

November 20, 2014

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Pudge Willcox

Counties
John Blount
Mark Evans, Chair
Judge Art Henson

Electric Generating Utilities
Gene Fisseler

Environmental
John R. Bartos,
Executive Committee

Groundwater Management Areas
David Bailey
Kathy Jones

Industries
James Comin
Glenn Lord

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

Water Districts
Marvin Marcell
Ron Neighbors, Vice-Chair
Jimmie Schindewolf

Water Utilities
James Morrison
William Teer

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

**Re: Amendment to the 2011 Region H Water Plan
Brazosport Water Authority
Adoption of Amendment by Region H**

Dear Mr. Patteson:

The Region H Water Planning Group (RHWPG) has reviewed, considered, and approved the amendment of the 2011 Region H Regional Water Plan (RWP) to include two projects to be developed by the Brazosport Water Authority (BWA). This action follows your determination of minor amendment status on September 5, 2014.

According to your determination of this revision as a minor amendment, the RHWPG provided 14-day notice prior to the November 5, 2014 RHWPG meeting to consider adoption of the amendment. Following this adoption of the amendment, a 14-day period was also observed for the receipt of comment related to the action through November 19th. The RHWPG now wishes to submit the completed amendment package along with comments received from the public regarding the amendment.

Attached to this letter, please find the final amendment package for your consideration. Please note that this package includes the amended sections of the 2011 RWP and a summary of corrections to be made to DB12 to accommodate the amendment. In addition, a summary of comments received on the project are also included as an attachment.

Should you have any further questions regarding this submittal, please feel free to contact me at 281.440.3924 or mevans@nhcrwa.com or the Region H consultant, Jason Afinowicz, at 713.600.6841 or jason.afinowicz@freese.com.

Sincerely,



Mark Evans
Region H Chair

TWDB Liaison
Lann Bookout

cc: Lann Bookout, TWDB

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

Brazosport Water Authority

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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	New Technical Memoranda 4B-52 (Brazosport Water Authority Brackish Groundwater Reverse Osmosis Water Treatment Plant and Wells) and 4B-53 (Brazosport Water Authority Conventional Water Plant Expansion)
J	Amended Table 4C-1: WWP-Level Project Costs
K	Amended Table 4C-2: WUG-Level Project Costs
L	Amended Appendix 4E: Environmental Flows Modeling for New WMS
M	Amended excerpts from Chapter 5: Impacts of Management Strategies on Water Quality and Impacts of Moving Water from Rural and Agricultural Areas
N	Summary of database entries anticipated for DB12
O	Comments received regarding proposed amendment

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Attachment A:

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

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- **Houston Bayous Permit** –The City of Houston has applied for an interruptible supply permit in the lower San Jacinto basin. The conjunctive use of this supply with existing supplies owned in the Trinity River Basin will reduce interbasin transfers in non-drought years.

Infrastructure Strategies

Inclusion of the many major infrastructure projects that will be implemented throughout the region in order to more effectively utilize existing water supplies or to allow the use of future water resources strategies, including:

- **Brazosport Water Authority–Brackish Groundwater Reverse Osmosis Water Treatment Plant and Wells**
- **Brazosport Water Authority–Conventional Water Plant Expansion**
- **Central Harris County Regional Water Authority Transmission and Distribution**
- **Chambers-Liberty Counties Navigation District West Chambers County System**
- **City of Houston Distribution Infrastructure Expansion**
- **City of Houston Treatment Infrastructure Expansion**
- **Harris County MUD 50 Surface Water Treatment Plant**
- **Luce Bayou Transfer**
- **LLWSSSC Surface Water Project**
- **North Fort Bend Water Authority Transmission and Distribution**
- **North Harris County Regional Water Authority Transmission and Distribution**
- **Pearland Surface Water Treatment Plant**
- **Sealy Groundwater Treatment Expansion**
- **West Harris County Regional Water Authority Transmission and Distribution**

Other Strategies

- **Brazoria County Interruptible Supplies for Irrigation** –This strategy uses interruptible supplies to meet the needs of irrigation within Brazoria County, mirroring the system of annual contracts currently used in the area for surface-water-based irrigation.
- **Brazos Saltwater Barrier**—A proposed gated structure on the lower Brazos above Freeport to protect lower basin intakes from the seasonal saltwater influence, which is expected to worsen as the basin is fully utilized.
- **Freeport Desalination** – A proposed facility in Freeport for desalination of seawater for municipal use, thereby enhancing flows for manufacturing uses in the lower Brazos River basin.

The 2011 Region H Water Plan meets all projected water demands, at an estimated capital cost of approximately \$12.0 billion for the recommended water management strategies. A summary of the selected strategies, their yields and their costs is shown in *Table ES-7*. *Table ES-8* shows the recommended combination of strategies required for each County to meet its projected water shortages. An in-depth discussion of the recommended plan is contained in *Chapter 4: Identification, Evaluation and Selection of Water Management Strategies Based on Needs*.

**Table ES-7
Recommended Water Management Strategies**

<u>WMS</u>	<u>Max Project Volume (ac-ft/yr)</u>	<u>WWP Capital Cost \$</u>	<u>WUG Capital Cost \$</u>	<u>Starting Decade</u>
Conservation Strategies:				
Industrial Conservation	TBD	\$0	TBD	2010
Irrigation Conservation	77,881	\$0	\$757,436	2010
Municipal Conservation	105,494	\$0	\$0	2010
Contractual Strategies:				
Expand/Increase Current Contracts	142,599	\$0	See Contracts	2010
New Contracts from Existing Supplies	83,558	\$0	See Contracts	2010
Reallocation of Existing Supplies	N/A	\$0	See Contracts	2010
TRA to SJRA Contract	76,476	\$302,781,597	See Contracts	2040
TRA to Houston Contract	123,524	See Luce Bayou	See Contracts	2030
WUG-Level Contracts ¹	N/A	\$0	\$2,390,273,157	2010
WWP Contracts	N/A	\$0	\$0	2010
Groundwater Strategies:				
Expanded Use of Groundwater	90,617	\$0	\$165,928,999	2010
Interim Strategies	45,512	\$0	\$86,701,535	2010
New Groundwater Wells for Livestock	41	\$0	\$18,635	2020
Groundwater Reduction Plans:				
CHCRWA GRP	4,806	See CHCRWA Trans.	\$0	2010
COH GRP	TBD	See COH Treatment	\$58,235,873	2010
City of Missouri City GRP	17,562	\$92,070,990	\$6,618,706	2010
Fort Bend MUD 25 GRP	589	\$0	\$776,145	2020
Fort Bend WCID 2 GRP	5,753	\$24,828,857	\$0	2020
NFBWA GRP ²	106,402	See NFBWA Trans.	\$1,638,063	2020
NHCRWA GRP ²	117,755	See NHCRWA Trans.	\$17,814,585	2010
Pecan Grove GRP	1,700	\$0	\$15,960,000	2020
Richmond/Rosenberg GRP	7,500	\$117,220,150	\$0	2020
River Plantation GRP	368	\$0	\$484,926	2010
SJRA WRAP ³	129,010	\$900,000,000	\$217,856,853	2020
Sugar Land GRP	9,796	\$161,360,049	\$6,360,101	2020
WHCRWA GRP ²	78,839	See WHCRWA Trans	\$35,268,970	2010
Infrastructure Strategies:				
BWA Brackish Groundwater	3,136	\$30,570,395	See Contracts	2020
BWA Plant Expansion	8,400	\$14,359,419	N/A	2020
CHCRWA Transmission Line	4,806	TBD	N/A	2010
CHCRWA Internal Distribution	4,806	TBD	N/A	2010
CLCND West Chambers System	2,800	\$20,380,000	See Contracts	2020
COH Distribution Expansion	TBD	\$261,040,000	N/A	2010
COH Treatment Expansion	Varies by decade	\$2,045,672,161	N/A	2010
Harris County MUD 50 WTP	632	\$0	\$6,131,600	2020
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

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

	2010	2020	2030	2040	2050	2060
Austin						
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
Net Shortage	0	223	251	265	273	285
Brazoria						
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
Net Shortage	-141,681	-172,351	-187,918	-214,074	-239,430	-271,322
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
Total after Recommendations	13,910	20,144	18,137	17,071	16,890	16,898
Chambers						
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
Net Shortage	-42,383	-46,640	-49,931	-53,216	-56,444	-59,764
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
Total after Recommendations¹	17,371	17,416	17,426	17,434	17,444	17,455
Fort Bend						
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
Net Shortage	1,349	2,920	-37,613	-67,088	-103,342	-155,383
Irrigation Conservation	5,197	5,197	5,197	5,197	5,197	5,197
WHCROWA GRP	0	0	0	0	0	0

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Attachment B:

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

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- NHCRWA Indirect Reuse
- Wastewater Reuse for Industry
- Wastewater Reclamation for Municipal Irrigation

Permit Strategies

- Brazos River Authority System Operations Permit
- Houston Bayous Permit

Other Strategies

- Brazoria County Interruptible Supplies for Irrigation
- Brazos Saltwater Barrier
- Freeport Desalination
- Montgomery County MUD 8/9 Brackish Water Desalination
- Sabine to Region H Transfer

Infrastructure Strategies

- Brazosport Water Authority–Brackish Groundwater Reverse Osmosis Water Treatment Plan and Wells
- Brazosport Water Authority–Conventional Water Plant Expansion
- CHCRWA Transmission Line
- CHCRWA Internal Distribution (see CHCRWA Transmission Line)
- CLCND West Chambers System
- COH Distribution Expansion (see COH Treatment Expansion)
- COH Treatment Expansion
- Huntsville WTP
- Harris County MUD 50 WTP
- LLWSSSC Surface Water Project
- Luce Bayou Transfer
- NFBWA Internal Distribution (see NFBWA Transmission Line)
- NFBWA Shared Transmission
- NHCRWA Internal Distribution (see NHCRWA Transmission Line)
- NHCRWA Transmission Line
- Pearland SWTP
- Sealy Groundwater Treatment Expansion
- WHCRWA Internal Distribution (see WHCRWA Transmission Line)
- WHCRWA Transmission Line

For each of these management strategies a detailed technical memorandum is provided in Appendix 4B. Not all of the strategies evaluated are based on developing additional water. Several strategies

**Table 4-4
Recommended Water Management Strategies**

<u>WMS</u>	<u>Max Project Volume (ac-ft/yr)</u>	<u>WWP Capital Cost \$</u>	<u>WUG Capital Cost \$</u>	<u>Starting Decade</u>
Conservation Strategies:				
Industrial Conservation	TBD	\$0	TBD	2010
Irrigation Conservation	77,881	\$0	\$757,436	2010
Municipal Conservation	105,494	\$0	\$0	2010
Contractual Strategies:				
Expand/Increase Current Contracts	142,599	\$0	See Contracts	2010
New Contracts from Existing Supplies	83,558	\$0	See Contracts	2010
Reallocation of Existing Supplies	N/A	\$0	See Contracts	2010
TRA to SJRA Contract	76,476	\$302,781,597	See Contracts	2040
TRA to Houston Contract	123,524	See Luce Bayou	See Contracts	2030
WUG-Level Contracts ¹	N/A	\$0	\$2,390,273,157	2010
WWP Contracts	N/A	\$0	\$0	2010
Groundwater Strategies:				
Expanded Use of Groundwater	90,617	\$0	\$165,928,999	2010
Interim Strategies	45,512	\$0	\$86,701,535	2010
New Groundwater Wells for Livestock	41	\$0	\$18,635	2020
Groundwater Reduction Plans:				
CHCRWA GRP	4,806	See CHCRWA Trans.	\$0	2010
COH GRP	TBD	See COH Treatment	\$58,235,873	2010
City of Missouri City GRP	17,562	\$92,070,990	\$6,618,706	2010
Fort Bend MUD 25 GRP	589	\$0	\$776,145	2020
Fort Bend WCID 2 GRP	5,753	\$24,828,857	\$0	2020
NFBWA GRP ²	106,402	See NFBWA Trans.	\$1,638,063	2020
NHCRWA GRP ²	117,755	See NHCRWA Trans.	\$17,814,585	2010
Pecan Grove GRP	1,700	\$0	\$15,960,000	2020
Richmond/Rosenberg GRP	7,500	\$117,220,150	\$0	2020
River Plantation GRP	368	\$0	\$484,926	2010
SJRA WRAP ³	129,010	\$900,000,000	\$217,856,853	2020
Sugar Land GRP	9,796	\$161,360,049	\$6,360,101	2020
WHCRWA GRP ²	78,839	See WHCRWA Trans	\$35,268,970	2010
Infrastructure Strategies:				
BWA Brackish Groundwater	3,136	\$30,570,395	See Contracts	2020
BWA Plant Expansion	8,400	\$14,359,419	N/A	2020
CHCRWA Transmission Line	4,806	TBD	N/A	2010
CHCRWA Internal Distribution	4,806	TBD	N/A	2010
CLCND West Chambers System	2,800	\$20,380,000	See Contracts	2020
COH Distribution Expansion	TBD	\$261,040,000	N/A	2010
COH Treatment Expansion	Varies by decade	\$2,045,672,161	N/A	2010
Harris County MUD 50 WTP	632	\$0	\$6,131,600	2020

Attachment C:

Amended Table 4A-3: Water Management Strategy Screening

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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	Regulatory/Constr. Risk	Implementability	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 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	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			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			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			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			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			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			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			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			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	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			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. 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			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	

Attachment D:

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

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Attachment E:

Amended Table 4A-5: Recommended WMS by County

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

	2010	2020	2030	2040	2050	2060
Austin						
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
Net Shortage	0	223	251	265	273	285
Brazoria						
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
Net Shortage	-141,681	-172,351	-187,918	-214,074	-239,430	-271,322
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
Total after Recommendations	13,910	20,144	18,137	17,071	16,890	16,898
Chambers						
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
Net Shortage	-42,383	-46,640	-49,931	-53,216	-56,444	-59,764
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
Total after Recommendations¹	17,371	17,416	17,426	17,434	17,444	17,455

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Amended Table 4A-6: Decadal WMS Summary

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Attachment G:

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

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Amended Table 4A-8: WUG-Level Contracts

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Attachment I:

New Technical Memoranda 4B-52 (Brazosport Water Authority Brackish Groundwater Reverse Osmosis Water Treatment Plant and Wells) and 4B-53 (Brazosport Water Authority Conventional Water Plant Expansion)

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REGION H WATER MANAGEMENT STRATEGY ANALYSIS TECHNICAL MEMORANDUM

STRATEGY TITLE: Brazosport Water Authority Brackish Groundwater Reverse Osmosis Water Treatment Plant and Wells¹

DATE: July 8, 2014

SUMMARY

STRATEGY DESCRIPTION: Desalination of brackish groundwater from the Gulf Coast Aquifer to enhance the yield of surface water sources in use in the lower Brazos River Basin.

SUPPLY QUANTITY: Phase 1: 2.4 MGD average/6.0 MGD peak
Phase 2: 2.8 MGD average/10.0 MGD peak

SUPPLY SOURCE: Gulf Coast Aquifer (Lissie formation)

IMPLEMENTATION DECADE: 2020 (Online date in 2017 for Phase 1)

TOTAL STRATEGY COST: Phase 1: \$19,686,000
(Costs rounded to nearest \$100) Phase 2: \$10,884,400

UNIT WATER COST: Phase 1: \$594 per ac-ft at peak capacity
Phase 2: \$390 per ac-ft at peak capacity

WATER MANAGEMENT STRATEGY ANALYSIS DESCRIPTION

INTRODUCTION

The Brazosport Water Authority (BWA) serves seven communities in the southern Brazoria County area in addition to potable service to Dow Chemical and two Texas Department of Criminal Justice (TDCJ) units. In December, 2013, BWA concluded a Texas Water Development Board (TWDB) Regional Facility Planning Grant study (Study) to examine the potential for serving the current BWA service area as well as other portions of Brazoria County in the future. The Study included several recommendations including the development of a reverse osmosis (RO) water treatment plant (WTP) at the site of the current BWA surface water treatment plant to be fed by brackish groundwater well field in the vicinity of the current plant site. The RO WTP would function in two basic modes:

1. When the Brazos River has sufficient flow, including Harris and Brazoria Reservoir diversions, the RO WTP would provide a minimal baseline potable water flow, supplementing the primary, lower-cost potable water from the BWA surface water treatment plant.
2. When the Brazos River has insufficient flow, the RO WTP would operate up to its peak capacity to meet the potable water demands.

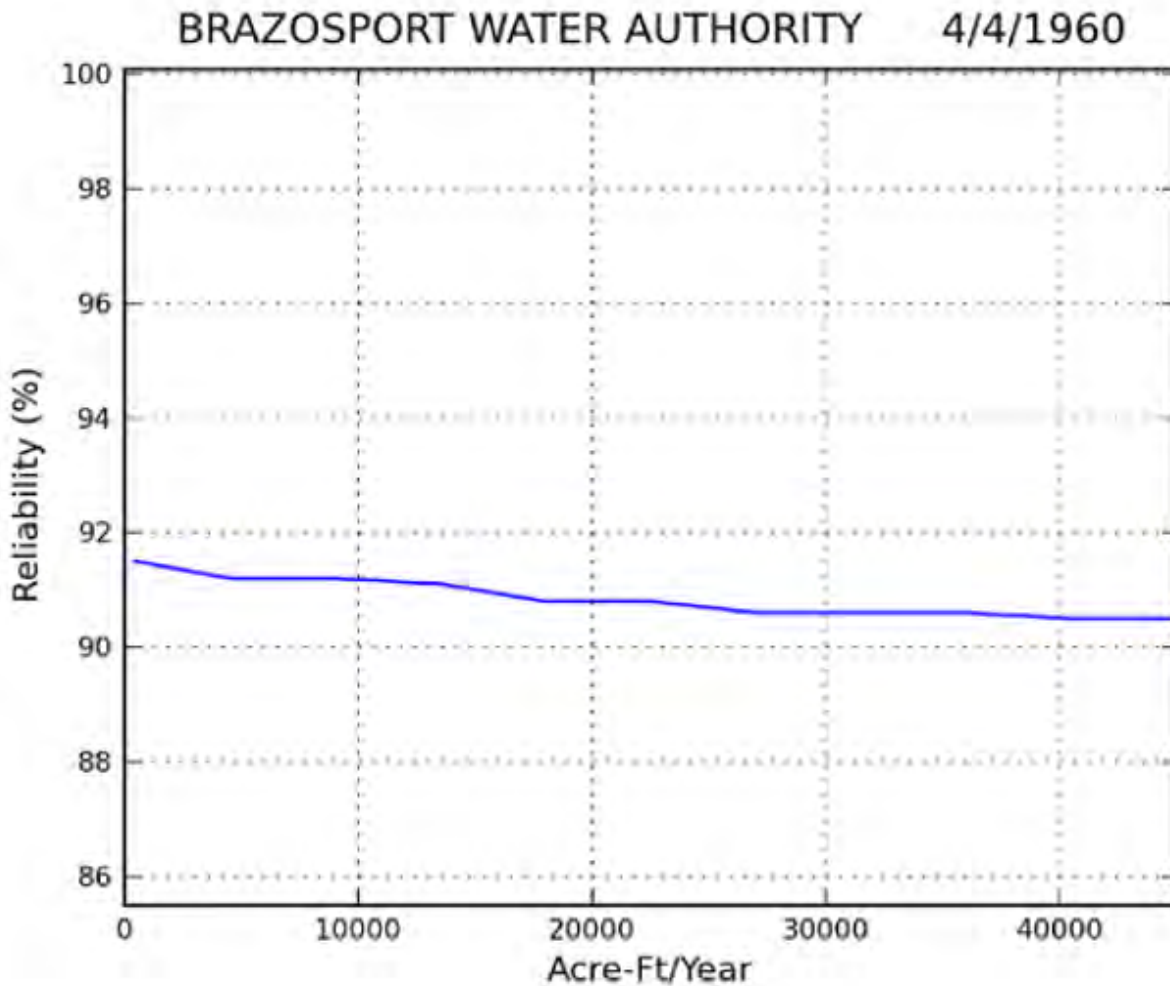
ANALYSIS

Existing surface water supplies were evaluated using the Texas Commission on Environmental Quality (TCEQ) Brazos River Basin and San Jacinto-Brazos Coastal Basin Water Availability Model (WAM). For the purposes of this exercise, the full authorization version of the model (bwam3) was employed to evaluate availability from BWA's water right, 5366. As shown in *Figure 1*, this right of 45,000 ac-ft/yr was found to have a time reliability of approximately 90.5 percent. That is, the right is 100% divertible 90.5

¹ This memorandum was prepared using information from Brazoria County Regional Water Facility Study prepared by CDM Smith for Brazosport Water Authority.

percent of the monthly simulation periods. *Figure 1* also shows that even a dramatically reduced target of only one percent of the permit value has limited improvement in reliability. In effect, the WAM indicates that availability for this right is subject to dramatic swings in river conditions resulting in conditions where either the entirety of or none of the right is available for diversion at any given time. This reliability is depicted below in *Figure 1*.

Figure 1
Simulated Reliability of BWA Water Right 5366



As part of the regional study, various approaches were considered to close the water supply gap. These include the purchase of surface water from wholesale providers in the Brazos River Basin, brackish groundwater desalination, and seawater desalination. Brackish groundwater desalination was selected as the preferred alternative for meeting supply shortages in supply due to availability and cost of water considerations.

Although the RO WTP's initial phase capacity is rated at 6 MGD, actual operation of the facility would result in a somewhat lower long-term average rate of production. The study indicates that Phase 1 of the facility will operate at peak capacity (6.0 MGD) 10 percent of the time to mitigate shortages in surface water supply. The plant would normally operate at just 2.0 MGD 90 percent of the time. This results in an average rate of production of 2.40 MGD. In order to produce the peak rate of 6.00 MGD a feed rate of 6.7 MGD is anticipated. This is based on blending 4.0 MGD of membrane permeate with 2.0 MGD of bypass flow. Similar permeate and bypass blending for the 2.40 MGD average flow will require a long-term groundwater production rate of 2.7 MGD or approximately 3,000 ac-ft/yr.

The proposed brackish groundwater facilities would consist of three closely located wells and collection lines ranging from 12-in. to 36-in. diameter. The WTP would provide cartridge filter pretreatment, chemical additives, and final treatment through three RO membrane racks. Costs for the identified facilities are shown below in *Table 1*.

The Phase 2 facility will operate at its 10.0 MGD peak capacity 10 percent of the time and a baseline rate similar to Phase 1 of 2.0 MGD, 90 percent of the time. This results in an average rate of production of 2.8 MGD. Peak capacity will be achieved with a feed rate of 11.2 MGD to produce 6.7 MGD of permeate to be blended with 3.3 MGD of bypass flow. The total long-term rate of production of groundwater will be 2.8 MGD or approximately 3,136 ac-ft/yr. Although it is difficult to determine what level of production would be required each year, this yield of 3,136 ac-ft/yr represents a yield under drought of record conditions assuming the 90/10 operating approach discussed above. This level of supply does not result in over-allocation of an existing or planned source of water. Of the estimated groundwater supply availability in the 2011 Regional Water Plan, adequate supply quantity remained unallocated in sufficient capacity to supply this strategy.

An additional two wells will be incorporated into the overall well field to reach the Phase 2 capacity of 10.0 MGD connected by additional 12-in. and 36-in. piping. Pretreatment will be accomplished in the same manner as Phase 1. Costs for the identified facilities are shown below in *Table 2*.

An overview of the well field configuration can be seen below in *Figure 2*. Discharge of concentrate from the RO process will be accomplished through discharge to the Brazos River.

WATER USER GROUP APPLICATION

BWA serves several communities in Brazoria County as well as service to Dow Chemical and County-Other WUGs. This strategy may potentially provide supply to the following WUGs:

- Angleton
- Brazoria
- Clute
- County-Other, Brazoria County, San Jacinto-Brazos Basin
- County-Other, Brazoria County, Brazos Basin
- County-Other, Brazoria County, Brazos-Colorado Basin
- Freeport
- Lake Jackson
- Manufacturing, Brazoria County, San Jacinto-Brazos Basin
- Manufacturing, Brazoria County, Brazos Basin
- Oyster Creek
- Richwood

In addition to the WUGs currently served, additional service area may be incorporated into the BWA system as growth continues within Brazoria County.

ISSUES AND CONSIDERATIONS

Development of this project may impact environmental conditions in the immediate vicinity of the plant through disturbance of habitat.

According to the USFWS Online Endangered Species list, the following threatened or endangered species are found in Brazoria County: brown pelican (*Pelecanus occidentalis*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), piping plover (*Charadrius melodus*), and whooping crane (*Grus americana*). Of these species, the brown pelican, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, and piping plover are coastal species and should not occur on the project site.

Whooping cranes are listed as endangered in Brazoria County. The cranes breed in Canada and winter on the Texas Gulf Coast at the Aransas National Wildlife Refuge and may migrate through the project area during the spring and fall. Whooping cranes would be unlikely to use the site during migration due to the forested nature of the project area.

Construction within the vicinity of the Waters of the U.S. found along the Brazos River may be subject to Section 404 of the Clean Water Act (CWA) and crossing of the Brazos River to install collection line to the remote well across the river would be subject to a Section 10 permit from the U.S. Army Corps of Engineers. These issues may be covered under Nationwide Permit (NWP) 39 assuming certain conditions are met such as limitation of disturbance to no more than 0.5 acres. Also, construction of a pipeline across the CR 2004 bridge would be considered, itself, a bridge under Section 9 of the River and Harbors Act and require authorization.

In addition to the Brazos River, review of U. S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps indicates the potential presence of forested wetland within portions of the project site. The soils comprising the project site consist of Norwood silt loam, 0 to 1 percent slopes and Pledger clay. Both these soils are hydric soils in Brazoria County, further supporting the potential presence of wetlands on at least a portion of the project site.

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 recommended. In addition, coordination with the THC regarding the proposed project would be required to comply with USACE NWP general condition 20. Federal actions, such as Section 404/10 permits, also trigger Section 106 compliance with the National Historic Preservation Act.

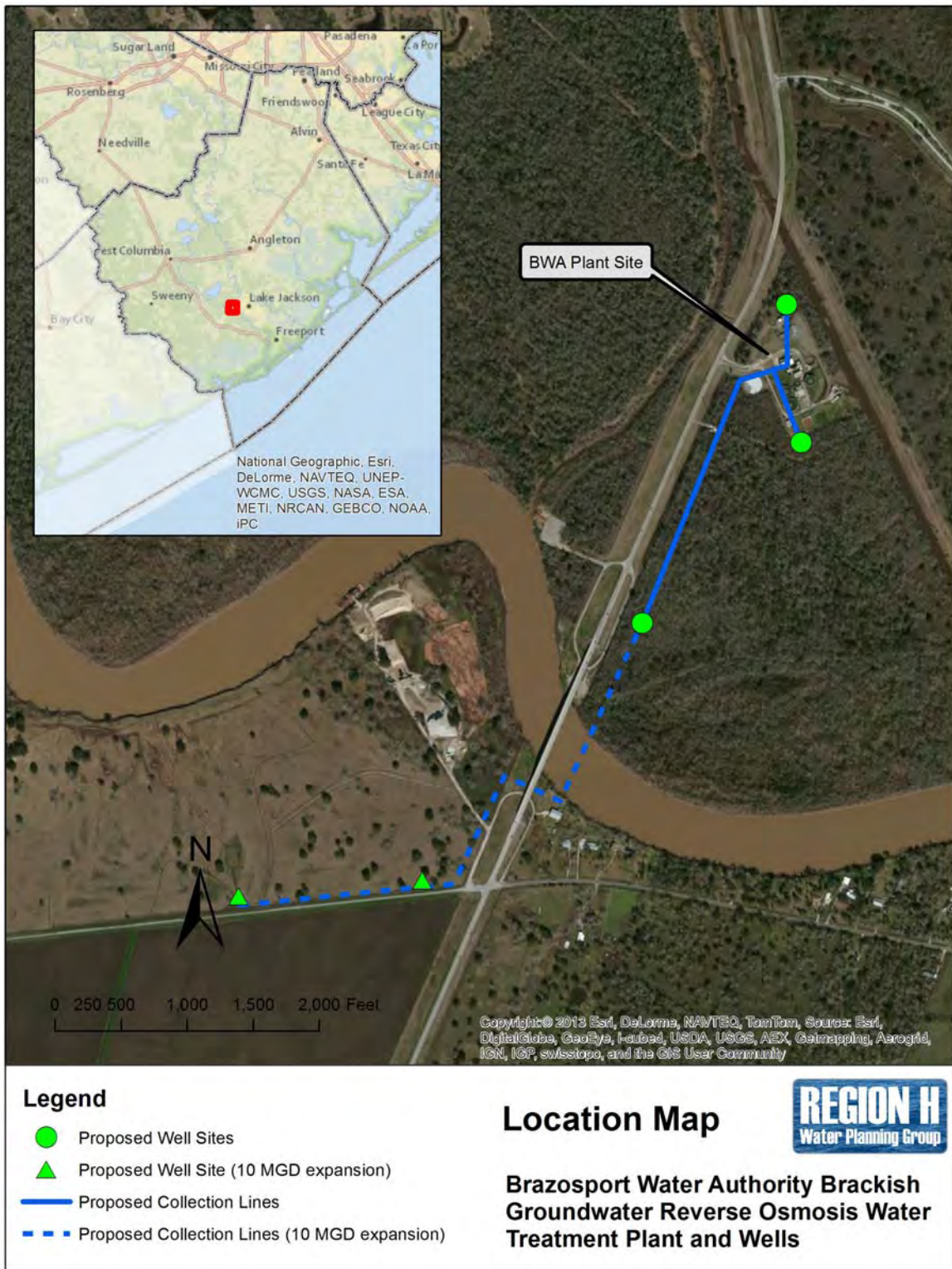
Proposed project activities at the project site would all occur within Zone AE of an existing floodplain (Flood Insurance Rate Map {FIRM} 48039C0615H). Activities within the floodplain may require a permit from or coordination with the local floodplain administrator and must comply with applicable FEMA-approved state or local floodplain requirements.

The Brazos River in the project vicinity is a State owned riverbed. Any activity within or beneath the confines of the Brazos River would require an easement from the GLO prior to proceeding with construction.

The development of groundwater production may potentially increase the risk of subsidence and saltwater intrusion, especially for sites near the coast. To address these concerns, BWA has performed investigations into the potential for subsidence and drawdown occurring in the vicinity of the well field. To accomplish this, BWA utilized both the Houston Area Groundwater Model (HAGM) and the Lower-Colorado River Basin (LCRB). Various scenarios yielded maximum incremental subsidence. In a scenario similar to the proposed well field configuration, the subsidence predicted by the HAGM reached a maximum of 1.25 feet at the well field under a constant pumping scenario of 4,000 gpm (5.76 MGD) between 2005 and 2050. A scenario splitting pumpage stratigraphically across the Beaumont and Lissie formations in the LCRB demonstrated subsidence of 0.43 feet between the same time period. Note that this pumping rate of 5.76 MGD is greater than the anticipated long-term average pumping rates for Phases 1 and 2 discussed above. In addition to this desktop analysis, BWA is in the process of preparing subsidence monitoring equipment for use in tracking long-term trends in proximity of the well field.

RO concentrate disposal to the Brazos River will be accomplished in a way to minimize potential environmental impacts. Discharge is anticipated to occur below State Highway (SH) 332 where there is no limit set for Total Dissolved Solids (TDS). At this point, the salinity of RO concentrate is expected to be below the ambient levels of the Brazos River. Similar strategies have been employed for other projects in the Brazos River Basin. This discharge will require permitting under the Texas Pollutant Discharge Elimination System (TPDES).

**Figure 2
Location Map**



REGION H WATER MANAGEMENT STRATEGY ANALYSIS TECHNICAL MEMORANDUM

STRATEGY TITLE: Brazosport Water Authority Conventional Water Plant Expansion¹

DATE: July 8, 2014

SUMMARY

STRATEGY DESCRIPTION: Expansion of BWA's conventional surface water treatment plant to enhance the yield of surface water sources in use in the lower Brazos River Basin.

SUPPLY QUANTITY:	7.5 MGD
SUPPLY SOURCE:	Brazos River
IMPLEMENTATION DECADE:	2020
TOTAL STRATEGY COST: (Costs rounded to nearest \$100)	\$14,359,400
UNIT WATER COST:	\$432 per ac-ft at peak capacity

WATER MANAGEMENT STRATEGY ANALYSIS DESCRIPTION

INTRODUCTION

The Brazosport Water Authority (BWA) serves seven communities in the southern Brazoria County area in addition to potable service to Dow Chemical and two Texas Department of Criminal Justice (TDCJ) units. In December, 2013, BWA concluded a Texas Water Development Board (TWDB) Regional Facility Planning Grant study (Study) to examine the potential for serving the current BWA service area Brazoria County in the future. In addition to the development of a new reverse osmosis (RO) water treatment plant (WTP), located at the same site as BWA's existing surface water treatment plant, the study also recommended expanding BWA's conventional treatment plant capacity by 7.5 MGD in order to accommodate additional growth within and surrounding the existing service area of the facility.

ANALYSIS

The proposed strategy will include the expansion of BWA's 19.97 MGD conventional filtration treatment plant by an additional 7.5 MGD. This project will work in conjunction with the proposed brackish groundwater and RO facilities to provide adequate supplies to meet future needs to be served by BWA. Costs for these facilities are shown in *Table 1*.

WATER USER GROUP APPLICATION

BWA serves several communities in Brazoria County as well as service to Dow Chemical and County-Other WUGs. This strategy may potentially provide supply to the following WUGs:

- Angleton
- Brazoria
- Clute

¹ This memorandum was prepared using information from Brazoria County Regional Water Facility Study prepared by CDM Smith for Brazosport Water Authority.

- County-Other, Brazoria County, San Jacinto-Brazos Basin
- County-Other, Brazoria County, Brazos Basin
- County-Other, Brazoria County, Brazos-Colorado Basin
- Freeport
- Lake Jackson
- Manufacturing, Brazoria County, San Jacinto-Brazos Basin
- Manufacturing, Brazoria County, Brazos Basin
- Oyster Creek
- Richwood

In addition to the WUGs currently served, additional service area may be incorporated into the BWA system as growth continues within Brazoria County.

ISSUES AND CONSIDERATIONS

Development of this project may impact environmental conditions in the immediate vicinity of the plant through disturbance of habitat.

According to the USFWS Online Endangered Species list, the following threatened or endangered species are found in Brazoria County: brown pelican (*Pelecanus occidentalis*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempi*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), piping plover (*Charadrius melodus*), and whooping crane (*Grus americana*). Of these species, the brown pelican, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, and piping plover are coastal species and should not occur on the project site.

Whooping cranes are listed as endangered in Brazoria County. The cranes breed in Canada and winter on the Texas Gulf Coast at the Aransas National Wildlife Refuge and may migrate through the project area during the spring and fall. Whooping cranes would be unlikely to use the site during migration due to the forested nature of the project area.

Proposed project activities at the project site would all occur within Zone AE of an existing floodplain (Flood Insurance Rate Map {FIRM} 48039C0615H). Activities within the floodplain may require a permit from or coordination with the local floodplain administrator and must comply with applicable FEMA-approved state or local floodplain requirements.

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

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Attachment K:

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

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Amended Appendix 4E: Environmental Flows Modeling for New WMS

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Section 1- Introduction

The *Environmental Flows Study* completed during the 1st 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 1st 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 1st 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.

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 18 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

Model ID	WMS Name	Modeling Methodology
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.
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

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

Max H																				
Season	Base	BCO	BII	BSW	CMC	COH	FBO	FRU	GOC	IGW	M25	MCR	NFB	NHC	NWL	RMI	SJW	SLG	WCS	WHC
Spring	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%	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%

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

Min Q-Sal																				
Season	Base	BCO	BII	BSW	CMC	COH	FBO	FRU	GOC	IGW	M25	MCR	NFB	NHC	NWL	RMI	SJW	SLG	WCS	WHC
Spring	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%	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%

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	GOC	IGW	M25	MCR	NFB	NHC	NWL	RMI	SJW	SLG	WCS	WHC	
Jan	84%	84%	84%	84%	84%	85%	84%	84%	84%	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%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%
Aug	65%	65%	65%	65%	65%	66%	65%	65%	65%	65%	65%	65%	65%	65%	65%	64%	65%	65%	65%	65%	65%
Sep	91%	91%	91%	91%	91%	92%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	92%
Oct	78%	78%	78%	78%	78%	80%	79%	78%	78%	78%	78%	78%	78%	78%	78%	78%	80%	78%	78%	78%	79%
Nov	47%	47%	47%	47%	47%	48%	48%	47%	47%	48%	47%	47%	47%	48%	47%	47%	48%	47%	47%	47%	48%
Dec	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	46%	47%	47%	47%	47%	47%

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

BCO																				
Month	Base	BCO	BII	BSW	CMC	COH	FBO	FRU	GOC	IGW	M25	MCR	NFB	NHC	NWL	RMI	SJW	SLG	WCS	WHC
Jan	84%	84%	84%	84%	84%	85%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	85%	84%	84%	84%
Feb	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%
Apr	69%	69%	69%	69%	69%	70%	69%	69%	69%	70%	69%	69%	69%	69%	69%	69%	70%	69%	69%	70%
May	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%	55%	56%	56%	56%	56%
Jul	44%	44%	44%	44%	44%	45%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%
Aug	51%	51%	51%	51%	51%	53%	51%	51%	51%	51%	51%	51%	51%	51%	51%	50%	53%	51%	51%	51%
Sep	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%
Nov	47%	47%	47%	47%	47%	48%	48%	47%	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%	46%	47%	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	GOC	IGW	M25	MCR	NFB	NHC	NWL	RMI	SJW	SLG	WCS	WHC
Jan	84%	84%	84%	84%	84%	85%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	85%	84%	84%	84%
Feb	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%
Apr	75%	75%	75%	75%	75%	76%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	76%	75%	75%	75%
May	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%	58%	58%	58%	58%	58%	58%	58%	58%	59%	58%	58%	58%
Jul	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%	47%
Aug	65%	65%	65%	65%	65%	66%	65%	65%	65%	65%	65%	65%	65%	65%	65%	65%	64%	65%	65%	65%
Sep	91%	91%	91%	91%	91%	92%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	92%
Oct	78%	78%	78%	78%	78%	80%	79%	78%	78%	78%	78%	78%	78%	78%	78%	78%	80%	78%	78%	79%
Nov	73%	73%	73%	73%	73%	74%	74%	73%	73%	73%	73%	73%	73%	73%	73%	73%	73%	73%	73%	74%
Dec	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, SJRA WRAP, and WHCRWA GRP; these changes were shown to occur primarily between August and October. However, FTA changes by less than two 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
		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

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Attachment M:

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

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are at greater risk for contamination from these sites as a result of the more direct travel paths for potential contaminated water to reach these areas, especially if they are being pumped by small household or livestock wells. At this time, there are no recorded incidents of contaminated groundwater in the Region as a result of these sites.

The water quality parameters and water management strategies selected by the RHWPG were evaluated to determine the impacts on water quality as a result of these recommended strategies. This evaluation used the data available to compare current conditions to future conditions with Region H management strategies in place. The recommended and alternative management strategies, as described in *Chapter 4* of this report and used in this evaluation, are listed below.

Recommended Water Management Strategies

Conservation Strategies:

- Industrial Conservation
- Irrigation Conservation
- Municipal Conservation

Contractual Strategies:

- Expand/Increase Current Contracts
- New Contracts from Existing Supplies
- Reallocation of Existing Supplies
- TRA to SJRA Contract
- TRA to Houston Contract
- WUG-Level Contracts¹
- WWP Contracts

Groundwater Strategies:

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

Groundwater Reduction Plans:

- CHCRWA GRP
- COH GRP
- City of Missouri City GRP
- Fort Bend MUD 25 GRP
- Fort Bend WCID 2 GRP
- NFBWA GRP²
- NHCRWA GRP²
- Pecan Grove GRP
- Richmond/Rosenberg GRP
- River Plantation GRP
- SJRA WRAP³
- Sugar Land GRP
- WHCRWA GRP²

Infrastructure Strategies:

- BWA Brackish Groundwater
- BWA Plant Expansion
- CHCRWA Internal Distribution
- CLCND West Chambers System
- COH Distribution Expansion
- COH Treatment Expansion
- Harris County MUD 50 WTP
- Huntsville WTP

LLWSSSC Surface Water Project
Luce Bayou Transfer
NFBWA Internal Distribution
NFBWA Shared Transmission Line
NHCROWA Internal 2010 Distribution
NHCROWA Internal 2020 Distribution
NHCROWA Internal 2030 Distribution
NHCROWA Transmission 2010
NHCROWA Transmission 2020
NHCROWA Transmission 2030
Pearland SWTP
Sealy GW Treatment Expansion
WHCROWA Internal Distribution
WHCROWA 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
Houston Indirect Reuse
Montgomery MUD 8/9 Indirect Reuse
NHCROWA 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, 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.

The Houston Bayous Permit has the potential to reduce instream flows. The requested diversions from the Houston Bayous Permit account for 20% to 40% of the average flow in Sims, Brays, and Buffalo bayous and 40% to 70% of the average flow in White Oak Bayou. The location of the diversion facilities will also have to be located and any wetland mitigation considered appropriately.

The Sabine to Region H Transfer has the potential to introduce Neches and Sabine River water into the Trinity, San Jacinto, San Jacinto - Brazos, and Brazos basins. This strategy therefore has the potential to result in changes in water chemistry, temperature, nutrients, organic particulates, and sediment in the Neches and Trinity basins. Instream flows in the lower Sabine River will also be reduced by the additional diversion of water from the Sabine River basin. Instream flows in portions of the Neches, Trinity, and San Jacinto Rivers will increase slightly. This strategy is included in the 2011 Plan as an alternative to off-channel reservoirs in Brazoria and Fort Bend Counties. Water transferred from the Sabine to the San Jacinto basin will be used to meet demands primarily in the Brazos and San Jacinto – Brazos basins. This may be accomplished by using the imported water in lieu of Trinity water from Lake Livingston to meet demands in Harris County. Additional infrastructure would be required to convey water from the San Jacinto basin to meet demands in the Brazos and San Jacinto – Brazos basins.

Montgomery County MUD 8/9 Brackish Water Desalination and BWA Brackish Groundwater will not affect other water management strategies, but only the salinity in the area of the discharge. The location of the brine disposal will have to be investigated further to determine the impacts of brine concentrate effluent on the receiving surface water or groundwater. As with all groundwater projects, the potential for subsidence must be considered and guarded against although these impacts may be mitigated by development of groundwater at greater depth.

5.3 Evaluation of Third-Party Impacts of Reduced Levels in Water Supply Reservoirs

One of the distinguishing characteristics of Region H is the abundance of recreational opportunities that enrich the quality of life of its residents. (See *Chapter 3* for a discussion of recreational water uses.) Recreation also contributes to attracting tourists and tourist dollars to the region. Some of these recreational activities are associated with water, both freshwater and salt water, and may be sensitive to water supply. The relation to water supply translates through impacts on reservoir levels, instream flows, bay and estuary inflows, water quality, habitat and aesthetics. *Table 5-1* lists recreational activities in Region H and the ways in which those activities are sensitive to water supply.

Although the major reservoirs in Region H were built and are maintained for municipal and industrial water supply, their existence has spurred the development of recreation related economic activity around their perimeters. In addition, this recreation-oriented development expands the tax base of local jurisdictions located near the reservoirs. Other water bodies similarly provide economic opportunities in recreation support activities.

**Table 5-1
Recreational Activities Associated with Water in Region H**

Activity	Major Sensitivity to Supply
Boating: (Canoe/kayak, sailboats, personal watercraft, power boats)	Reservoir level Instream flow Aesthetics
Swimming	Aesthetics Water quality Reservoir level Instream flow
Fishing	Reservoir level

	Instream flow Bay & Estuary inflows Water quality Habitat
Hunting	Habitat Instream flow
Parks: (Camping, hiking, biking, horseback riding)	Aesthetics Habitat Instream flow
Nature Tourism	Reservoir level Instream flow Bay & Estuary inflows Habitat Aesthetics
Golfing	Course upkeep Aesthetics

These activities impact the economy of the region through many paths, some of which are captured under the heading of "commercial activities" in the municipal water user group (WUG) in the socioeconomic analysis of water shortages (discussed in *Chapter 4*). Examples of these would be the sale of boating equipment, pier use fees collected by a convenience store or hotel receipts. Others impacts are not accounted for among the WUGs.

The determination of a direct relationship between water management strategies and recreational opportunities and indirect economic impacts is not feasible, due to the numerous other factors that affect recreational economics (i.e., weather conditions, national economic conditions, travel restrictions, etc.). However, the collective affects of strategies on anticipated lake levels during historical meteorological conditions were analyzed and some conclusions may be inferred on the impacts to recreation and economics.

For this analysis, the TCEQ Water Availability Model was updated to include the water management strategies recommended by Region C and Region H in their 2006 Regional Water Plans. The tributaries to Galveston Bay were then modeled under four scenarios to compare the results with and without the recommended strategies. The scenarios used were Run 8 "Current Conditions" (current levels of water diversions and return flows), Run 1 (full use of water rights with current percentage of return flows), Run 3 (full use of water rights with no return flows) and a future condition (full use of water rights, new strategies in place, and full return flows except for recommended reuse strategies). The first three models used the year 2000 reservoir sedimentation conditions to represent the 2010 condition, and the fourth used the 2060 condition. The future sedimentation condition benefits downstream projects, because upper basin projects have less capacity to store available flows. In this case, Lakes Houston and Livingston may be considered downstream projects.

The results of these simulations are summarized in *Table 5-2*. Reservoir elevations, capacities and surface areas are shown in *Figure 5-1*, *Figure 5-2* and *Figure 5-3* as a reference. *Appendix 5B* contains figures graphically displaying the model outputs and the percentile comparisons. Percentile values indicate the percentage of time the result value is less than or equal to the subject value. Therefore, the maximum value is the full lake elevation, the median value is the lake level in 50% of the monthly outputs, and the minimum value is the lowest monthly elevation in the simulation. Because the yield of these water supply reservoirs is based upon full use of the stored water during the drought of record, the Run 3 minimum elevation is, by definition, the lake bottom elevation. Note that this value is greater in the 2060 conditions simulation due to the projected accumulation of sediments on the reservoir floor. Each simulation run used the same 57-year inflow data set, which includes the drought of record period.

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Attachment N:

Summary of database entries anticipated for DB12

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DB12 Entries: BWA to WUG Contracts

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 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	GULF COAST AQUIFER	BAZORIA	SAN JACINTO-BRAZOS	02015	GW
Is Source Supply selected for Rollup?				Y	
Is Source Cost selected for Rollup?				Y	

County Name:	BRAZORIA	Water Quality Improvements	WATER QUALITY IMPROV
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			
			2010:	2020:	2030:	2040:	2050:	2060:
Total Strategy Supply Volume for this WUG:			0	364	365	366	376	389
Is WUG selected for Rollup?			Y					
Is WUG Cost selected for Rollup?			Y					

Recommendation Type?	Is Used to Meet Need?	IBT?				
Recommended	N	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					
	2010:	2020:	2030:	2040:	2050:	2060:
WUG WMS Annual Cost:	\$0	\$156,176	\$156,587	\$29,455	\$33,233	\$38,242
WUG Capital Costs:	\$1,557,884					
Term of Debt Service:	20					

WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:	Basin Name:			
H	BRAZORIA	NONE	080072000	BRAZORIA	BRAZOS			
			2010:	2020:	2030:	2040:	2050:	2060:
Total Strategy Supply Volume for this WUG:			0	64	64	64	64	64
Is WUG selected for Rollup?			Y					
Is WUG Cost selected for Rollup?			Y					

Recommendation Type?	Is Used to Meet Need?	IBT?				
Recommended	N	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					
	2010:	2020:	2030:	2040:	2050:	2060:
WUG WMS Annual Cost:	\$0	\$35,372	\$35,372	\$5,086	\$5,086	\$5,086
WUG Capital Costs:	\$347,378					
Term of Debt Service:	20					

WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:	Basin Name:			
H	CLUTE	NONE	080118000	BRAZORIA	SAN JACINTO-BRAZOS			
			2010:	2020:	2030:	2040:	2050:	2060:
Total Strategy Supply Volume for this WUG:			0	213	218	221	229	240
Is WUG selected for Rollup?			Y					
Is WUG Cost selected for Rollup?			Y					

Recommendation Type?	Is Used to Meet Need?	IBT?				
Recommended	N	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					
	2010:	2020:	2030:	2040:	2050:	2060:
WUG WMS Annual Cost:	\$0	\$95,809	\$97,864	\$20,129	\$21,759	\$25,284
WUG Capital Costs:	\$1,008,353					
Term of Debt Service:	20					

DB12 Entries: BWA to WUG Contracts

4.	WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:		Basin Name:	
	H	COUNTY-OTHER	NONE	080757020	BRAZORIA		SAN JACINTO-BRAZOS	
				2010:	2020:	2030:	2040:	2050:
				0	1,161	1,280	1,198	1,098
				2060:	945			
				Total Strategy Supply Volume for this WUG:				
				Is WUG selected for Rollup? Y				
				Is WUG Cost selected for Rollup? Y				

Recommendation Type?		Is Used to Meet Need?				IBT?		
Recommended		N				N		
Seller's Name:		Seller's Alpha:	WWP ID:		WUG ID:			
BRAZOSPORT WATER AUTHORITY		2000	120208093		N/A			
Recursive WMS Supply?:			Recursive WMS Project ID:					
N								
Include WUG WMS Cost numbers in WMS Source Cost Rollup?			Y					
			2010:	2020:	2030:	2040:	2050:	2060:
			\$0	\$460,424	\$509,061	\$135,532	\$93,878	\$90,121
			WUG WMS Annual Cost:					
			WUG Capital Costs:					
			Term of Debt Service:					
			20					

5.	WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:		Basin Name:	
	H	FREESPORT	NONE	080217000	BRAZORIA		SAN JACINTO-BRAZOS	
				2010:	2020:	2030:	2040:	2050:
				0	380	412	446	489
				2060:	543			
				Total Strategy Supply Volume for this WUG:				
				Is WUG selected for Rollup? Y				
				Is WUG Cost selected for Rollup? Y				

Recommendation Type?		Is Used to Meet Need?				IBT?		
Recommended		N				N		
Seller's Name:		Seller's Alpha:	WWP ID:		WUG ID:			
BRAZOSPORT WATER AUTHORITY		2000	120208093		N/A			
Recursive WMS Supply?:			Recursive WMS Project ID:					
N								
Include WUG WMS Cost numbers in WMS Source Cost Rollup?			Y					
			2010:	2020:	2030:	2040:	2050:	2060:
			\$0	\$162,521	\$175,655	\$56,963	\$64,013	\$74,904
			WUG WMS Annual Cost:					
			WUG Capital Costs:					
			Term of Debt Service:					
			20					

6.	WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:		Basin Name:	
	H	LAKE JACKSON	NONE	080338000	BRAZORIA		SAN JACINTO-BRAZOS	
				2010:	2020:	2030:	2040:	2050:
				0	561	584	625	682
				2060:	750			
				Total Strategy Supply Volume for this WUG:				
				Is WUG selected for Rollup? Y				
				Is WUG Cost selected for Rollup? Y				

Recommendation Type?		Is Used to Meet Need?				IBT?		
Recommended		N				N		
Seller's Name:		Seller's Alpha:	WWP ID:		WUG ID:			
BRAZOSPORT WATER AUTHORITY		2000	120208093		N/A			
Recursive WMS Supply?:			Recursive WMS Project ID:					
N								
Include WUG WMS Cost numbers in WMS Source Cost Rollup?			Y					
			2010:	2020:	2030:	2040:	2050:	2060:
			\$0	\$233,612	\$243,056	\$70,102	\$85,855	\$100,155
			WUG WMS Annual Cost:					
			WUG Capital Costs:					
			Term of Debt Service:					
			20					

7.	WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:		Basin Name:	
	H	MANUFACTURING	NONE	081001020	BRAZORIA		SAN JACINTO-BRAZOS	
				2010:	2020:	2030:	2040:	2050:
				0	311	128	127	102
				2060:	102			
				Total Strategy Supply Volume for this WUG:				
				Is WUG selected for Rollup? Y				
				Is WUG Cost selected for Rollup? Y				

Recommendation Type?		Is Used to Meet Need?				IBT?		
Recommended		N				N		
Seller's Name:		Seller's Alpha:	WWP ID:		WUG ID:			
BRAZOSPORT WATER AUTHORITY		2000	120208093		N/A			
Recursive WMS Supply?:			Recursive WMS Project ID:					
N								
Include WUG WMS Cost numbers in WMS Source Cost Rollup?			Y					
			2010:	2020:	2030:	2040:	2050:	2060:
			\$0	\$135,089	\$130,595	\$19,990	\$19,377	\$19,377
			WUG WMS Annual Cost:					
			WUG Capital Costs:					
			Term of Debt Service:					
			20					

DB12 Entries: BWA to WUG Contracts

8.	WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:	Basin Name:
	H	OYSTER CREEK	NONE	080730000	BRAZORIA	SAN JACINTO-BRAZOS
				2010:	2020:	2030:
				0	26	28
				2040:	2050:	2060:
				31	35	39
	Total Strategy Supply Volume for this WUG:					
	Is WUG selected for Rollup?			Y		
	Is WUG Cost selected for Rollup?			Y		

Recommendation Type?	Is Used to Meet Need?					IBT?
Recommended	N					N
Seller's Name:	Seller's Alpha:	WWP ID:			WUG ID:	
BRAZOSPORT WATER AUTHORITY	2000	120208093			N/A	
Recursive WMS Supply?:	Recursive WMS Project ID:					
N						
Include WUG WMS Cost numbers in WMS Source Cost Rollup?	Y					
	2010:	2020:	2030:	2040:	2050:	2060:
WUG WMS Annual Cost:	\$0	\$19,818	\$20,641	\$4,124	\$5,104	\$5,755
WUG Capital Costs:	\$253,002					
Term of Debt Service:	20					

9.	WUG Region:	WUG Name:	WUG Detail:	WUG ID:	County Name:	Basin Name:
	H	RICHWOOD	NONE	080501000	BRAZORIA	SAN JACINTO-BRAZOS
				2010:	2020:	2030:
				0	56	57
				2040:	2050:	2060:
				58	61	64
	Total Strategy Supply Volume for this WUG:					
	Is WUG selected for Rollup?			Y		
	Is WUG Cost selected for Rollup?			Y		

Recommendation Type?	Is Used to Meet Need?					IBT?
Recommended	N					N
Seller's Name:	Seller's Alpha:	WWP ID:			WUG ID:	
BRAZOSPORT WATER AUTHORITY	2000	120208093			N/A	
Recursive WMS Supply?:	Recursive WMS Project ID:					
N						
Include WUG WMS Cost numbers in WMS Source Cost Rollup?	Y					
	2010:	2020:	2030:	2040:	2050:	2060:
WUG WMS Annual Cost:	\$0	\$32,102	\$32,514	\$5,273	\$6,175	\$7,077
WUG Capital Costs:	\$347,561					
Term of Debt Service:	20					

DB12 Entries: Brackish Groundwater

WMS Project

Sponsor Region:	H
WMS Project ID:	
WMS Project Name:	BWA BRACKISH GW PLANT
WMS Description:	Brackish groundwater wells and plant.
WMS Type:	N : NEW SURFACE WATER OR NEW GROUNDWATER SOURCE
WMS Infrastructure:	WATER TREATMENT PLANT
Additional RWPGs:	None
Included in State Water Plan:	Y

Source(s)

Source Region	Source Name	County Name	Basin Name	Source ID	Source Type
H	GULF COAST AQUIFER	BAZORIA	SAN JACINTO-BRAZOS	02015	GW
Is Source Supply selected for Rollup?				N	
Is Source Cost selected for Rollup?				Y	

County Name:	BAZORIA	Water Quality Improvements	WATER QUALITY IMPROV
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?			N
Include WMS Source Cost numbers in WMS Project Cost Rollup?			Y

1.	Sponsor Region:	WWP Name:					
	H	BRAZOSPORT WATER AUTHORITY					
	Total Strategy Supply Volume for this WWP:	2010:	2020:	2030:	2040:	2050:	2060:
		0	3,136	3,136	3,136	3,136	3,136

Recommendation Type?	Recommended	Is Used to Meet Need?	N	IBT?	Y	
Include WWP WMS Cost numbers in WMS Source Cost Rollup?		Y				
	2010:	2020:	2030:	2040:	2050:	2060:
WWP WMS Annual Cost:	\$0	\$5,735,790	\$5,735,790	\$3,177,681	\$3,177,681	\$3,177,681
WWP Capital Costs:			\$30,570,395			
Term of Debt Service:			20			

DB12 Entries: Treatment Expansion

WMS Project

Sponsor Region:	H
WMS Project ID:	
WMS Project Name:	BWA WTP PLANT EXPANSION
WMS Description:	Expansion of conventional WTP operated by BWA.
WMS Type:	NEW SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)
WMS Infrastructure:	WATER TREATMENT PLANT
Additional RWPGs:	None
Included in State Water Plan:	Y

Source(s)

Source Region	Source Name	County Name	Basin Name	Source ID	Source Type
H	BRAZOS RIVER RUN-OF-RIVER	BAZORIA	BRAZOS	3461205366	SW
Is Source Supply selected for Rollup?				N	
Is Source Cost selected for Rollup?				Y	

County Name:	BRAZORIA	Water Quality Improvements	WATER QUALITY IMPROVEMENTS
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?			N
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	5,874	5,874	5,874	5,874	5,874

Recommendation Type?	Is Used to Meet Need?						IBT?
Recommended	N						Y
Include WWP WMS Cost numbers in WMS Source Cost Rollup?	Y						
	2010:	2020:	2030:	2040:	2050:	2060:	
WWP WMS Annual Cost:	\$0	\$3,958,654	\$3,958,654	\$2,757,067	\$2,757,067	\$2,757,067	
WWP Capital Costs:	\$14,359,419						
Term of Debt Service:	20						

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Attachment O:

Comments received regarding proposed amendment

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The public comment period for this amendment concluded November 19, 2014 with no comments being received by the Region H Water Planning Group or the project sponsor.