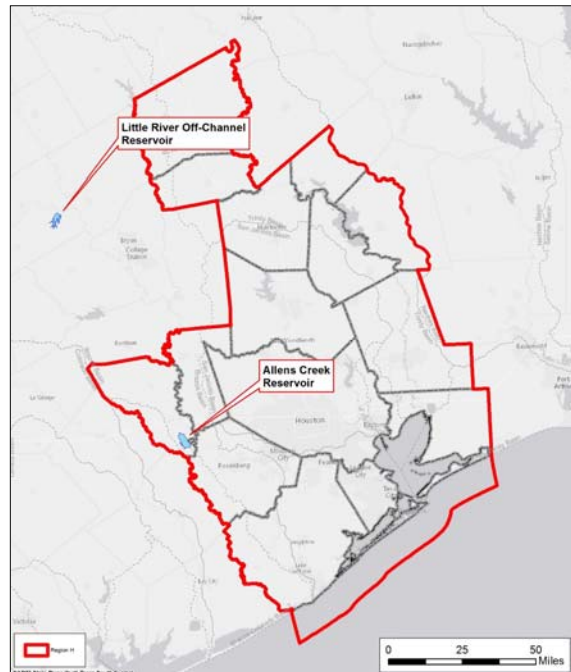
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## Agenda Item 12 USS and URS, Rec.

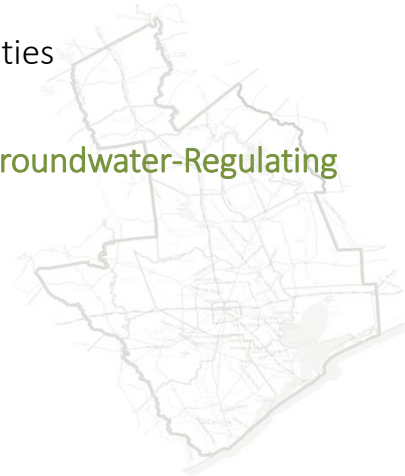
- Preliminary Recommendation

- Retain 2011 WMS sites
  - Allens Creek Reservoir
  - Little River Off-Channel Reservoir



## Agenda Item 12 USS and URS, Rec.

- Regulatory and Administrative
  - Quantitative Environmental Analysis
  - TPDES Permitting of Wastewater Reclamation Facilities
  - Access to Current Water Availability Models
  - Availability of Groundwater within Jurisdictions of Groundwater-Regulating Entities



## Agenda Item 12 USS and URS, Rec.

- Legislative
  - Interbasin Transfers
  - Texas Bays and Estuaries Program Funding
  - Rule of Capture
  - Groundwater Conservation Districts
  - Water Supply Project Financing Mechanism
  - Groundwater Availability Modeling Funding
  - Agricultural and Irrigation Conservation Funding
  - Water Conservation
  - Water Conservation Research Funding



## Agenda Item 12

### USS and URS, Rec.

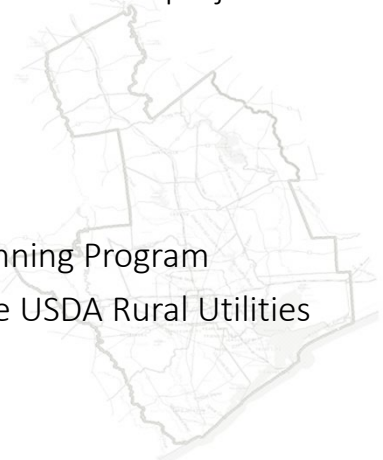
- Legislative (continued)
  - Flood Liability of Water Supply Reservoirs
  - Incorporation of Technology Advancements in Projections
  - Ongoing RWPG Activities



## Agenda Item 12

### USS and URS, Rec.

- Infrastructure Finance
  - Board Participation Program for regional water and wastewater projects
  - State Revolving Fund Programs
  - State Loan Program
  - Agricultural Water Conservation Loan Program
  - Texas Community Development Program
  - Regional Water Supply and Wastewater Facilities Planning Program
  - Water and Waste Disposal Loans and Grants from the USDA Rural Utilities Service
  - Desalination Research and Demonstration Projects



## Agenda Item 12 USS and URS, Rec.

- Infrastructure Finance (continued)
  - Water Research Program – Agriculture
  - Regionalization



## Agenda Item 12 USS and URS, Rec.

- Next Steps
  - Incorporate into Chapter 8
  - Available for review in March
  - Approved along with IPP in April



Recommendation	Type
Quantitative Environmental Analysis	Regulatory and Administrative
<b>Discussion:</b>	
<p>The Regional Water Planning Guidelines require that the evaluation of potentially feasible water management strategies include a quantitative analysis of environmental factors including effects on wildlife habitat, cultural resources, and effect of upstream development on bays, estuaries, and arms of the Gulf of Mexico (31TAC357.7.(a)(8)(A)). The TWDB has provided detailed guidance on specific study methods to be used in determining population, water demand, project costs, socioeconomic impacts and yield from current and proposed supply sources, but it has not provided similar guidance in the area of environmental impacts. This lack of specificity is resulting in different methods being used in different regions. Additionally, it places the planning groups at risk of needing to conduct additional analysis after state agencies review the Initially Prepared Plans, and add those results to the report after the public review period has closed.</p>	
<b>Recommendation:</b>	
<p>The Region H Water Planning Group recommends that the TWDB determines, in conjunction with the TCEQ and TPWD, which specific environmental studies and analysis are required for each category of management strategy (i.e., new water right, new reservoir, etc.). Furthermore, the guidance should be added to the Planning Guidelines, so that RWPGs can reflect the cost of those requirements in their budgets and scopes of work. Adding environmental guidelines will also make water plans consistent across the State.</p>	



Recommendation	Type
TPDES Permitting of Wastewater Reclamation Facilities	Regulatory and Administrative
<b>Discussion:</b>	
<p>Existing Texas Pollutant Discharge Elimination System (TPDES) permit requirements do not encourage, and in fact discourage, wastewater reuse and reclamation. This recommendation relates solely to issues in the TPDES permitting process and not rules directly applicable to the use of reuse and reclaimed water outlined in TCEQ Section 210. Authorization of reclaimed water use may require a new or amended permit when the treatment results in a discharge of wastewater into waters within the state. This effectively double-counts the waste load from a facility and could potentially provide a regulatory obstacle for some wastewater reuse projects.</p>	
<p>In terms of wastewater reuse (e.g., without further treatment), a violation of an end-user's discharge permit could be caused by using effluent to replace or supplement another water source. An example would be an industry, whose discharge is close to its permitted limit for a given constituent, exceeding that limit by virtue of its use of effluent from a separate wastewater treatment plant. In terms of wastewater reclamation (e.g., with further treatment), permitting the discharge from a wastewater reclamation facility could be difficult and unnecessarily expensive in certain cases. Wastewater reclamation often entails advanced treatment of wastewater discharged from one or more treatment facilities for industrial use. If this advanced treatment facility is separate, it may require a separate TPDES permit. Under current TCEQ rules for consolidated permits, discharges from a new facility are considered as occurring in addition to all currently permitted discharges for the purpose of assessing the collective effect on the receiving stream. While this is the correct procedure for evaluating a discharge from a new waste source, it effectively double-counts the waste load from a reclamation facility; once at the original plant, and again at the additional treatment facility. Designing a reclamation facility to sufficiently mitigate this double-counting is unneeded and may be cost-prohibitive. In actuality, the waste load should be divided between the applicable facilities depending upon the reuse and reclamation demands.</p>	
<p>Therefore, the permitting process should be modified to address both reuse and reclamation projects that draw effluent from existing wastewater plants, so that daily loads may be accurately assessed on a combined maximum daily load and maximum daily concentration basis. Wastewater plants should be permitted accordingly.</p>	
<b>Recommendation:</b>	
<p>The Region H Water Planning Group recommends that the TCEQ clarify the TPDES rules for wastewater permitting so that the environmental impacts of reuse and reclamation facility discharges are assessed in conjunction with appurtenant reductions in discharges for their source water facilities. This will eliminate double-counting of waste loads and remove a potential obstacle for some wastewater reuse projects in the State.</p>	

Recommendation	Type
Access to Current Water Availability Models	Regulatory and Administrative
<b>Discussion:</b>	
<p>Water Availability Models (WAMs) are a core component of the regional water planning process and, furthermore, are required by TWDB’s rules for plan development. During the development of the 2016 RWP, TWDB’s rules required the use of the most current Run 3 (Full Authorization) WAM and also the consideration of environmental flows standards as adopted by TCEQ for each applicable basin. However, model versions for the San Jacinto and Brazos River Basins including environmental flows standards were not made available in a reasonable timeline for use in the development of the RWP despite the adoption of these standards in 2011 and 2014, respectively. The absence of these models required the Regional Water Planning Groups working in these basins to develop representative models themselves in an effort to account for TWDB-mandated requirements to consider environmental flows. This produced not only an undue burden on the Planning Groups, but also introduced an opportunity for inconsistency across Groups and between the Groups and the State regarding their interpretation and application of the environmental flow standards. In addition, models for various models throughout the state were often not available through TCEQ’s website during this planning process with the only explanation provided as “WAM files for this basin are being updated and are currently unavailable.” Finally, due to extreme hydrologic conditions, many basins throughout Texas have experienced new drought of record in recent years that are not included in the historic period of the current WAMs. To date, no timeline has been proposed for the extension of these periods in order to cover these conditions which has also placed additional burden on the development of RWPs in these regions. Due to the critical nature of these models for both regional planning and water rights analyses, it is imperative that a more robust system be implemented for maintaining these models and making them available to the public.</p>	
<b>Recommendation:</b>	
<p>The Region H Water planning Group recommends that TCEQ rules be amended to include a reasonable timeline for the update of WAMs based associated with significant changes to water rights conditions in each basin and also on a routine basis as the historical period of record grows over time. Furthermore, these rules should require that the most recent model for each basin be made available through the TCEQ website for use by both the RWPGs and the public.</p>	

Recommendation	Type
Availability of Groundwater within Jurisdictions of Groundwater-Regulating Entities	Legislative
<b>Discussion:</b>	
<p>During the development of the 2016 Region H Regional Water Plan, it was recognized that the approach to groundwater availability required by TWDB's rules may place an unrealistic limit on groundwater production for various reasons, including:</p> <ul style="list-style-type: none"> <li>• Although GCDs are bound to the DFCs adopted by GMAs, they are not required to use the MAG as a means of achieving that goal.</li> <li>• The perspectives of the GMA and RWP processes are inherently different. Where pumpage estimates used in GMA planning represent long-term levels of groundwater production, the demands and supplies used by RWPGs must represent dry-year conditions. Strict adherence to the MAG prevents the use of flexibility in dealing with short-term supply needs.</li> <li>• The requirement that RWPs be developed using the MAGs as the sole source of groundwater supply information may create an undue burden to the GMA process. As demands in Region H change over time, so does the allowable level of groundwater pumpage, requiring the GMA process to regularly</li> </ul> <p>The result of this requirement has been the undue unrealistic water needs in excess of 200,000 ac-ft/yr along with costs that are not consistent with the actual, long-term water supply strategy for the region. In order for the planning process to maintain a bottom-up approach and a realistic view of</p>	
<b>Recommendation:</b>	
<p>Allow Regional Water Planning Groups to work with local regulatory bodies to develop appropriate, dry-year groundwater supplies for use in regional water planning that are consistent with local conditions and regulation.</p>	

Recommendation	Type
Interbasin Transfers	Legislative
<b>Discussion:</b>	
<p>Senate Bill One states that water rights developed as a result of an interbasin transfer become junior to other water rights granted before the interbasin transfer permit. Senate Bill One made obtaining a permit for interbasin transfer significantly more problematic than it was under prior law and thus, it discouraged the use of interbasin transfers for water supply. This is undesirable for several reasons. First, current supplies greatly exceed projected demands in some basins, and the supplies already developed in those basins can only be used via interbasin transfers (e.g. Trinity Basin within Region H).</p>	
<p>Second, interbasin transfers have been used extensively in Texas and are an important part of the state’s current water supply. For example, three of the five Region H Major Water Providers (City of Houston, Trinity River Authority and San Jacinto River Authority) maintain current permits for interbasin transfers collectively of over 1,000,000 acre-feet per year. A substantial portion of future water demands within the San Jacinto basin (Harris County in particular) of Region H must rely on interbasin transfers.</p>	
<p>Third, emerging regional water supply plans for major metropolitan areas in Texas (Dallas-Fort Worth and San Antonio) rely on interbasin transfers as a key component of their plans. It is difficult to envision developing a water supply for these areas without significant new interbasin transfers.</p>	
<b>Recommendation:</b>	
<p>The Region H Water Planning Group recommends that the legislature revise the current law on interbasin transfers and remove the unnecessary and counterproductive barriers to such transfers that now exist.</p>	

Recommendation	Type
Texas Bays and Estuaries Program Funding	Legislative
<b>Discussion:</b>	
<p>The Texas 80<sup>th</sup> Legislature established the current process of assessing the environmental quality of riverine and estuarine systems and applying the “best available science” in prescribing actions to preserve these systems. These recommendations have, in turn, been incorporated into the Regional Water Planning process and serve as a critical standard for the evaluation of future water management strategies. However, the current levels of funding within the State of Texas Bay &amp; Estuary program are insufficient to continue the needed monitoring, study, and development of management strategies for the bay.</p>	
<b>Recommendation:</b>	
<p>The Region H Water Planning Group recommends establishment of additional and dedicated funding to pursue necessary future efforts of the Galveston Bay &amp; Estuary program.</p>	

Recommendation	Type
Rule of Capture	Legislative
<b>Discussion:</b>	
<p>Groundwater is a vital resource within Region H. This is especially true within the rural counties of the region that are predominantly dependent on groundwater. Current groundwater law based on the Rule-of-Capture has facilitated orderly development of groundwater systems throughout the State of Texas and, barred the intrusion of private interests, and it could continue to serve the water usage interests throughout the state. It appears that the Rule-of-Capture could continue per the status quo to serve the groundwater interests within the region.</p>	
<b>Recommendation:</b>	
<p>The Region H Water Planning Group supports continued usage of the Rule-of-Capture as the basis of groundwater law throughout the State of Texas except as modified through creation of certified groundwater conservation districts.</p>	

Recommendation	Type
Groundwater Conservation Districts	Legislative
<b>Discussion:</b>	
<p>Region H communities, particularly those within the rural areas of the region, are dependent on groundwater supplies. Groundwater is a very valuable resource to this region. Region H contains counties, specifically Austin, Leon and Madison, where some municipalities, water supply corporations and property owners believe Groundwater Conservation Districts (GCD) are needed to retain long-term groundwater supplies within their respective counties. Region H also has several counties, including Brazoria, Waller and Montgomery, where groundwater supplies will, in theory, reach their maximum sustainable yield due solely to projected in-county water usage rates. A GCD is a potential vehicle for these counties to manage and protect groundwater supplies from over-development within each respective county. Senate Bill 2 of the 77th Legislature authorized the formation of four new GCDs in Region H (Bluebonnet, Brazoria County, Lone Star and Mid-East Texas) to manage and protect groundwater resources.</p>	
<b>Recommendation:</b>	
<p>The Region H Water Planning Group supports creation of GCDs, as necessary, by local subarea water interests. The RHWPG supports development of truly regional GCDs as opposed to single county districts to recognize the regional expansiveness of underground aquifers and to provide the greatest degree of regional water supply protections.</p>	

Recommendation	Type
Water Supply Project Financing Mechanism	Legislative
<b>Discussion:</b>	
<p>The Region H Regional Water Plan includes development of several surface water reservoirs and other supply projects. The capital cost to develop these projects is significantly higher than the historic cost of water supply projects. The high projected costs dissuade local communities from making a financial commitment to support future projects. These financing issues will delay the implementation of needed projects.</p> <p>The 80th Texas Legislature (2007) appropriated funding to enable issuance of \$440 million in bonds for the Water Infrastructure Fund (WIF) to fund water plan projects. The program is designed with a maximum repayment period of 20 years, which may not be adequate for financing larger projects such as surface water reservoirs.</p> <p>In 2013, the Texas Legislature created the State Water Implementation Fund for Texas (SWIFT) which was approved by Texas voters to provide \$2 billion dollars for the creation of a new loan program for the implementation of the State Water Plan. This program offers low-interest and deferred loan with maturities up to 30 years which enhances the opportunity for finding large, capital projects that are critical to the SWP. In addition, the program also funds the option of State ownership in projects as another alternative for development.</p>	
<b>Recommendation:</b>	
<p>The Region H Water Planning Group wishes to recognize the Legislature’s efforts in implementing the SWIFT program and also supports ongoing and expanded support for financing methods by the State of Texas for development of water supply projects recommended within adopted RWPs.</p>	



Recommendation	Type
Groundwater Availability Modeling Funding	Legislative
<b>Discussion:</b>	
<p>Many areas of Region H are totally dependent on groundwater to support the long-term viability of these areas. The current Groundwater Availability Modeling (GAM) effort is supported since it is the most comprehensive groundwater assessment and analysis effort of the previous 20 years. The current GAMs effort, however, is omitting minor aquifers and other groundwater considerations that are vital for certain local communities.</p>	
<b>Recommendation:</b>	
<p>The Region H Water Planning Group supports continued funding for the GAMs effort and recommends comprehensive analysis of all groundwater resources within the state.</p>	

Recommendation	Type
Agricultural and Irrigation Conservation Funding	Legislative
<b>Discussion:</b>	
<p>The Region H water management plan includes a number of irrigation conservation based water management strategies. It is apparent that adoption of irrigation conservation practices may benefit the irrigation and agricultural industry in addition to local communities that may take advantage of water supply savings resulting from irrigation conservation. Additionally, the RHWPG supports further research and development of water-efficient and drought-resistant crop and species.</p>	
<b>Recommendation:</b>	
<p>The Region H Water Planning Group supports funding of research and development studies associated with the efficient usage of irrigation technologies and practices.</p>	

Recommendation	Type
Water Conservation	Legislative
<b>Discussion:</b>	
<p>The RHWPG strongly supports water conservation at all levels. The RHWPG has incorporated water conservation in the regional water plan as a management strategy. However, realizing advanced conservation savings in municipal county-other areas may be difficult, as these practices require some management, funding and oversight. While the RHWPG does not advocate a one-size-fits-all conservation program for the State of Texas, they recommend that the legislature address water conservation and provide some guidance and ability for county and local governments to implement these programs. The 78<sup>th</sup> Legislature appointed a Water Conservation Task Force to study water conservation policies and best management practices, and to report their results to the 79<sup>th</sup> Legislature in 2005. The 80<sup>th</sup> Legislature passed Senate Bill 3 creating a Water Conservation Advisory Council consisting of 23 members to provide a resource with expertise in water conservation.</p>	
<b>Recommendation:</b>	
<p>Region H Water Planning Group supports water conservation and recommends that the legislature continue to address and improve water conservation activities in the state.</p>	

Recommendation	Type
Water Conservation Research Funding	Legislative
<b>Discussion:</b>	
<p>The Water Conservation Implementation Task Force identified numerous best management practices in TWDB Report 362 – Water Conservation Best Management Practices Guide. The Best Management Practices outlined in the report were developed using information compiled from past research and studies along with information provided by the task force members. Additional water-saving technologies may still be developed in the future.</p>	
<b>Recommendation:</b>	
<p>The Region H Water Planning Group recommends that the State fund research into advanced conservation technologies.</p>	

Recommendation	Type
Flood Liability of Water Supply Reservoirs	Legislative
<b>Discussion:</b>	
<p>Flood control reservoirs are generally drawn down at the beginning of the annual wet season so that when large rain events occur, the runoff may be captured and later released more slowly into the receiving stream. These reservoirs therefore reduce downstream flood levels and prevent inundation in low areas. In contrast, water supply reservoirs are operated to capture and retain as much stream flow as allowable under their permits in order to have supply available during periods of high demand. This practice results in less available storage volume to capture runoff during major storms. When a major storm event occurs upstream or above a water supply reservoir, the reservoir operator must sometimes release flood flows during and after the event to prevent flooding upstream of the reservoir or to prevent damage to the dam and other facilities associated with the reservoir. Although this flood flow can contribute to downstream flooding, most reservoirs actually reduce the amount of flooding which could have occurred had the reservoir not been constructed.</p> <p>In recent years, plaintiffs with property in the downstream floodplains have brought multiple lawsuits against major water supply reservoir operators. Some recent court decisions have held the operators liable for damages to the downstream properties. If this trend is allowed to continue, it will increase insurance rates for these entities and will force operational changes to occur that may result in less available water supply for periods of need. The net effect to water users will be an increase in the cost of surface water throughout the state.</p>	
<b>Recommendation:</b>	
<p>Consider State legislation clarifying the liability exposure of reservoir operators for passing storm flows through water supply reservoirs.</p>	

Recommendation	Type
Incorporation of Technology Advancements in Projections	Legislative
<b>Discussion:</b>	
Current population projections based on traditional historic growth patterns may not accurately reflect the changes likely to occur in the future as digital connectivity continues to alter our economic, educational and social institutions.	
<b>Recommendation:</b>	
The Region H Water Planning Group recommends that the State direct the State Demographer's office to explore the potential changes in population distribution made possible by rapid advancements in information technology.	

Recommendation	Type
Ongoing RWPG Activities	Legislative
<b>Discussion:</b>	
<p>It is apparent that the RWPGs will have to meet periodically to address changed conditions related to the adopted regional water management plans. Ongoing activities will include, but not be limited to:</p> <ol style="list-style-type: none"> <li>1. Consideration of additions and modifications to the adopted plans</li> <li>2. Serving as communications liaisons with the water user communities within each region</li> <li>3. Assisting in the reconciliation of inter-regional water issues</li> </ol> <p>It will be necessary to consider additional and adequate funding to support maintenance of the RWPGs. Also, the administrative provisions of Senate Bill One and the subsequent policies that have been enacted should be reviewed to determine if the appropriate organizational structure exists to accomplish the work of the RWPGs. Additional funding should be developed to support technical studies necessary to support the needs of the RWPGs.</p>	
<b>Recommendation:</b>	
<p>The Region H Water Planning Group recommends that the TWDB request additional and adequate funding and the adoption of the appropriate administrative procedures from the legislature to facilitate ongoing activities of the RWPGs. Funding should be made available throughout the entirety of the planning cycle without funding “gaps” that make it difficult for planning groups to accomplish their ongoing efforts.</p>	

Recommendation	Type
Board Participation Program for regional water and wastewater projects	Infrastructure Finance
<b>Discussion:</b>	
<p>This program enables the Water Development Board to assume a temporary ownership interest in a regional project when the local sponsors are unable to assume debt for an optimally sized facility. Payments on the funds provided by the State are deferred until a customer base grows into the capacity it funded. The deferred interest payments do not accrue additional interest. By funding up to 50% of a project, the program helps the local sponsors optimize facility sizes and avoid later expansions and replacements.</p>	
<p>This program will be extremely important for the development of the recommended water management strategies, as well as for water treatment and distribution systems. Large projects, particularly reservoirs, must be developed in anticipation of future demands due to the long periods of time required for planning, permitting, property acquisition and construction. For example, Allens Creek Reservoir is estimated to cost over \$316 million. The current customer base cannot support this high cost. The Board Participation program is one of the few programs available to assist local sponsors with this water management strategy. Other reservoir projects within Region H could also experience similar financing issues.</p>	
<p>The Board Participation Program will also be important during the expansion of surface water service into areas affected by subsidence. As areas develop and implement Groundwater Reduction Plans, it is expected that communities will develop plans for regional treatment and distribution systems to reduce costs. Board participation in these facilities will allow them to be optimally sized at their inception. The Board Participation Program offers the important advantage of reducing the unit costs for water service for both existing and future water users of the optimally sized facility.</p>	
<b>Recommendation:</b>	
<p>Increase funding of the Board Participation Program as needed to allow development of these water supply projects.</p>	



Recommendation	Type
State Revolving Fund Programs (Drinking Water State Revolving Fund and Clean Water State Revolving Fund)	Infrastructure Finance
<b>Discussion:</b>	
<p>These programs provide loans at subsidized interest rates for the construction of water treatment and distribution systems and for source water protection (DWSRF) and for wastewater collection and treatment systems (CWSRF). As the loans are paid off, the TWDB uses the funds to make new loans (thus the name Revolving Fund). State funds for the program receive a federal match through the Environmental Protection Agency. These loans are intended for projects to bring existing systems into compliance with rules and regulations, and are available to political subdivisions, water supply corporations and privately-owned water systems. Applications are collected at the beginning of each year, given a priority ranking, and funded to the extent possible. Projects not funded in a given year may carry forward into the next year’s ranking.</p> <p>These programs are important in that they assist sub-standard water systems in attaining the minimum water quality mandated by Federal and State regulations, but they are not intended to fund system expansions due to projected growth. However, these programs may apply to individual systems in the Region experiencing water quality declines, or to those systems affected by the changed standard for Arsenic. The SRF Fund may also provide assistance to water providers with aging treatment systems and transmission lines.</p>	
<b>Recommendation:</b>	
<p>Increase the funding of the State Revolving Funds Program in future decades, and expand the program to include coverage for system capacity increases to meet projected growth for communities.</p>	

Recommendation	Type
State Loan Program	Infrastructure Finance
<b>Discussion:</b>	
<p>The State Loan Program provides loans to Political Subdivisions and Water Supply Corporations for water, wastewater, flood control and municipal solid waste projects. Payments are not deferred in this program as they are under the State Participation Program, and the interest rates are not subsidized as they are in the Revolving Fund Programs. These loans are available for both local projects and for the local sponsors of regional projects. Acquisition and construction of water treatment and distribution systems are eligible for funding. Loans are made on a first come, first served basis.</p>	
<p>This program will be heavily utilized in groundwater-served areas introducing surface water to meet current and projected demands. The ready availability of groundwater across the region has allowed development to occur outside existing surface water service areas. As the limits of available groundwater are reached (sustainable yields and/or regulatory limits), surface water treatment and transmission systems must be constructed to meet future demands. The costs are significant in that they are required in a short time span, instead of initiated and expanded over time as they are in areas originally served by surface water. Where local rate payers cannot afford to directly pay for transition costs, State loans offer a significant cost advantage over most commercial and many public funding options, using the State’s high bond rating rather than the rating of the local sponsor.</p>	
<b>Recommendation:</b>	
Increase funding of the State Loan Program to meet near-term infrastructure cost projections.	

Recommendation	Type
Agricultural Water Conservation Loan Program	Infrastructure Finance
<b>Discussion:</b>	
<p>This program provides loans to soil and water conservation districts, underground water conservation districts and districts authorized to supply water for irrigation. These districts may further lend the funds to private individuals for equipment and materials, labor, preparation and installation costs to improve water-use efficiency related to irrigation of their private lands. There is also a grant program for equipment purchases by eligible districts for the measurement and evaluation of irrigation systems and agricultural water conservation practices, and for efficient irrigation and conservation demonstration projects, among others. However, these grants are not available to individual irrigators. Similar Federal loan and grant programs are available, but require a 25% to 50% local match.</p> <p>In the Region H Water Plan, irrigation conservation is a recommended strategy in eight counties (Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, and Waller). In some cases, the conservation of water through these agricultural programs provides additional water for use by municipalities that also sue groundwater supplies. As it is unlikely that municipalities will seek out and fund irrigation conservation projects, the task of encouraging conservation will fall to the wholesale water providers and those government entities with jurisdiction in those counties. Even with Agricultural Water Conservation Loan Program assistance, irrigators will be slow to invest in water-conserving equipment until water rates increase, making it economically advantageous to do so. The difficulty increases in areas where groundwater is the primary supply source for irrigation.</p> <p>Additionally, irrigators in Region H also find it difficult to access funding programs as these typically require ownership of the irrigated property. Much of the production within the region is performed by farmers who lease land from others, making them ineligible for these programs.</p> <p>Eligible districts will need to act as conservation brokers, identifying those irrigators with the potential to reduce water demand through equipment improvements, and matching them with available loans. By reducing usage in this manner, water suppliers will be able to provide the saved portion of their supply to new customers. To assist with the immediate adoption of these improved conservation practices, a one-time grant or subsidy program for water-efficient equipment purchases may help by reducing the loans amounts required by each irrigator. If the requirements of an existing Federal loan or grant program could be met, the State could provide all or part of the local matching share. Since the methods used by irrigators vary across the state, such a program would need to be flexible, with local oversight provided by those districts currently eligible for the Agricultural Water Conservation Loan Program. Consistency with the applicable Regional Water Plan may be included as a prerequisite for this program, as it is for other State grants and loans.</p>	
<b>Recommendation:</b>	
<p>Provide a mechanism to leverage Federal grant programs for agriculture by providing the local matching share. Increase funding of associated loan programs and consider adding a one-time grant or subsidy component to stimulate early adoption of conservation practices by individual irrigators. Provide opportunities for joint cooperation between growers and land owners to facilitate the use of funding programs for property under long-term lease agreements.</p>	

Recommendation	Type
Texas Community Development Program	Infrastructure Finance
<b>Discussion:</b>	
<p>The federal Community Development Block Grant program provides grants and loans to low-income communities for certain projects, including water and wastewater infrastructure. It is administered in Texas under the Office of Rural Community Affairs as the Texas Community Development Program. The Small Town Environment Program (STEP) under the TCDP provides water and sewer system grants to cities and counties not eligible for funding under the Colonias or Economically Disadvantaged Areas Programs (EDAP). Within Region H, there are no Colonias or EDAP-eligible communities, but STEP grants may be obtained.</p>	
<b>Recommendation:</b>	
<p>Continue State and Federal support of the Texas Community Development Program, and increase the allocation of funds for the Small Town Environment Program.</p>	

Recommendation	Type
Regional Water Supply and Wastewater Facilities Planning Program	Infrastructure Finance
<b>Discussion:</b>	
<p>This program provides planning grants to Political Subdivisions for studies and analyses to determine feasible alternatives for regional water supply and wastewater facility needs. The planning must include more than one service area or political subdivision to be considered regional. Grants are generally limited to 50% of the total cost, and cannot be applied to the preparation of state and federal permits, administrative or legal proceedings of regulatory agencies, or the preparation of engineering plans and specifications.</p>	
<p>This grant program can assist in planning for local areas, particularly the unincorporated areas of each county. Local sponsors investigating the best means to serve their populations may join with neighboring communities and water providers and request a planning grant, thus reducing their individual planning costs. Determination of the optimal institutional arrangement between political subdivisions is one of the eligible study areas under this program. Should a regional facility prove to be the best solution for the group, they may elect to pursue additional support from the State Loan and Participation programs.</p>	
<p>One limitation of the program is that it cannot be applied to the detailed facility planning or preliminary engineering design of the proposed facility. These early engineering phase costs can represent as much as 30% of the cost of the facility, and generally must be completed before accurate financial requirements can be defined. Inclusion of these costs in either the planning grant or pre-project loan programs would better help these small communities develop the projects they need.</p>	
<b>Recommendation:</b>	
<p>Increase funding of e Regional Water Supply and Wastewater Facilities Planning Program in anticipation of upcoming development throughout the state, and expand the program to include the preliminary engineering design costs for recommended facilities.</p>	

Recommendation	Type
Water and Waste Disposal Loans and Grants from the USDA Rural Utilities Service	Infrastructure Finance
<b>Discussion:</b>	
<p>This Federal program provides loans and grants in rural areas and communities of up to 10,000 people for water, wastewater, storm water and municipal solid waste projects. The program is intended for communities that cannot obtain commercial loans at reasonable rates. Loans are made at or below market rates, depending upon the eligibility of the recipient. Grants can cover up to 75% of project costs when required to reduce user costs to a reasonable level. A separate program of Emergency Community Water Assistance Grants (up to \$500,000 per project) is also available to communities experiencing rapid declines in water quality or quantity.</p> <p>This program is similar to the state loan and revolving fund programs. It offers another option to small communities and rural areas unable to finance required infrastructure without assistance. However, this is a nationwide program, and the competition for available funds is correspondingly greater. Colonias and border areas are specifically identified as target areas for the grant portion of this program, and it is therefore in the State’s interest to support its continued funding.</p> <p>The TWDB was recently authorized by the 77<sup>th</sup> Texas legislature to establish a similar program at the state level. The Rural Water Assistance Fund will provide low-interest loans to municipalities, water districts and non-profit water supply corporations. The program is still under development and has not yet been funded.</p>	
<b>Recommendation:</b>	
Support continued and increased funding of Water and Waste Disposal Loans and Grants from USDA Rural Utilities Service at the Federal level, and fund the State Rural Water Assistance Fund.	

Recommendation	Type
Desalination Research and Demonstration Projects	Infrastructure Finance
<b>Discussion:</b>	
<p>House Bill 1370 of the 78<sup>th</sup> Texas legislature directed the Texas Water Development Board to “undertake or participate in research, feasibility and facility planning studies, investigations and surveys as it considers necessary to further the development of cost-effective water supplies from seawater desalination in the state.” The TWDB has concluded desalination site assessments, and is preparing to assist in the construction of three demonstration facilities along the Texas Gulf Coast. The Region H Water Planning Group supports this demonstration project.</p>	
<b>Recommendation:</b>	
<p>Provide research grants for the study of current and upcoming desalination technologies available to wholesale and retail water suppliers. Continue to fund appropriate demonstration facilities to develop a customer base, and pursue Federal funding for desalination programs. Focus particular attention to “near-term” efforts such as brackish groundwater desalination as a way of bridging current and long-term seawater desalination alternatives.</p>	

Recommendation	Type
Water Research Program - Agriculture	Infrastructure Finance
<b>Discussion:</b>	
<p>The Texas Water Development Board offers research grants to individuals or political subdivisions for water research on topics published in the Board’s Request for Proposals. Eligible topics include product and process development.</p>	
<p>In the Region H Water Plan, one recommendation to the legislature is to establish funding for agricultural research in the areas of efficient irrigation practices and the development of water-efficient and drought-resistant crop and species. Irrigators cannot generally afford the increased cost of water when new supplies are developed in today’s market. By reducing demand in a cost-efficient manner, small irrigators may be able to continue farming. This is another potential topic for the Water Research Program.</p>	
<b>Recommendation:</b>	
<p>Provide increased research grants to study and better develop drought-resistant crop species and efficient irrigation practices.</p>	



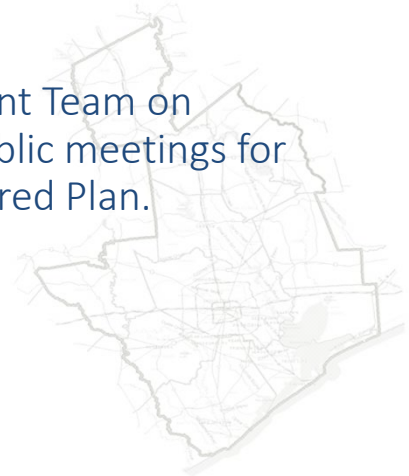
Recommendation	Type
Regionalization	Infrastructure Finance
<b>Discussion:</b>	
<p>As communities assess the growing costs of water infrastructure, economies of scale can be realized by combining the needs of water user groups into larger, more efficient water supply, treatment and distribution facilities. Regional facilities offer interconnections between existing systems, which can increase overall reliability. The individual system connections to these systems can be phased over time to meet regional demands with less impact on individual systems than each individually trying to expand. In areas where groundwater limits are being reached, regional groups can identify areas where surface water supply is most needed, and allow other areas to remain on groundwater systems. Sharing costs across a wide customer base keeps rates comparable between service areas.</p> <p>A range of cooperative options exists, including formation of regional authorities, inter-local agreements, public-private partnerships, local government corporations and public contracting with a private regional supplier. The optimal arrangement between political subdivisions depends upon the specific project and the goals of the parties. Partnerships with private investors through public-private partnerships and direct contracting with privately-owned facilities offer an advantage of using private financing to meet part of the initial planning and construction costs. The regulations governing these partnerships must protect the public represented by the partnership, but if too restrictive, may prevent the partnership from realizing potential cost savings through the use of private-sector procurement and construction practices.</p> <p>Consideration should be given to reducing procurement restrictions for Local Government Corporations to encourage the pooling of resources for funding regional projects. Also, existing assistance programs should remain available when political subdivisions enter into public/public or public/private partnerships.</p>	
<b>Recommendation:</b>	
<p>Region H supports the forming of regional partnerships and encourages the State to allow them the greatest possible latitude for financing in their governing regulations. Additionally, the State Participation Program should be made available to these public/private partnerships and to private nonprofit water supply corporations.</p>	

## Agenda Item 13

Receive presentation from Consultant Team on recommendations for the schedule of public meetings for presentation of the Initially Prepared Plan.

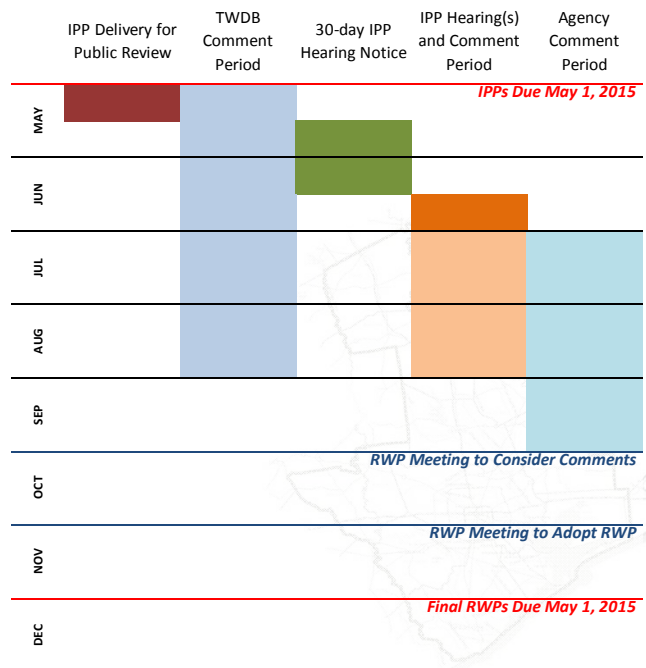
## Agenda Item 13 Public Process

Receive presentation from Consultant Team on recommendations for the schedule of public meetings for presentation of the Initially Prepared Plan.



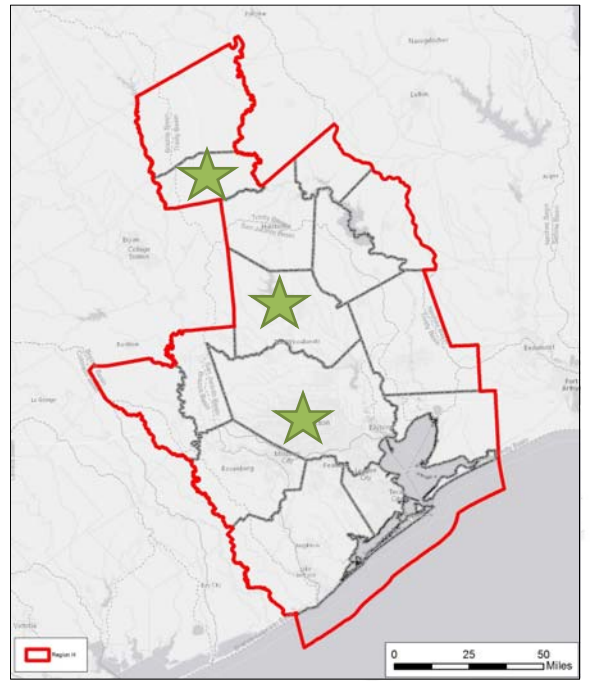
## Agenda Item 13 Public Process

- IPP submittal by May 1
- Public events
  - 1 public hearing required
  - Typically 1 public hearing, 3 locations
- Comment periods
  - TWDB: 120 days from IPP submittal
  - Agency: 90 days from public hearing
  - Public: 60 days from public hearing



## Agenda Item 13 Public Process

- Proposed schedule
  - Two events (week of June 15)
    - Madisonville
    - Houston
  - One events (week of June 22)
    - Conroe (RWPG meeting)
  - RWPG Meetings
    - October 7
    - November 4



## Agenda Item 15

Receive presentation from Consultant Team and Texas Water Development Board regarding the process for and preparation of an application for a Regional Water Planning Grant from the Texas Water Development Board for funding of the fifth round of regional water planning for Region H.

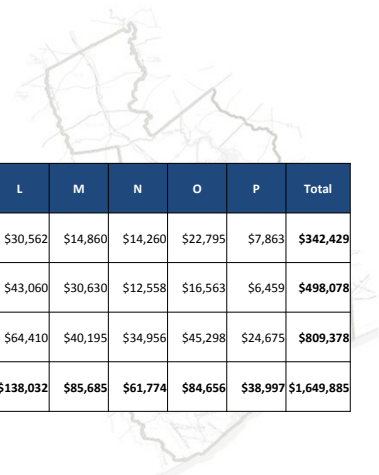
## Agenda Item 15 2021 RWP

Receive presentation from Consultant Team and Texas Water Development Board regarding the process for and preparation of an application for a Regional Water Planning Grant from the Texas Water Development Board for funding of the fifth round of regional water planning for Region H.



## Agenda Item 15 2021 RWP

- Texas Water Development Board Research and Planning Fund  
Senate Bill One Regional Water Planning Grant
  - Publication date: 2014/12/15
  - Due date: 2015/03/03



Task	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Total
<b>2A</b> Non-Population Related Water Demand Projections	\$20,104	\$13,707	\$24,198	\$26,425	\$8,064	\$29,819	\$40,286	\$28,385	\$26,840	\$9,874	\$24,387	\$30,562	\$14,860	\$14,260	\$22,795	\$7,863	<b>\$342,429</b>
<b>2B</b> Population & Population-Related Water Demand Projections	\$15,043	\$10,112	\$89,070	\$37,364	\$10,815	\$21,533	\$59,531	\$73,371	\$31,390	\$7,414	\$33,165	\$43,060	\$30,630	\$12,558	\$16,563	\$6,459	<b>\$498,078</b>
<b>10</b> Public Participation, Administration, and Adoption	\$42,373	\$33,061	\$75,399	\$63,808	\$26,567	\$55,756	\$87,983	\$76,153	\$59,661	\$27,279	\$51,804	\$64,410	\$40,195	\$34,956	\$45,298	\$24,675	<b>\$809,378</b>
<b>Total</b>	<b>\$77,520</b>	<b>\$56,880</b>	<b>\$188,667</b>	<b>\$127,597</b>	<b>\$45,446</b>	<b>\$107,108</b>	<b>\$187,800</b>	<b>\$177,909</b>	<b>\$117,891</b>	<b>\$44,567</b>	<b>\$109,356</b>	<b>\$138,032</b>	<b>\$85,685</b>	<b>\$61,774</b>	<b>\$84,656</b>	<b>\$38,997</b>	<b>\$1,649,885</b>

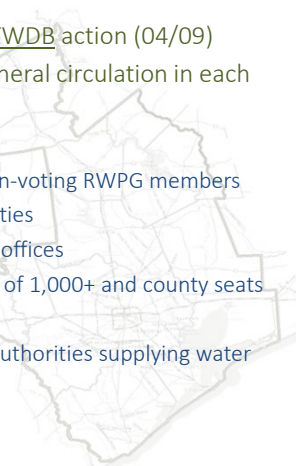
## Agenda Item 15 2021 RWP

### ■ Requirements

#### ■ Application

- Application Form
- Detailed Scope of Work
- Schedule
- Proof of Notification

#### ■ Public Notice

- 30 days prior to TWDB action (04/09)
  - Newspaper of general circulation in each county
  - Mailed notice
    - Voting and non-voting RWPG members
    - Interested parties
    - County Clerks offices
    - Municipalities of 1,000+ and county seats
    - County judges
    - Districts and authorities supplying water
    - All RWPGs
- 

Type: RFP/RFI/RFQ

Project Name: [Regional Water Planning](#)

Agency: [Texas Water Development Board](#)

Location: Austin, TX 78711

Level Of Government: State

Submittal/Due Date: **3/3/2015 12:00 PM** **Due in 77 days**

Publication Date: 12/15/2014

Last Updated Date: 12/15/2014

Onvia Reference #: RFP:30518085

[View Map](#)

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**Specifications**

Description: Request for Applications for Regional Water Planning  
 The Texas Water Development Board's (TWDB) Research and Planning Fund offers grants to eligible applicants for the development or revision of regional water plans. The proposed activities must be the development of a plan, an amendment to an approved regional water plan developed by the regional water planning group for a regional water planning area pursuant to the Texas Water Code, §16.053 and Chapter 357, or other special studies approved by the TWDB which will enhance water planning efforts in the region. Activities eligible for funding are those related to the development or revision of regional water plans including public meetings and hearings. Activities ineligible for funding include activities which the TWDB determines existing information or data is sufficient, activities directly related to the preparation of applications for state or federal permits or other approvals, activities associated with administrative or legal proceedings by regulatory agencies, preparation of engineering plans and specifications, or activities relating to individual system facility needs.

**When to Apply**

The TWDB is publishing a Request for Applications in the Texas Register, scheduled for December 12, 2014. Unsolicited applications can be filed at any time but will only be considered for funding depending on availability of funds and demonstrated need. The current timeline for consideration of applications is as follows:

- March 3, 2015 – Application, including required scope of work (as defined by TWDB in Request for Applications) due to TWDB by 12:00 p.m. (noon).
- (Estimated April 9, 2015) – TWDB staff will present funding recommendations for Board consideration to negotiate and execute contract amendments. Prior to TWDB Board action, in accordance with 31 TAC 357.21(d)(4), regional water planning groups (RWPGs) should submit proof of public notice that an application for planning assistance has been filed.

**Who may apply**

Eligible applicant - A political subdivision that has been designated in writing to the executive administrator by the RWPG as a representative of the RWPG to receive funds for all or part of the cost of developing or revising regional water plans defined in Texas Water Code, §16.053 and Chapter 357 of this title (relating to Regional Water Planning).

Political subdivision includes a city, county, district, or authority created under the Texas Constitution, Article III, §52, or Article XVI, §59, any other political subdivision of the state, any interstate compact commission to which the state is a party, and any nonprofit water supply corporation created and operating under Texas Water Code Chapter 67 (relating to Nonprofit Water Supply or Sewer Service Corporations).

**Additional Instructions**

- Regional Water Planning Grant Application Instructions
- Guidance for Preparation of the Regional Water Planning Grant Application

**Additional Information**

Documents relevant to the Request for Applications for the fifth cycle of regional water planning

**Contact Information**

Temple McKinnon, Manager  
 Regional Water Planning  
 Texas Water Development Board  
 P.O. Box 13231, Austin, TX 78711



(512) 475-2057  
temple.mckinnon@twdb.texas.gov

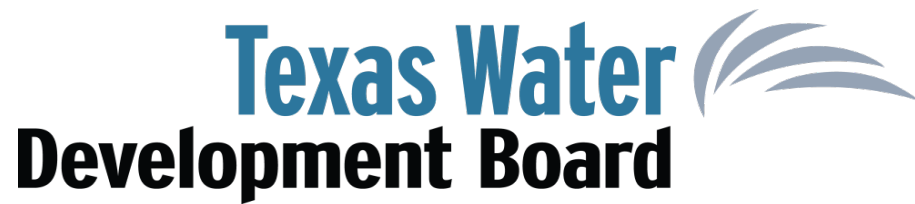
Project Documents:  [RWP Grant Application Instruct...](#) Document

Products and Services: **Primary:** Land use services, Water resource services

Categories: Environmental Planning  
Clean Water  
Wastewater

#### Agency Contact

Buyer: [Temple McKinnon](#)  
Buyer Job Title: Manager  
Buyer Email: [temple.mckinnon@twdb.texas.gov](mailto:temple.mckinnon@twdb.texas.gov)  
Agency: [Texas Water Development Board](#)  
Owner Address: 1700 North Congress Avenue  
P.O. Box 13231  
Austin, Texas 78711  
Owner Phone: p: (512) 463-7847  
Owner Website: <http://www.twdb.state.tx.us>



**Texas Water Development Board**  
**Research and Planning Fund**  
**Senate Bill One**  
**Regional Water Planning Grant**  
**Application Instructions**

December 2014

**General:**

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**Who may apply:**

Eligible applicant - A political subdivision that has been designated in writing to the executive administrator by the RWPG as a representative of the RWPG to receive funds for all or part of the cost of developing or revising regional water plans defined in Texas Water Code, §16.053 and Chapter 357 of this title (relating to Regional Water Planning).

Political subdivision includes a city, county, district, or authority created under the Texas Constitution, Article III, §52, or Article XVI, §59, any other political subdivision of the state, any interstate compact commission to which the state is a party, and any nonprofit water supply corporation created and operating under Texas Water Code Chapter 67 (relating to Nonprofit Water Supply or Sewer Service Corporations).

**Application Submittal:**

Each RWPG must submit a single application containing a proposed scope of work which includes a task and expense budget, a description of tasks to be performed, specific deliverables for each task, and a task schedule. Utilize the document developed by TWDB: “Initial Scope of Work for the Fifth Cycle of Regional Water Planning” located at <http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2021/index.asp>.

Tasks should be related to the following activities:

- Population and water demand projections; and
- Public participation and plan adoption activities.

Initial funding for the fifth regional water planning cycle will be limited to a maximum of \$1,649,885

million. None of this funding will be awarded by task on a competitive basis. Administrative funds including public participation activities will account for \$809,378 or 49 percent of the initial funds appropriated and will be allocated to each region according to formula funding. The total regional allocation is shown in Table 1 below. See Table 2 for Task budget breakdown by region.

Table 1. Initial Funding by Region

Region	Initial Funding
A	\$77,520
B	\$56,880
C	\$188,667
D	\$127,597
E	\$45,446
F	\$107,108
G	\$187,800
H	\$177,909
I	\$117,891
J	\$44,567
K	\$109,356
L	\$138,032
M	\$85,685
N	\$61,774
O	\$84,656
P	\$38,997
<b>Total</b>	<b>\$1,649,885</b>

Applications are to be copied on both sides of the paper and recycled materials should be used when possible. A total of five (5) copies and one electronic version (CD) should be submitted to the following address:

Texas Water Development Board  
 Contracts and Purchasing  
 1700 North Congress  
 P. O. Box 13231  
 Austin, Texas 78711-3231

All applications **must be complete** and include general information, proposed planning information, and proof of notification, including a copy of the letter to be sent to individuals and a list of the intended recipients. A list of required items with check boxes has been provided in the following pages to assist you in completing the application. **Please check the boxes after you have included the respective items in the application and return the completed checklist with the application.**

**If a Grant is Awarded:**

A copy of our standard contract for Senate Bill 1 Research and Planning Fund grants will be forthcoming for preview. Please make note of the following requirements that will be included in the regional water planning contract:

- a) applicants must coordinate existing water planning for the purpose of providing information for the proposed planning and to avoid duplication of activities;
- b) all subcontracts for professional services must be awarded in accordance with the Professional Services Procurement Act, Tex. Gov't Code § 2254.001, *et seq.*;
- c) all subcontracts for work performed before being contracted or assigned must be accepted in writing by the Texas Water Development Board;

- d) all subcontracts must include a detailed task and expense budget for each item of work to be performed;
- e) all subcontracts must include provisions that require subcontractor compliance with Texas Water Development Board rules and grant contract with the applicant;
- f) all subcontractor charges must be paid by the applicant prior to submitting a voucher to the Texas Water Development Board;
- g) funding from the Texas Water Development Board will be on a 20-percent advance or cash reimbursable basis with a 5% retainage to be withheld by the Texas Water Development Board until conclusion of the planning contract;
- h) applicants must submit payment requests including substantiating documentation and progress reports to the Texas Water Development Board for reimbursement of expenses;
- i) applicants must submit twelve (12) double-sided copies of the draft regional water plan (Initially Prepared Plan) to the Texas Water Development Board for review and comment, and two (2) electronic copies of the entire Initially Prepared Plan, one (1) in searchable Portable Document Format (PDF) and one (1) in Microsoft Word (MSWord) Format;
- j) applicants must submit nine (9) bound, double-sided copies of the Final Regional Water Plan (using recycled materials when possible) that incorporates and addresses comments received from the Texas Water Development Board; two (2) electronic copies of the entire Final Regional Water Plan, one (1) in searchable Portable Document Format (PDF) and one (1) in Microsoft Word (MSWord) Format; and one (1) electronic copy of all files on which the plan is based;
- k) the Texas Water Development Board retains unlimited rights to technical or other data or models resulting directly from the planning, including associated with subcontracts; and
- l) applicants must provide the Texas Water Development Board with copies of all original electronic data, models, and programs resulting directly from the planning for the initially prepared plan and the adopted regional water plan.

Additionally, in accordance with 31 TAC 357.12(a)(1), regional water planning groups will be required to hold a pre-planning public meeting to receive public input on issues that should be addressed or provisions that should be included in the regional or state water plan. This meeting must be held prior to conducting any reimbursable activities associated with the regional water plan development.

**If you have questions regarding preparation of an application, call the Texas Water Development Board's Contract and Purchasing Division at (512) 936-6079.**

### **Application Checklist**

#### **I. GENERAL INFORMATION**

- 1. Legal name of applicant(s).
- 2. Regional Water Planning Group.
- 3. Authority of law under which the applicant was created.
- 4. Applicant's official representative, Name, Title, Mailing address, Phone number, Fax number, if available, E-mail Address, and Vendor ID Number.
- 5. DUNS Number. If you do not have a DUNS number, visit: <https://iupdate.dnb.com/iUpdate/viewiUpdateHome.htm>

- 6. Is this application in response to a Request for Applications published in the Texas Register?  
Yes            x            No
  
- 7. If yes to No. 6 above, list document number and date of publication of the Texas Register.
  
- 8. Type of proposed planning (Check all that apply)
  - Initial scope of work
  - Development of a regional water plan    X
  - Revision of a regional water plan
  - Special studies approved by TWDB
  
- 9. Total proposed planning cost (see Table 1 for total initial cost by region)
  
- 10. Total grant funds requested from the Texas Water Development Board.
  
- 11. Detailed statement of the purpose for which the money will be used. (Not to exceed 1 page.)
  
- 12. Detailed description of why state funding assistance is needed. (Not to exceed 1 page.)
  
- 13. Identify potential sources and amounts of funding available for implementation of viable solutions resulting from proposed planning.

**II. PLANNING INFORMATION**

- 14. A detailed scope of work for proposed planning. (Include Initial Scope of Work for the Fifth Cycle of Regional Water Planning document prepared by TWDB located at <http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2021/index.asp>)
  
- 15. A task budget for detailed scope of work by task. (See Table 2 for task budget by region).
  
- 16. An expense budget for scope of work by expense category. *Example is included.*
  
- 17. A time schedule for completing detailed Scope of Work by task. (see Scope of Work document referenced above)
  
- 18. Specific deliverables for each task in Scope of Work. (see Scope of Work document referenced above)
  
- 19. Method of monitoring study progress.
  
- 20. Qualifications and direct experience of proposed project staff.

### III. WRITTEN ASSURANCES

Written assurance of the following items:

- Proposed planning does not duplicate existing projects;
- Implementation of viable solutions identified through the proposed planning will be diligently pursued and identification of potential sources of funding for implementation of viable solutions;

### IV. PROOF OF NOTIFICATION

- Proof of notification. The notice of intent to apply for Regional Water Planning funds should be posted by the RWPG's Political Subdivision **at least 30 days prior to TWDB Board consideration of funding applications** (estimated TWDB Board meeting date of April 9, 2015). Prior to TWDB Board action, in accordance with 31 TAC 357.21(d)(4), the applicant must provide TWDB a copy of the notice, a list of who the notice was sent to, the date the notice was sent, copies of all notices as published showing the name of the newspaper and date on which the notice was published.

The notification must meet the following requirements as set forth in 31 TAC 357.21(d)(2) and 31 TAC 357.21(d)(6):

1. publishing notice in a newspaper of general circulation in each county located in whole or in part in the regional water planning area (RWPA); and
2. mailing notice to all voting and non-voting RWPG members; any person or entity who has requested notice of RWPG activities in writing or email; each County Clerk, in writing, within the RWPA; each County Clerk in counties outside the RWPA where a recommended or alternative water management strategy would be located; each mayor of a municipality with a population of 1,000 or more or which is a county seat that is located in whole or in part in the RWPA; each county judge of a county located in whole or in part in the RWPA; each special or general law district or river authority with responsibility to manage or supply water in the RWPA based upon lists of such water districts and river authorities obtained from Texas Commission on Environmental Quality; and all RWPGs in the state.

The notice must include the following:

- Name and address of applicant and applicant's official representative;
- Brief description of the regional water planning area;
- Purpose of the proposed planning;
- Texas Water Development Board Executive Administrator's name (Kevin Patteson) and address (P.O. Box 13231, Austin, Texas 78711);
- Name and address of contact person at Texas Water Development Board (David Carter, P.O. Box 13231, Austin, Texas 78711);
- Statement that any comments on the proposed planning must be filed with the applicant and the Texas Water Development Board Executive Administrator within 30 days of the date on which the notice was mailed.

Table 2. Task Budget by Region

TASK		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Total
<b>2A</b>	Non-Population Related Water Demand Projections	\$20,104	\$13,707	\$24,198	\$26,425	\$8,064	\$29,819	\$40,286	\$28,385	\$26,840	\$9,874	\$24,387	\$30,562	\$14,860	\$14,260	\$22,795	\$7,863	<b>\$342,429</b>
<b>2B</b>	Population & Population-Related Water Demand Projections	\$15,043	\$10,112	\$89,070	\$37,364	\$10,815	\$21,533	\$59,531	\$73,371	\$31,390	\$7,414	\$33,165	\$43,060	\$30,630	\$12,558	\$16,563	\$6,459	<b>\$498,078</b>
<b>10</b>	Public Participation, Administration, and Adoption	\$42,373	\$33,061	\$75,399	\$63,808	\$26,567	\$55,756	\$87,983	\$76,153	\$59,661	\$27,279	\$51,804	\$64,410	\$40,195	\$34,956	\$45,298	\$24,675	<b>\$809,378</b>
<b>TOTAL</b>		<b>\$77,520</b>	<b>\$56,880</b>	<b>\$188,667</b>	<b>\$127,597</b>	<b>\$45,446</b>	<b>\$107,108</b>	<b>\$187,800</b>	<b>\$177,909</b>	<b>\$117,891</b>	<b>\$44,567</b>	<b>\$109,356</b>	<b>\$138,032</b>	<b>\$85,685</b>	<b>\$61,774</b>	<b>\$84,656</b>	<b>\$38,997</b>	<b>\$1,649,885</b>



**CONTRACTOR (RWPG POLITICAL SUBDIVISION) EXPENSE BUDGET**

CATEGORY	TOTAL AMOUNT
Other Expenses <sup>1</sup>	\$X
Subcontract Services	\$X
Voting Planning Member Travel <sup>2</sup>	\$X
Total Study Cost <sup>3</sup>	\$XX,XXX

<sup>1</sup>Eligible Other Expenses are administrative costs associated with Political Subdivisions and are defined to be direct, non-labor costs including:

- a) expendable supplies actually consumed in direct support of the planning process;
- b) direct communication charges;
- c) limited direct costs/fees of maintaining RWPG website domain, website hosting, and/or website – not to exceed \$250.00 per calendar year;
- d) reproduction of materials directly associated with notification or planning activities (currently 10¢ per copy or the actual non-labor direct costs as documented by the Contractor);
- e) direct postage (e.g., postage for mailed notification of funding applications or meetings); and
- f) other direct costs of public meetings, all of which must be directly related to planning (e.g., newspaper and other public notice posting costs).

<sup>2</sup>Voting Planning Member Travel Expenses is defined as eligible mileage expenses incurred by regional water planning members that cannot be reimbursed by any other entity, political subdivision, etc. as certified by the voting member. The reimbursed amount is limited to the maximum amounts authorized for state employees by the General Appropriations Act, Tex. Leg. Regular Session, 2013, Article IX, Part 5, as amended or superseded.

<sup>3</sup>Ineligible Expenses include, but are not limited to:

- a) Compensation for the time or expenses of RWPGs members' service on or for the RWPG;
- b) Costs of administering the RWPGs, including labor costs, or building, or overhead costs associated with the Political Subdivision;
- c) Indirect or labor costs of public notice and meetings, including time and expenses for attendance at such meetings;
- d) Costs for training;
- e) Costs of reviewing products developed due to funding requests to TWDB;
- f) Costs of administering the regional water planning grant and associated contracts;
- g) Labor, reproduction, or distribution of newsletters;
- h) Direct costs greater than \$250.00 per year for domain fees, website hosting, and/or web site maintenance costs;
- i) Food, drink, or lodging for Regional Water Planning Group members (including tips and alcoholic beverages);
- j) Purchase, rental, or depreciation of equipment (e.g., computers, copiers, fax machines);
- k) General purchases of office supplies not documented as consumed directly for the planning process; and
- l) Costs associated with social events or tours.

## Agenda Item 17

Receive report regarding recent and upcoming activities related to communications and outreach efforts on behalf of the Region H Planning Group.

## Agenda Item 17 Community Outreach

Receive report regarding recent and upcoming activities related to communications and outreach efforts on behalf of the Region H Planning Group.



## Agenda Item 17 Community Outreach

- North Houston Association  
Environment Committee  
November 13
- Gulf Coast-Montgomery County  
Water Efficiency Network  
January 29
- H-GAC Natural Resources  
Advisory Committee  
February 5



## Agenda Item 18

Agency communications and general information.

**RECEIVED**

DEC 15 2014

San Jacinto River Authority  
G&A Office

**Texas Water  
Development Board**

P.O. Box 13231, 1700 N. Congress Ave.  
Austin, TX 78711-3231, [www.twdb.texas.gov](http://www.twdb.texas.gov)  
Phone (512) 463-7847, Fax (512) 475-2053

December 8, 2014

Mark Evans  
Chair, Region H  
c/o N. Harris Co. Regional Water Authority  
3648 Cypress Creek Pkwy #110  
Houston, Texas 77068

Re: Infrastructure Financing Survey responses

Dear Mr. Evans:

With the recent implementation of the State Water Implementation Fund for Texas (SWIFT), the Texas Water Development Board (TWDB) has made Infrastructure Financing (IFR) Survey forms available on our website. Your planning group has previously conducted the IFR Survey as part of the development of its regional water plan, and will continue to do so under Task 9 in your current planning effort. With an IFR Survey response being a statutory requirement for an entity to access SWIFT funding, some entities pursuing SWIFT funds who haven't responded to the last IFR Survey may need to complete an IFR Survey. TWDB will be directly collecting this updated information on recommended water management strategies in the 2012 State Water Plan from entities interested in applying for SWIFT funding.

We wanted to make you aware of this process should you receive questions from entities in your region. You can reference interested parties to our website at the link below <http://www.twdb.texas.gov/financial/programs/SWIFT/index.asp> or refer them to your TWDB regional water planning project manager.

If you have any questions, please contact Lann Bookout at 512-936-9439.

Sincerely,



Jeff Walker  
Deputy Executive Administrator  
Water Supply & Infrastructure

Cc: Mr. Jace Houston, P.O. Box 329, Conroe, Texas 77305-0329

<p>Our Mission : To provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas</p>	<p>: Board Members : Carlos Rubinstein, Chairman   Bech Bruun, Member   Kathleen Jackson, Member : : Kevin Patteson, Executive Administrator</p>
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**Gulf Coast Waste Disposal Authority**

910 Bay Area Boulevard • Houston, Texas 77058  
Phone: 281.488.4115 • Fax: 281.488.3331 • www.gcwda.com

December 9, 2014

Mr. Mark Evans,  
Chair, RHWPG  
c/o San Jacinto River Authority  
1577 Dam Site Road  
Conroe, Texas 77304

This letter is to inform you that Gulf Coast Waste Disposal Authority (GCA) is currently applying to the Texas Water Development Board for a grant to advance regional wastewater treatment and water reuse strategies to support the future needs of the Mont Belvieu service area. The planning area for this feasibility study includes:

- Harris County Precinct 2
- Liberty County Precincts 1 and 4
- Chambers County Precincts 3 and 4
- Mont Belvieu, TX
- Cove, TX
- Old River-Winfree, TX
- Baytown, TX
- Houston-Galveston Area Council
- Region H Water Planning group

In response to the community's rapid growth GCA is collaborating with various partners to evaluate a regional approach that could increase wastewater treatment capacity and existing water supplies to the area. GCA, in partnership with the City of Mont Belvieu and a group of industries with wastewater discharge permits in the Mont Belvieu area, will undertake a feasibility study to evaluate options for building a regional wastewater treatment facility and a water reuse treatment and delivery system.

This feasibility study will identify the manufacturing, environmental, operational, and financial opportunities and constraints associated with a regional wastewater treatment facility and a water reuse treatment and delivery system. This report is necessary for GCA and the Mont Belvieu area partners to more effectively address future water supply and water quality issues through cost effective, sustainable solutions.

Any comments on the proposed planning must be filed with the applicant listed below and the Texas Water Development Board Executive Administrator within 30 days of the date on which this notice was mailed.

Ricky Clifton  
General Manager  
Gulf Coast Waste Disposal Authority  
910 Bay Area Blvd.  
Houston, Texas 77058

Kevin Patterson  
Texas Water Development Board  
Executive Administrator  
P.O. Box 13231 (1700 N. Congress Ave.)  
Austin, Texas 78711-3231

Sincerely,

A handwritten signature in blue ink, appearing to read 'Ricky Clifton', is written over a faint, larger version of the same signature.

Ricky Clifton  
General Manager

RC:LT/lb

c: GCA File #2000-03

# TEXAS DEPARTMENT OF PUBLIC SAFETY

5805 N LAMAR BLVD • BOX 4087 • AUSTIN, TEXAS 78773-0001

512/424-2000

[www.dps.texas.gov](http://www.dps.texas.gov)



STEVEN C. McCRAW  
DIRECTOR  
DAVID G. BAKER  
ROBERT J. BODISCH, SR.  
DEPUTY DIRECTORS



COMMISSION  
A. CYNTHIA LEON, CHAIR  
MANNY FLORES  
FAITH JOHNSON  
STEVEN P. MACH  
RANDY WATSON

RECEIVED

NOV 17 2014

San Jacinto River Authority  
G&A Office

November 10, 2014

Dear Jace Houston,

The Drought Preparedness Council, which is comprised of representatives from 16 state agencies as well as appointees of the governor, would like to offer its assistance on drought-related issues encountered during the planning process. Authorized and established in 1999 as part of the 76<sup>th</sup> Texas Legislature, the council was created to carry out the provisions of Sections 16.055 and 16.0551 of the state water code. Its responsibilities include the assessment and public reporting of drought monitoring and water supply conditions; advising the governor on significant drought conditions; recommending response plans for drought related disasters; advising regional water planning groups on drought-related issues in the regional water plans; coordinating local, state and federal drought-response planning; and submitting a report to the legislature every odd numbered year.

Council members represent a broad swath of state agencies, including Texas Division of Emergency Management, Texas Water Development Board, Texas Commission on Environmental Quality, Texas Parks and Wildlife Department, Texas Department of Agriculture, Texas AgriLife Extension Service, Texas State Soil and Water Conservation Board, Texas Department of Housing and Community Affairs, Texas Forest Service, Texas Department of Transportation, Texas Department of Economic Development, Office of the State Climatologist, Public Utilities Commission, Electric Reliability Council of Texas and Texas Health and Human Services Commission. Each member brings expertise in his or her field, and the greatest strength of the council lies in its ability to utilize the knowledge and skills of its members for the betterment of Texas. The council includes members of the emergency management community who can guide regional groups in the emergency management process, including how to request resources, and can provide instructions to local emergency management partners.

The council is aware that your regional water planning group has been drafting its 2016 Regional Water Plan, including its drought chapter. Per Title 31 of Texas Administrative Code Section 357.42(h), regional water planning groups may come to the council for "any relevant recommendations from the Drought Preparedness Council." As chairman of the council, I would like to extend the council's assistance on any drought related issues that you may come across while working through the regional water planning process. Additionally, the council and I recommend that regions:

- Follow the outline template for Chapter 7 provided to the regions by Texas Water Development Board staff in February of 2013, making an effort to fully address the assessment of current drought preparations and planned responses, as well as planned responses to local drought conditions or loss of municipal supply. Find this template here: [http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2016/doc/current\\_docs/project\\_docs/20130220\\_ex\\_outline\\_ch7.docx](http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2016/doc/current_docs/project_docs/20130220_ex_outline_ch7.docx)
- Evaluate the drought preparedness impacts of unanticipated population growth or industrial growth within the region over the planning horizon.

If you have any questions for the council or would like to attend the Drought Preparedness Council's monthly meetings, please contact Mario Chapa at [Mario.Chapa@dps.texas.gov](mailto:Mario.Chapa@dps.texas.gov) or [TDEM.Drought@dps.texas.gov](mailto:TDEM.Drought@dps.texas.gov).

Sincerely,

A handwritten signature in blue ink, appearing to read "W. Nim Kidd". The signature is stylized and cursive.

W. Nim Kidd, CEM, TEM

*Chief*

Texas Division of Emergency Management

*Assistant Director*

Texas Homeland Security

Texas Department of Public Safety