PORT CORPUS CHRISTI

June 25, 2021

Kathy Humphreys
TCEQ Staff Attorney
Environmental Law Division
MC-173, P.O. Box 13087
Austin, Texas 78711-3087

Re: SOAH Docket No. 582-20-1895; TCEQ Docket No. 2019-1156-IWD; Application of Port of Corpus Christi Authority of Nueces County for TPDES Permit No. WQ0005253000

Dear Ms. Humphreys:

This letter is in response to your letter of June 4, 2021, and the TCEQ Commission order remanding the above referenced permit to SOAH to take additional evidence. The list of items requested by the Executive Director's staff and the Port Authority's responses are below.

Request: Revised Application pages (one copy in track changes, one "clean" copy).

Response: See "PCCA Harbor Island Updated Application Forms" and "PCCA Harbor Island Exhibit AR-4 Redline" located here: https://bakerwotring.sharefile.com/i/id716c41edfe422a8

Request: Revised map showing the accurate location of the proposed diffuser and information and distances regarding its proximity to the scour hole in the channel (i.e., Will the diffuser sit in the hole, or on the near-shore side of it?);

Response: See "PCCA Harbor Island Updated Application Forms" located here: https://bakerwotring.sharefile.com/i/id716c41edfe422a8

Requests: Depth of the water body at the proposed diffuser;
Average depth of the water body;
Diffuser port height above the channel bottom;
Accurate channel bottom slopes to be used with the brine modeling option in CORMIX;

Confirmation of the diffuser design, including the specifications of the diffuser design and the depth at which the ports will discharge;
Accurate density characterization of the wastewater and/or confirmation that the effluent densities in the original application are still appropriate with the intake location moved to the gulf;
The Port of Corpus Christi's revised CORMIX prediction file(s) for the most critical case(s);
A detailed explanation of how the diffuser will achieve the critical dilutions at flowrates less than 95.6 MGD;

Response: See "PCCA Harbor Island Updated Application Forms" located here: https://bakerwotring.sharefile.com/i/id716c41edfe422a8

Request: Site-specific value(s) for ambient velocity. Please provide a range of data points for the ambient velocity;

Response: See "PCCA Harbor Island Updated Application Forms" and for more detail see Parsons "Field Sampling Technical Memorandum" both of which are located here: https://bakerwotring.sharefile.com/i/id716c41edfe422a8

Request: Confirmation that the results of the Port of Corpus Christi's SUNTANS modeling is (or isn't) applicable given the revised info and modeling;

Response: The Port Authority has confirmed that the SUNTANS modeling performed by Dr. Jordan Furnans is applicable given the revised information and modeling.

Request: A summary of all changes/corrections that you are making to the original application.

Response: In summary, the PCCA Harbor Island Updated Application Forms found here https://bakerwotring.sharefile.com/i/id716c41edfe422a8 include:

- A new signature page;
- Laboratory reports for salinity toxicity testing in synthetic sea water;
- Tischler/Kocurek Memorandum "Harbor Island Desalination Plant – Effluent Diffuser Conceptual Design" with updated diffuser design, diffuser location, and modeling;
- Revised Process Design Narrative; and
- Revised figures showing current placement of diffuser.

In addition, the Port Authority is producing supporting data and Parsons Field Sampling Technical Memorandum regarding the ambient velocity, bathymetry, and water quality data and an Amend Designation of Expert Witnesses, all of which can be found here https://bakerwotring.sharefile.com/i/id716c41edfe422a8.

Please let me know if you have any questions or would like any additional information from the Port Authority.

Sincerely,
PORT OF CORPUS CHRISTI AUTHORITY

Sarah L. Garza
Director of Environmental Planning & Compliance

cc: Service list

SERVICE LIST – SOAH DOCKET NO. 582-20-1895

TCEQ Executive Director

1. Kathy Humphreys – kathy.humphreys@tceq.texas.gov
2. Bobby Salehi - bobby.salehi@tceq.texas.gov
3. Harrison Malley - harrison.malley@tceq.texas.gov

TCEQ Public Interest Counsel

Sheldon P. Wayne – sheldon.wayne@tceq.texas.gov

TCEQ Office of the Chief Clerk- for filings only

Bridget Bohac: (via eFilings): https://www14.tceq.texas.gov/epic/eFiling/

City of Port Aransas

1. Emily Rogers – erogers@bickerstaff.com
2. Bill Dugat, III – bdugat@bickerstaff.com

Port Aransas Conservancy

1. Kirk D. Rasmussen – krasmussen@jw.com
2. Benjamin Rhem – brhem@jw.com
3. Craig R. Bennett – cbennett@jw.com
4. Susan Ayers – sayers@jw.com

Port Aransas Conservancy and James Harrison King, Tammy King, Edward Steves, Sam Steves

1. Richard Lowerre – rl@lf-lawfirm.com
2. David Frederick – dof@lf-lawfirm.com

Audubon Texas

1. Scott Moorhead – scott.moorhead@audubon.org

Individual Protestants

1. Phillip Bartlett - pvb@srcaccess.net
2. Stacey Bartlett - ssbartlett1129@gmail.com
3. Cara Denney - cara@ibilky.com ; CARA@keepherwildporta.com
4. Aldo Dyer - aldo.dyer@gmail.com
5. Mark Grosse - markgrosse1972@gmail.com
6. Jo Krueger – jkrueger22@gmail.com
7. Sarah Searight – sarahsearight@me.com
8. Susan Simpson – sandjfiser@gvtc.com
9. Lisa Turcotte – lisaturcotte55@gmail.com

Study Title

Short-Term Chronic Toxicity of Salinity
To the Inland Silverside (*Menidia beryllina*)
Under Static-Renewal Test Conditions

Performed For

Parsons Environment & Infrastructure Group
9101 Burnet Road, Suite 210
Austin, TX 78758

Project Officer
Randy Palachek

Author
Janelle Mikulas, M.S.

Study Period
11 June 2021 to 21 June 2021

Performing Laboratory

STILLMEADOW
INCORPORATED

Environmental Toxicology Laboratory
12852 Park One Drive
Sugar Land, Texas 77478

Telephone: (281) 240-8828
Fax: (281) 240-8448

Certificate Number T104704352-20-13

Project Number
21-607-001

STATEMENT OF PROCEDURAL COMPLIANCE

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. The information contained herein is accurate and complete.

Janelle Mikulas, M.S. — Date: 23 Jun 21

STATEMENT OF QUALITY ASSURANCE

The report and study data were audited to assure that the study was performed in accordance with STILLMEADOW, Inc. Standard Operating Procedures and regulatory guidelines. This report is an accurate reflection of the raw data.

Quality Assurance Auditor — Date: 23 Jun 21

EXECUTIVE SUMMARY

Objective	The objective of this study was to determine the chronic toxicity of Salinity for Parsons Environment & Infrastructure Group to the inland silverside, *Menidia beryllina*.			
Study Director	Janelle Mikulas, M.S.			
Test Type	7-Day Static Renewal Short Term Chronic Toxicity Test			
Test Method	United States Environmental Protection Agency (EPA-821-R-02-014) (2002) Method 1006.0			
Test Dates (Times)	11 June 2021 (0850) to 18 June 2021 (0942)			
Test Substance	Salt			
Dilution Water	Synthetic Seawater			
Test Concentrations	Control (25 ppt), 30 ppt, 35 ppt, 40 ppt, 45 ppt			
Source of Organisms	STILLMEADOW Inc. Culture Laboratory			
Age of Test Organisms	7-11 days			
Test Acceptability	**Parameter**		**Test Data**	**EPA Criterion**
	Survival	Control	100%	≥80%
		Control CV[1]	0.00%	≤40%
		Highest Salinity CV	5.73%	≤40%
	Growth	Control	0.63 mg	≥0.50 mg
		Control CV	7.48%	≤40%
		Highest Salinity CV	7.04%	≤40%
		PMSD[2]	11.6	---
Test Results	**Parameter**		**Critical Concentration**	**NOEC[3] Test Solution**
	Survival		Pass	45 ppt
	Growth		Pass	45 ppt

[1]CV = Coefficient of Variation
[2]PMSD = Percent Minimum Significant Difference
[3]NOEC = No Observed Effect Concentration

INTRODUCTION

The objective of this study was to determine the chronic toxicity to *Menidia beryllina* larvae of salinity for Parsons Environment & Infrastructure Group. This study is conducted in compliance with Texas Pollution Discharge Elimination System (TPDES) permit requirements; and in accordance with Texas Water Code Chapter 5, Subchapter R, Title 30 Texas Administrative Code Chapter 25 and the National Environmental Laboratory Accreditation Program (NELAP), Certificate Number T104704352-20-13. All original data, laboratory notebooks, and associated documentation are archived by the STILLMEADOW, Inc. Environmental Toxicology Laboratory.

METHODS AND MATERIALS

Test Substance/Dilution Water

Dilution water was synthetic seawater prepared according to USEPA (2002) guidelines. Initial characterization of the dilution and control water is given in Table 1. Dilution water was salted to the appropriate salinity for each test concentration.

Table 1. Chemical characterization of dilution water

Batch/Sample # Synthetic Seawater	Date Prepared	pH (SU)	Salinity (ppt)	Ammonia (mg/L NH_3N)	Total Residual Chlorine (mg/L)
QA21082	10 Jun 21	7.9	26	0.00	0.02
QA21084	14 Jun 21	7.8	24	0.00	0.01

TEST CONDITIONS

The 7-day short-term chronic test using *Menidia beryllina* and subsequent data analyses were carried out according to procedures specified by USEPA (2002) guidelines and STILLMEADOW, Inc. Environmental Toxicology Laboratory's Standard Operating Procedures. Table 2 lists a summary of the test conditions.

Table 2. Summary of test conditions

Organism lot #, Organism Source	AE210174, STILLMEADOW, Inc.
Organism age	7-11 days
Organisms per replicate	8
Replicates per concentration	5
Volume of test solution	500 mL
Test chamber	800-mL polystyrene beaker
Test temperature	25±1°C
Test duration	7 days
Dissolved oxygen	≥ 60% saturation
Photoperiod	16 L/ 8 D
Light intensity	50 – 100 ft c
Feeding regimen	twice daily, concentrated *Artemia* nauplii

Procedures

Test solutions (solutions for test renewals) were prepared daily at the STILLMEADOW, Inc. Environmental Toxicology Laboratory. The solutions were used for the renewals the day they were prepared.

Dissolved oxygen, salinity, pH, and temperature were measured in each treatment at the beginning and end of each 24-hour exposure period. Chamber temperature was also monitored daily. Aeration was not employed. The animals were fed twice daily during the test.

Test solutions were renewed by gently pouring old solutions out of the test beakers and replacing with new test solutions. During the renewal the larvae remained in the beaker along with approximately 20% of the old test solution.

At test initiation, at each renewal, and at test termination, the total number of live larvae was recorded for each test chamber. The unpreserved larvae from each test beaker were transferred to tared weigh boats at test termination and dried at 100-105°C for a minimum of 6 hours. The dried larvae were weighed to the nearest 0.001mg for determination of growth effects.

DATA ANALYSIS

All data were analyzed according to the statistical flow chart outlined in the EPA chronic testing manual (USEPA 2002). Table 3 lists the methods that were used in the analyses of the normality and homogeneity tests. A printout of statistical results is included in Appendix A.

TOXCALC™ Version 5.0 was used for all statistical evaluations. Survival and growth data were analyzed using hypothesis-testing techniques.

Table 3. Statistical methods used to analyze data for the toxicity test.

Endpoint	Comparison	Procedure
Survival	Transformation	Arc Sine $(y)^{1/2}$
	Normality	Shapiro-Wilk's Test ($\alpha \leq 0.01$)
	Homogeneity of Variances	Cannot Be Confirmed
	Reduction Relative to Control	Steel's Many-One Rank Test ($\alpha=0.05$)
Growth (Mean Dry Weight)	Transformation	No Transformation
	Normality	Shapiro-Wilk's Test ($\alpha \leq 0.01$)
	Homogeneity of Variances	Bartlett's Test ($\alpha \leq 0.01$)
	Reduction Relative to Control	Dunnett's Test ($\alpha=0.05$)

RESULTS

Survival and growth (mean dry weight) data for test organisms are provided in Table 4. Survival and mean dry weight at each concentration were compared to survival and weight of the control to determine statistically significant effects. The results of these comparisons are given in Table 5. Salinity over the course of the test is given in Table 6.

Table 4. Survival and mean dry weight for *M. beryllina* larvae exposed to test solutions for 7 days

Treatment (ppt)	Percent Survival (by day)				Dry Weight				Significant Effect Relative to Control	
					Original # of Fish		Surviving # of Fish			
	1	2	7	CV (%)	Mean (mg)	CV (%)	Mean (mg)	CV (%)	Survival	Mean Dry Weight[1]
25 (Control)	100	100	100	0.00	0.63	7.48	0.63	7.48		
30	100	100	100	0.00	0.67	6.43	0.67	6.43	NS[2]	NS
35	100	100	100	0.00	0.67	9.56	0.67	9.56	NS	NS
40	100	100	100	0.00	0.67	6.47	0.67	6.47	NS	NS
45	100	100	98	5.73	0.61	7.04	0.63	7.72	NS	NS

[1]Growth analysis for statistically significant effects relative to the control is based on the original number of fish.
[2]NS = Not Statistically Significant

Table 5. Summary of Statistical Endpoints.

Endpoint	Value (ppt)
Survival NOEC (No Observed Effect Concentration)	45
Growth NOEC	45

Table 6. Summary of Salinity.

Test Conc.	Salinity (parts per thousand)													
	Day 0	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7
	New	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	Old
25	25	24	25	25	25	24	24	24	24	25	25	26	26	26
30	30	30	31	30	31	30	30	29	29	30	31	30	31	30
35	35	35	36	35	36	35	35	34	34	35	36	35	36	36
40	40	40	41	40	41	40	40	40	40	40	41	40	40	41
45	45	45	46	45	46	46	45	44	44	45	46	45	46	46

REFERENCE TOXICANT TEST RESULTS

STILLMEADOW, Inc. conducts routine standard reference toxicant testing using *Menidia beryllina* obtained from STILLMEADOW, Inc. cultures. Sodium Dodecyl Sulfate (SDS) is used as the reference toxicant with synthetic seawater as the dilution water; the test method followed is USEPA method 1006.0 (USEPA, 2002). A copy of STILLMEADOW, Inc.'s most recent standard reference toxicant control chart for this species is presented in Appendix B.

STUDY DEVIATIONS

No deviations from the prescribed guidelines or standard operating procedures were identified during the study.

REFERENCES

U.S. Environmental Protection Agency (USEPA). 2002. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms*. Third Edition, October 2002. EPA-821-R-02-014.

Ives, Michael A. TOXCALC™ Version 5.0. 1994. TidePool Scientific Software. McKinleyville, California.

APPENDIX A

Statistical Analysis

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	6/11/2021	Test ID:	21-607-001	Sample ID:	Salt
End Date:	6/18/2021	Lab ID:	QA21082, 84	Sample Type:	
Sample Date:		Protocol:	EPA-821-R-02-014	Test Species:	MB-Menidia beryllina
Comments:					

Conc-ppt	1	2	3	4	5
:ontrol (25 ppt)	1.0000	1.0000	1.0000	1.0000	1.0000
30	1.0000	1.0000	1.0000	1.0000	1.0000
35	1.0000	1.0000	1.0000	1.0000	1.0000
40	1.0000	1.0000	1.0000	1.0000	1.0000
45	1.0000	0.8750	1.0000	1.0000	1.0000

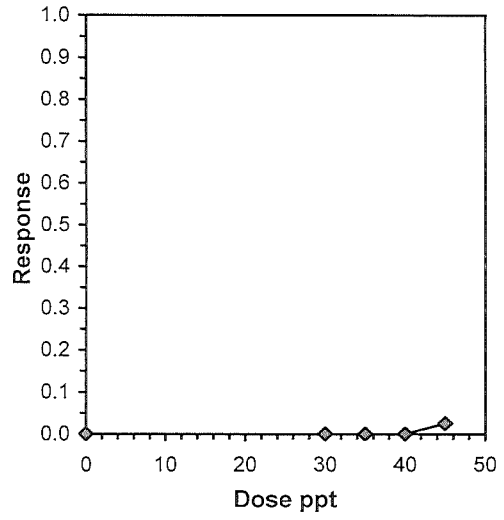
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-ppt	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
:ontrol (25 ppt)	1.0000	1.0000	1.3931	1.3931	1.3931	0.000	5			1.0000	1.0000
30	1.0000	1.0000	1.3931	1.3931	1.3931	0.000	5	27.50	17.00	1.0000	1.0000
35	1.0000	1.0000	1.3931	1.3931	1.3931	0.000	5	27.50	17.00	1.0000	1.0000
40	1.0000	1.0000	1.3931	1.3931	1.3931	0.000	5	27.50	17.00	1.0000	1.0000
45	0.9750	0.9750	1.3564	1.2094	1.3931	6.055	5	25.00	17.00	0.9750	0.9750

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.4503	0.888	-3.5721	16.6245
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	45	>45		

Linear Interpolation (200 Resamples)

Point	ppt	SD	95% CL(Exp)	Skew
IC05	>45			
IC10	>45			
IC15	>45			
IC20	>45			
IC25	>45			
IC40	>45			
IC50	>45			



ToxCalc v5.0.23

Reviewed by: 6/22/2021
6/23/2021

Larval Fish Growth and Survival Test-7 Day Biomass

Start Date:	6/11/2021	Test ID:	21-607-001	Sample ID:	Salt
End Date:	6/18/2021	Lab ID:	QA21082, 84	Sample Type:	
Sample Date:		Protocol:	EPA-821-R-02-014	Test Species:	MB-Menidia beryllina
Comments:					

Conc-ppt	1	2	3	4	5
;ontrol (25 ppt)	0.6104	0.6479	0.6055	0.5769	0.6988
30	0.6834	0.6290	0.6231	0.7005	0.7198
35	0.7134	0.5978	0.7216	0.7094	0.5991
40	0.7166	0.7131	0.6173	0.6436	0.6643
45	0.6241	0.5888	0.6353	0.5475	0.6568

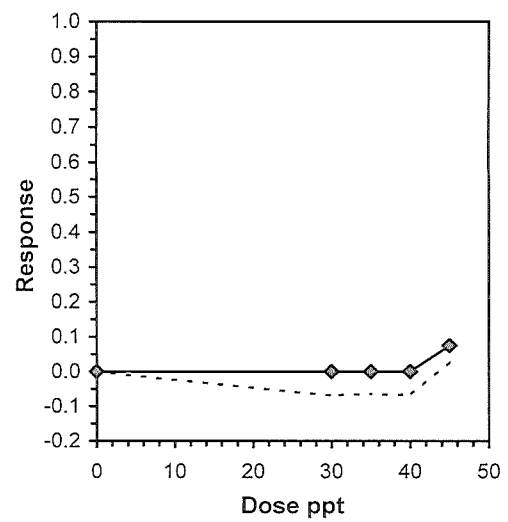
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-ppt	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
;ontrol (25 ppt)	0.6279	1.0000	0.6279	0.5769	0.6988	7.484	5				0.6596	1.0000
30	0.6712	1.0689	0.6712	0.6231	0.7198	6.433	5	-1.404	2.300	0.0709	0.6596	1.0000
35	0.6683	1.0643	0.6683	0.5978	0.7216	9.560	5	-1.310	2.300	0.0709	0.6596	1.0000
40	0.6710	1.0686	0.6710	0.6173	0.7166	6.471	5	-1.398	2.300	0.0709	0.6596	1.0000
45	0.6105	0.9723	0.6105	0.5475	0.6568	7.036	5	0.564	2.300	0.0709	0.6105	0.9256

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9216	0.888	-0.1773	-1.4047
Bartlett's Test indicates equal variances (p = 0.92)	0.94859	13.2767		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	45	>45			0.07091	0.11294	0.00409	0.00238	0.18492	4, 20

Linear Interpolation (200 Resamples)

Point	ppt	SD	95% CL(Exp)	Skew
IC05	43.359			
IC10	>45			
IC15	>45			
IC20	>45			
IC25	>45			
IC40	>45			
IC50	>45			



ToxCalc v5.0.23

Reviewed by: JM 22Jun21

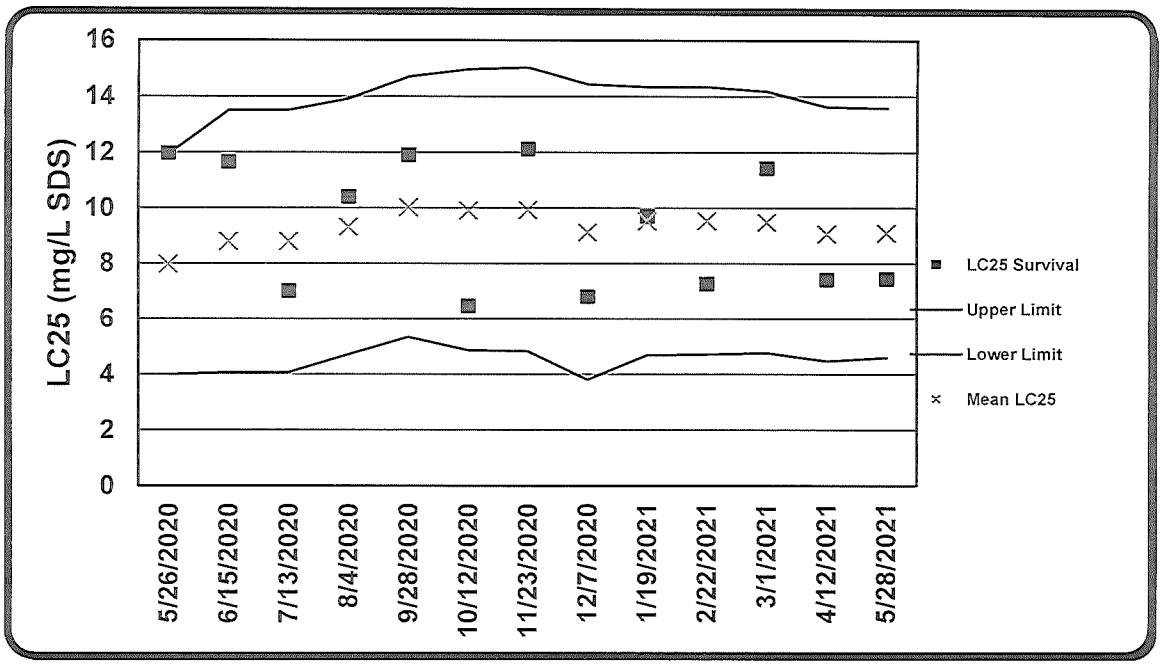
EL 23Jun21

APPENDIX B

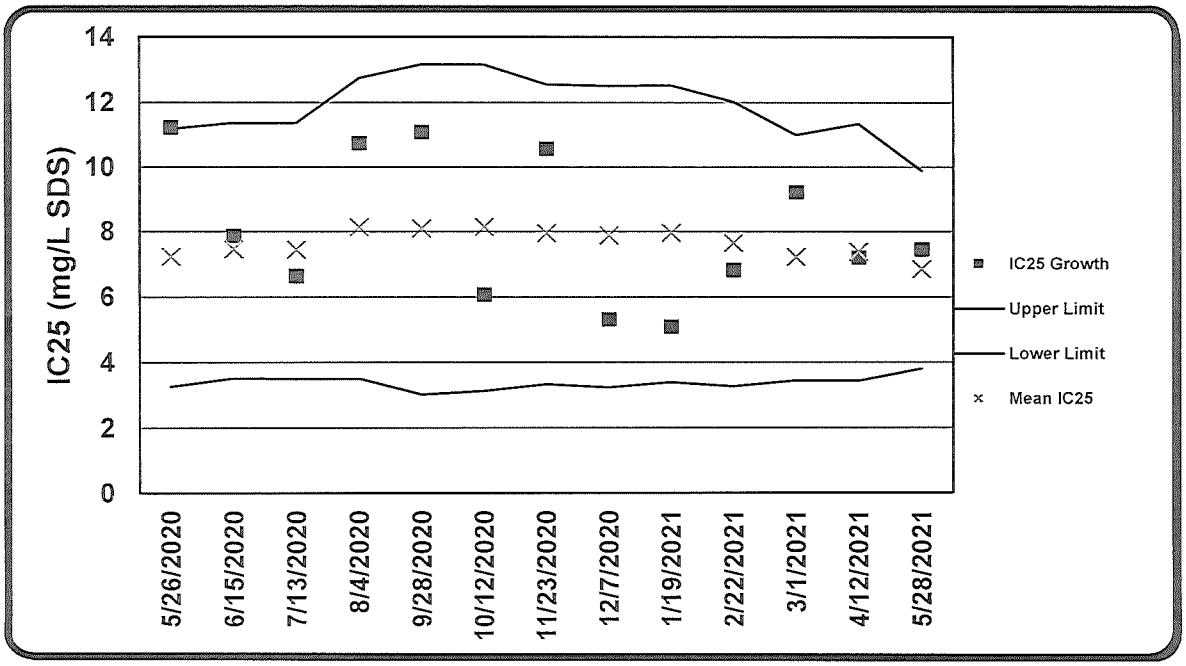
Standard Reference Toxicant Control Charts

Menidia beryllina Short-Term Chronic Standard Reference Toxicant Control Charts

LC25 (mg/L SDS) Survival



IC25 (mg/L SDS) Growth



Study Title

Short-Term Chronic Toxicity of Salinity
To the Mysid Shrimp (*Mysidopsis bahia*)
Under Static-Renewal Test Conditions

Performed For
Parsons Environment & Infrastructure Group
9101 Burnet Road, Suite 210
Austin, TX 78758

Project Officer
Randy Palachek

Author
Janelle Mikulas, M.S.

Study Period
11 June 2021 to 21 June 2021

Performing Laboratory

STILLMEADOW
INCORPORATED

Environmental Toxicology Laboratory
12852 Park One Drive
Sugar Land, Texas 77478

Telephone: (281) 240-8828
Fax: (281) 240-8448

Certificate Number T104704352-20-13

Project Number
21-607-002

STATEMENT OF PROCEDURAL COMPLIANCE

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. The information contained herein is accurate and complete.

Janelle Mikulas, M.S. — Date: 23 Jun 21

STATEMENT OF QUALITY ASSURANCE

The report and study data were audited to assure that the study was performed in accordance with STILLMEADOW, Inc. Standard Operating Procedures and regulatory guidelines. This report is an accurate reflection of the raw data.

Quality Assurance Auditor — Date: 23 Jun 21

EXECUTIVE SUMMARY

Objective	The objective of this study was to determine the chronic toxicity of Salinity for Parsons Environment & Infrastructure Group to the Mysid shrimp, *Mysidopsis bahia*.			
Study Director	Janelle Mikulas, M.S.			
Test Type	7-Day Static Renewal Short Term Chronic Toxicity Test			
Test Method	United States Environmental Protection Agency (EPA-821-R-02-014) (2002) Method 1007.0			
Test Dates (Times)	11 June 2021 (1110) to 18 June 2021 (0915)			
Test Substance	Salt			
Dilution Water	Synthetic Seawater			
Test Concentrations	Control (25 ppt), 30 ppt, 35 ppt, 40 ppt, 45 ppt			
Source of Organisms	STILLMEADOW, Inc. Culture Laboratory			
Age of Test Organisms	7 days			
Test Acceptability	**Parameter**		**Test Data**	**EPA Criterion**
	Survival	Control	95%	≥80%
		Control CV[1]	9.75%	≤40%
		Highest Salinity CV	9.75%	≤40%
	Growth	Control	0.44 mg	≥0.20 mg
		Control CV	15.22%	≤40%
		Highest Salinity CV	16.29%	≤40%
		PMSD[2]	13.6	---
Test Results	**Parameter**		**Critical Concentration**	**NOEC[3] Test Solution**
	Survival		Pass	45 ppt
	Growth		Pass	45 ppt

[1]CV = Coefficient of Variation
[2]PMSD = Percent Minimum Significant Difference
[3]NOEC = No Observed Effect Concentration

INTRODUCTION

The objective of this study was to determine the chronic toxicity to *Mysidopsis bahia* larvae of salinity for Parsons Environment & Infrastructure Group. This study is conducted in compliance with Texas Pollution Discharge Elimination System (TPDES) permit requirements; and in accordance with Texas Water Code Chapter 5, Subchapter R, Title 30 Texas Administrative Code Chapter 25 and the National Environmental Laboratory Accreditation Program (NELAP), Certificate Number T104704352-20-13. All original data, laboratory notebooks, and associated documentation are archived by the STILLMEADOW, Inc. Environmental Toxicology Laboratory.

METHODS AND MATERIALS

Test Substance

Test Substance/Dilution Water

Dilution water was synthetic seawater prepared according to USEPA (2002) guidelines. Initial characterization of the dilution and control water is given in Table 1. Dilution water was salted to the appropriate salinity for each test concentration.

Table 1. Chemical characterization of dilution water

Batch/Sample # Synthetic Seawater	Date Prepared	pH (SU)	Salinity (ppt)	Ammonia (mg/L NH_3N)	Total Residual Chlorine (mg/L)
QA21082	10 Jun 21	7.9	26	0.00	0.02
QA21084	14 Jun 21	7.8	24	0.00	0.01

TEST CONDITIONS

The 7-day short-term chronic test using *Mysidopsis bahia* and subsequent data analyses were carried out according to procedures specified by USEPA (2002) guidelines and STILLMEADOW, Inc. Environmental Toxicology Laboratory's Standard Operating Procedures. Table 2 lists a summary of the test conditions.

Table 2. Summary of test conditions

Organism lot #, Organism Source	AE210173, STILLMEADOW, Inc.
Organism age	7 days
Organisms per replicate	5
Replicates per concentration	8
Volume of test solution	300 mL
Test chamber	400-mL polystyrene beaker
Test temperature	26 ± 1 °C
Test duration	7 days
Dissolved oxygen	≥ 60% saturation
Photoperiod	16 L/ 8 D
Light intensity	50 – 100 ft c
Feeding regimen	twice daily, concentrated *Artemia* nauplii

Procedures

Test solutions (solutions for test renewals) were prepared daily at the STILLMEADOW, Inc. Environmental Toxicology Laboratory. The solutions were used for the renewals the day they were prepared.

Dissolved oxygen, salinity, pH, and temperature were measured in each treatment at the beginning and end of each 24-hour exposure period. Chamber temperature was also monitored daily. Aeration was not employed and the animals were fed twice daily during the test.

Test solutions were renewed by gently pouring old solutions out of the test beakers and replacing with new test solutions. During the renewal the larvae remained in the beaker along with approximately 20% of the old test solution.

At test initiation, at each renewal, and at test termination, the total number of live mysids was recorded for each test chamber. The unpreserved mysids from each test beaker were transferred to tared weigh boats at test termination and dried at 100-105°C for a minimum of 6 hours. The dried mysids were weighed to the nearest 0.001mg for determination of growth effects

DATA ANALYSIS

All data were analyzed according to the statistical flow chart outlined in the EPA chronic testing manual (USEPA 2002). Table 3 lists the methods that were used in the analyses of the normality and homogeneity tests. A printout of statistical results is included in Appendix A.

TOXCALC™ Version 5.0 was used for all statistical evaluations. Survival and growth data were analyzed using hypothesis-testing techniques.

Table 3. Statistical methods used to analyze data for the toxicity test.

Endpoint	Comparison	Procedure
Survival	Transformation	Arc Sine $(y)^{1/2}$
	Normality	Shapiro-Wilk's Test ($\alpha \leq 0.01$)
	Homogeneity of Variances	Cannot Be Confirmed
	Reduction Relative to Control	Steel's Many-One Rank Test ($\alpha=0.05$)
Growth (Mean Dry Weight)	Transformation	No Transformation
	Normality	Shapiro-Wilk's Test ($\alpha \leq 0.01$)
	Homogeneity of Variances	Bartlett's Test ($\alpha \leq 0.01$)
	Reduction Relative to Control	Dunnett's Test ($\alpha=0.05$)

RESULTS

Survival and growth (mean dry weight) data for test organisms are provided in Table 4. Survival and mean dry weight at each concentration were compared to survival and weight of the control to determine statistically significant effects. The results of these comparisons are given in Table 5. Salinity over the course of the test is given in Table 6.

Table 4. Survival and mean dry weight for *M. bahia* exposed to test solutions for 7 days

Treatment (ppt)	Percent Survival (by day)				Dry Weight				Significant Effect Relative to Control	
					Original # of Mysids		Surviving # of Mysids			
	1	2	7	CV (%)	Mean (mg)	CV (%)	Mean (mg)	CV (%)	Survival	Mean Dry Weight[1]
25 (Control)	98	95	95	9.75	0.42	15.22	0.44	10.03		
30	100	100	100	0.00	0.44	5.55	0.44	5.55	NS[2]	NS
35	100	100	100	0.00	0.45	9.48	0.45	9.48	NS	NS
40	100	100	100	0.00	0.45	10.04	0.45	10.04	NS	NS
45	100	95	95	9.75	0.37	16.29	0.39	18.46	NS	NS

[1]Growth analysis for statistically significant effects relative to the control is based on the original number of fish.
[2]NS = Not Statistically Significant

Table 5. Summary of Statistical Endpoints

Endpoint	Value (ppt)
Survival NOEC (No Observed Effect Concentration)	45
Growth NOEC	45

Table 6. Summary of Salinity.

Test Conc.	Salinity (parts per thousand)													
	Day 0	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7
	New	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	Old
25	25	24	26	25	25	24	25	24	24	25	25	26	26	26
30	30	30	31	30	31	30	30	29	29	30	31	30	31	30
35	35	35	36	35	36	35	35	34	34	35	36	35	36	36
40	40	40	41	40	41	40	40	40	41	40	41	40	41	41
45	45	45	46	45	46	46	45	44	46	45	46	45	45	46

REFERENCE TOXICANT TEST RESULTS

STILLMEADOW, Inc. conducts routine standard reference toxicant testing using *Mysidopsis bahia* obtained from STILLMEADOW, Inc. cultures. Sodium Dodecyl Sulfate (SDS) is used as the reference toxicant with synthetic seawater as the dilution water; the test method followed is USEPA method 1007.0 (USEPA, 2002). A copy of STILLMEADOW, Inc.'s most recent standard reference toxicant control chart for this species is presented in Appendix B.

STUDY DEVIATIONS

No deviations from the prescribed guidelines or standard operating procedures were identified during the study.

REFERENCES

U.S. Environmental Protection Agency (USEPA). 2002. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms*. Third Edition, October 2002. EPA-821-R-02-014.

Ives, Michael A. TOXCALC™ Version 5.0. 1994. TidePool Scientific Software. McKinleyville, California.

APPENDIX A

Statistical Analysis

Mysid Survival, Growth and Fecundity Test-7 Day Survival

Start Date:	6/11/2021	Test ID:	21-607-002	Sample ID:	Salt
End Date:	6/18/2021	Lab ID:	QA21082, 84	Sample Type:	
Sample Date:		Protocol:	EPA-821-R-02-014	Test Species:	MY-Mysidopsis bahia
Comments:					

Conc-ppt	1	2	3	4	5	6	7	8
ontrol (25 ppt)	1.0000	0.8000	0.8000	1.0000	1.0000	1.0000	1.0000	1.0000
30	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
35	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
40	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
45	1.0000	1.0000	1.0000	1.0000	0.8000	0.8000	1.0000	1.0000

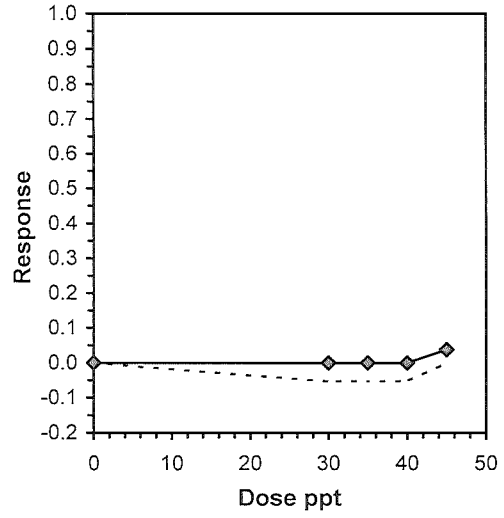
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-ppt	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
ontrol (25 ppt)	0.9500	1.0000	1.2857	1.1071	1.3453	8.574	8			0.9875	1.0000
30	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	8	76.00	47.00	0.9875	1.0000
35	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	8	76.00	47.00	0.9875	1.0000
40	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	8	76.00	47.00	0.9875	1.0000
45	0.9500	1.0000	1.2857	1.1071	1.3453	8.574	8	68.00	47.00	0.9500	0.9620

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.63802	0.919	-1.8977	3.38869
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	45	>45		

Linear Interpolation (200 Resamples)

Point	ppt	SD	95% CL	Skew
IC05	>45			
IC10	>45			
IC15	>45			
IC20	>45			
IC25	>45			
IC40	>45			
IC50	>45			



ToxCalc v5.0.23

Reviewed by: JM 22 Jun 21

Mysid Survival, Growth and Fecundity Test-Biomass

Start Date:	6/11/2021	Test ID:	21-607-002	Sample ID:	Salt
End Date:	6/18/2021	Lab ID:	QA21082, 84	Sample Type:	
Sample Date:		Protocol:	EPA-821-R-02-014	Test Species:	MY-Mysidopsis bahia
Comments:					

Conc-ppt	1	2	3	4	5	6	7	8
ontrol (25 ppt)	0.5266	0.3564	0.3238	0.4144	0.4392	0.4218	0.4614	0.3826
30	0.4582	0.4662	0.4352	0.4298	0.4574	0.3922	0.4240	0.4536
35	0.4478	0.4316	0.4600	0.4502	0.5252	0.4556	0.4882	0.3756
40	0.3640	0.4326	0.5096	0.4734	0.4624	0.4526	0.4968	0.4306
45	0.3906	0.3426	0.3802	0.3600	0.3974	0.3190	0.4682	0.2670

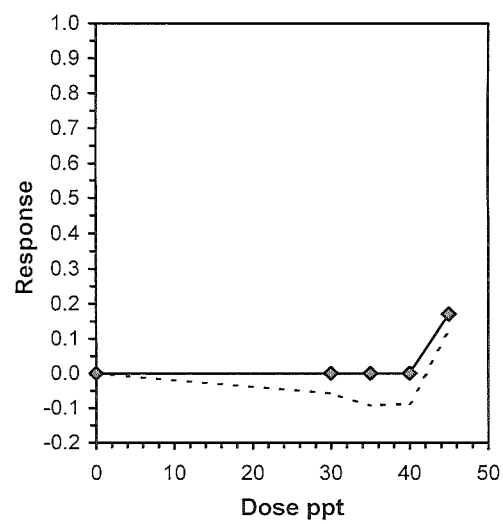
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-ppt	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
ontrol (25 ppt)	0.4158	1.0000	0.4158	0.3238	0.5266	15.221	8				0.4406	1.0000
30	0.4396	1.0572	0.4396	0.3922	0.4662	5.554	8	-0.969	2.239	0.0550	0.4406	1.0000
35	0.4543	1.0926	0.4543	0.3756	0.5252	9.479	8	-1.567	2.239	0.0550	0.4406	1.0000
40	0.4528	1.0889	0.4528	0.3640	0.5096	10.040	8	-1.505	2.239	0.0550	0.4406	1.0000
45	0.3656	0.8794	0.3656	0.2670	0.4682	16.289	8	2.042	2.239	0.0550	0.3656	0.8298

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9658	0.919	-0.0314	0.58143
Bartlett's Test indicates equal variances (p = 0.19)	6.13519	13.2767		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	45	>45			0.05499	0.13226	0.0109	0.00241	0.00479	4, 35

Linear Interpolation (200 Resamples)

Point	ppt	SD	95% CL		Skew
IC05	41.469	0.771	39.510	42.436	-2.1035
IC10	42.939				
IC15	44.408				
IC20	>45				
IC25	>45				
IC40	>45				
IC50	>45				



ToxCalc v5.0.23

Reviewed by: JM 22Jun21

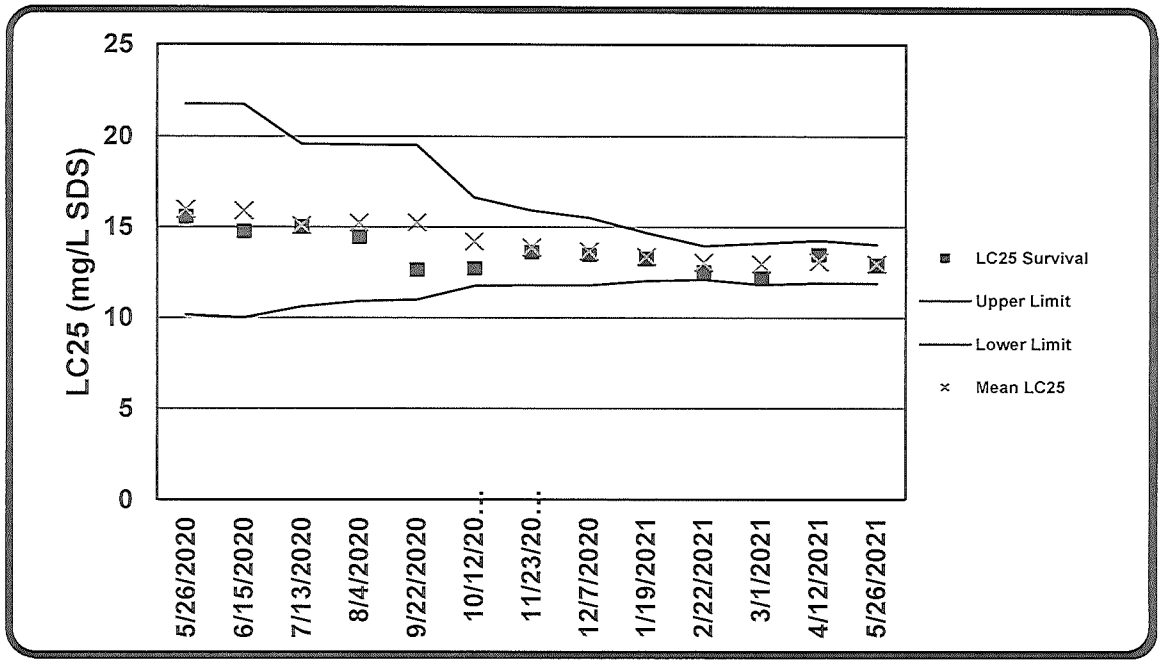
tmv EL 23Jun21

APPENDIX B

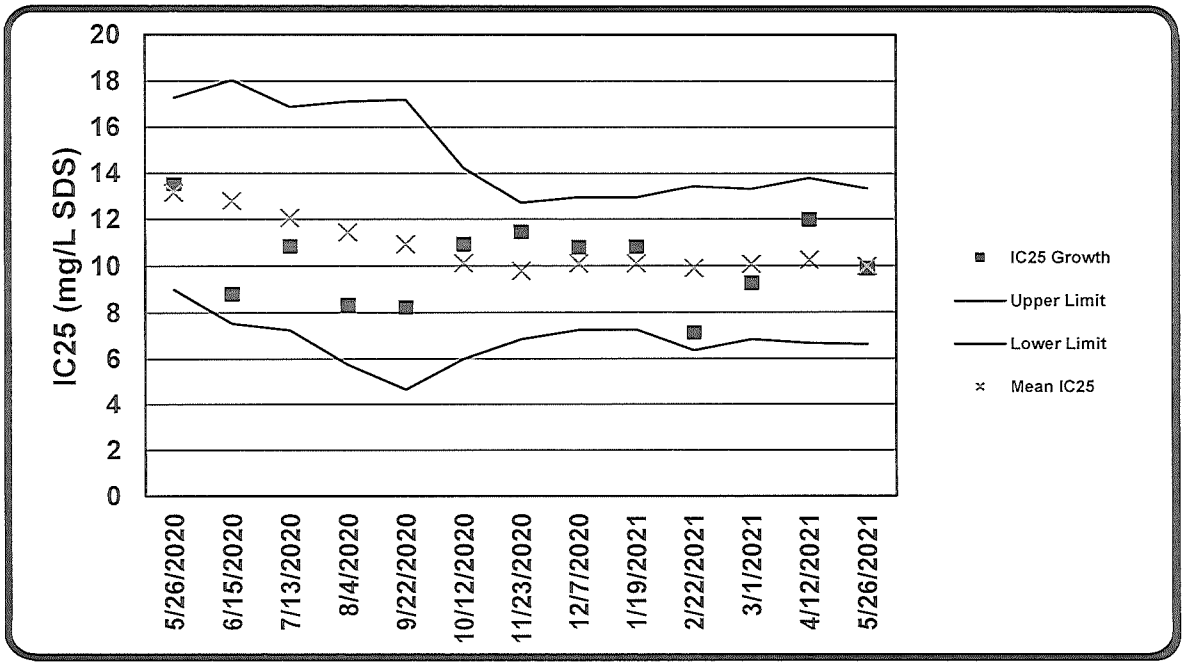
Standard Reference Toxicant Control Charts

Mysidopsis bahia Short-Term Chronic Standard Reference Toxicant Control Charts

LC25 (mg/L SDS) Survival



IC25 (mg/L SDS) Growth



10450 Stancliff Rd. Suite 210
Houston, TX 77099
T: +1 281 530 5656
F: +1 281 530 5887

June 23, 2021

Curt Burdorf
Parsons
9101 Burnet Rd
Ste 210
Austin , TX 78758

Work Order: **HS21060521**

Laboratory Results for: **Parsons - POCC Flow**

Dear Curt Burdorf,

ALS Environmental received 2 sample(s) on Jun 10, 2021 for the analysis presented in the following report.

This is a REVISED REPORT. Please see the Case Narrative for discussion concerning this revision.

Regards,

Generated By: DANE.WACASEY

Ragen Giga
Project Manager

Client: Parsons
Project: Parsons - POCC Flow
Work Order: HS21060521

SAMPLE SUMMARY

Lab Samp ID	Client Sample ID	Matrix	TagNo	Collection Date	Date Received	Hold
HS21060521-01	POCC - INTAKE-1	Water		09-Jun-2021 09:55	10-Jun-2021 08:00	☐
HS21060521-03	LL Mercury Field Blank	Water		09-Jun-2021 09:55	10-Jun-2021 08:00	☐

Client: Parsons
Project: Parsons - POCC Flow
Work Order: HS21060521

CASE NARRATIVE

Work Order Comments

- Revision I - This report was revised to report down to the MDL.

  Revision 2 - This report was revised June 23, 2021 in order to report to the MDL for Metals and to the PQL for all other parameters.

- The analyses for Mercury & Cyanide was subcontracted to ALS Environmental in Holland, MI.

ECD Organics by Method E608

Batch ID: 166899

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

GCMS Semivolatiles by Method E625

Batch ID: 166779

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

GCMS Volatiles by Method E624

Batch ID: R385410

Sample ID: HS21060472-02MS

- MS and MSD are for an unrelated sample

Metals by Method Calculation

Batch ID: R385823

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

Metals by Method E200.8

Batch ID: 166918

Sample ID: POCC - INTAKE-1 (HS21060521-01)

- Sample ran at 10x due to high concentration of Sodium.

Sample ID: HS21060616-01MS

- MS and MSD are for an unrelated sample

WetChemistry by Method SM2120B

Batch ID: R385335

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method E415.1

Batch ID: R385387

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

Client: Parsons
Project: Parsons - POCC Flow
Work Order: HS21060521

CASE NARRATIVE

WetChemistry by Method M2540D

Batch ID: R385585

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method M2540C

Batch ID: R385765

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method M4500-N C

Batch ID: R385851

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method E1664A

Batch ID: R385769

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method E410.4

Batch ID: R385686

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method SM2320B

Batch ID: R385528

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method E300

Batch ID: R385426

Sample ID: HS21060527-13MS

- MS and MSD are for an unrelated sample (Chloride)

WetChemistry by Method M3500-Cr B

Batch ID: R385353

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method SM4500 NH3-B-F

Batch ID: 167044

Sample ID: HS21060746-01MS

- MS and MSD are for an unrelated sample

Client: Parsons
Project: Parsons - POCC Flow
Work Order: HS21060521

CASE NARRATIVE

WetChemistry by Method E365.3

Batch ID: 166825

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method SM4500 S2-D

Batch ID: 166930

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method M4500 NH3 D

Batch ID: 166904

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method SM5540C

Batch ID: 166767

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method SM5210 B

Batch ID: 166765,166766

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

Client:	Parsons	**ANALYTICAL REPORT**
Project:	Parsons - POCC Flow	WorkOrder:HS21060521
Sample ID:	POCC - INTAKE-1	Lab ID:HS21060521-01
Collection Date:	09-Jun-2021 09:55	Matrix:Water

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
VOLATILES		**Method:E624**				Analyst: PC
1,1,1-Trichloroethane	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
1,1,2,2-Tetrachloroethane	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
1,1,2-Trichloroethane	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
1,1-Dichloroethene	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
1,2-Dibromoethane	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
1,2-Dichlorobenzene	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
1,2-Dichloroethane	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
1,2-Dichloropropane	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
1,3-Dichlorobenzene	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
1,4-Dichlorobenzene	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
2-Butanone	< 10.0		10.0	ug/L	1	10-Jun-2021 14:36
Acrylonitrile	< 10.0		10.0	ug/L	1	10-Jun-2021 14:36
Benzene	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Bromodichloromethane	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Bromoform	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Carbon tetrachloride	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Chlorobenzene	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Chloroform	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Dibromochloromethane	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Ethylbenzene	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Hexachlorobutadiene	< 5.00	n	5.00	ug/L	1	10-Jun-2021 14:36
Methylene chloride	< 10.0		10.0	ug/L	1	10-Jun-2021 14:36
Tetrachloroethene	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Toluene	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Trichloroethene	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Vinyl chloride	< 2.00		2.00	ug/L	1	10-Jun-2021 14:36
1,3-Dichloropropene, Total	< 5.00		5.00	ug/L	1	10-Jun-2021 14:36
Total Trihalomethanes (TTHMs)	< 5.00	a	5.00	ug/L	1	10-Jun-2021 14:36
Surr: 1,2-Dichloroethane-d4	*107*		*70-126*	*%REC*	*1*	*10-Jun-2021 14:36*
Surr: 4-Bromofluorobenzene	*99.0*		*82-124*	*%REC*	*1*	*10-Jun-2021 14:36*
Surr: Dibromofluoromethane	*98.0*		*77-123*	*%REC*	*1*	*10-Jun-2021 14:36*
Surr: Toluene-d8	*96.8*		*82-127*	*%REC*	*1*	*10-Jun-2021 14:36*

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**
Project:	Parsons - POCC Flow	WorkOrder:HS21060521
Sample ID:	POCC - INTAKE-1	Lab ID:HS21060521-01
Collection Date:	09-Jun-2021 09:55	Matrix:Water

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
SEMIVOLATILE		**Method:E625**		Prep:E625 / 11-Jun-2021		Analyst: GEY
1,2,4,5-Tetrachlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
2,4,5-Trichlorophenol	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
2,4-Dimethylphenol	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
2-Methylphenol	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
3&4-Methylphenol	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
3,3´-Dichlorobenzidine	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Anthracene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Benz(a)anthracene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Benzidine	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Benzo(a)pyrene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Bis(2-chloroethyl)ether	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Bis(2-ethylhexyl)phthalate	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Chrysene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Di-n-butyl phthalate	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Hexachlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Hexachlorocyclopentadiene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Hexachloroethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
N-Nitroso-di-n-butylamine	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
N-Nitrosodiethylamine	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Nitrobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Nonylphenol	< 5.00	n	5.00	ug/L	1	11-Jun-2021 14:58
Pentachlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Pentachlorophenol	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Phenanthrene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Pyridine	< 5.00		5.00	ug/L	1	11-Jun-2021 14:58
Surr: 2,4,6-Tribromophenol	*63.2*		*42-124*	*%REC*	*1*	*11-Jun-2021 14:58*
Surr: 2-Fluorobiphenyl	*59.1*		*48-120*	*%REC*	*1*	*11-Jun-2021 14:58*
Surr: 2-Fluorophenol	*38.0*		*20-120*	*%REC*	*1*	*11-Jun-2021 14:58*
Surr: 4-Terphenyl-d14	*88.1*		*51-135*	*%REC*	*1*	*11-Jun-2021 14:58*
Surr: Nitrobenzene-d5	*55.1*		*41-120*	*%REC*	*1*	*11-Jun-2021 14:58*
Surr: Phenol-d6	*39.9*		*20-120*	*%REC*	*1*	*11-Jun-2021 14:58*

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**	
Project:	Parsons - POCC Flow	WorkOrder:HS21060521	
Sample ID:	POCC - INTAKE-1	Lab ID:HS21060521-01	
Collection Date:	09-Jun-2021 09:55	Matrix:Water	

ANALYSES	RESULT	QUAL	MDL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
CHLORINATED PEST/PCBS BY E608		**Method:E608**			Prep:E608 / 15-Jun-2021		Analyst: JBA
Aroclor 1016	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:11
Aroclor 1221	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:11
Aroclor 1232	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:11
Aroclor 1242	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:11
Aroclor 1248	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:11
Aroclor 1254	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:11
Aroclor 1260	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:11
Surr: Decachlorobiphenyl	*66.2*			*61-154*	*%REC*	*1*	*15-Jun-2021 16:11*
Surr: Tetrachloro-m-xylene	*95.2*			*60-144*	*%REC*	*1*	*15-Jun-2021 16:11*
TRIVALENT CHROMIUM		**Method:Calculation**					Analyst: JHD
Chromium, Trivalent	< 0.0100	n		0.0100	mg/L	1	18-Jun-2021 12:18
TOTAL METALS BY E200.8		**Method:E200.8**			Prep:E200.8 / 16-Jun-2021		Analyst: JHD
Aluminum	**74.6**	J	**8.00**	**100**	**ug/L**	10	17-Jun-2021 15:57
Antimony	< 5.30		5.30	50.0	ug/L	10	17-Jun-2021 15:57
Arsenic	**3.01**	J	**2.50**	**20.0**	**ug/L**	10	17-Jun-2021 15:57
Barium	**19.9**	J	**0.840**	**40.0**	**ug/L**	10	17-Jun-2021 15:57
Beryllium	< 0.910		0.910	50.0	ug/L	10	17-Jun-2021 15:57
Boron	**3,570**		**167**	**200**	**ug/L**	10	17-Jun-2021 15:57
Cadmium	< 0.770		0.770	20.0	ug/L	10	17-Jun-2021 15:57
Calcium	**345,000**		**180**	**5000**	**ug/L**	10	17-Jun-2021 15:57
Chromium	< 2.51		2.51	40.0	ug/L	10	17-Jun-2021 15:57
Cobalt	< 0.400		0.400	50.0	ug/L	10	17-Jun-2021 15:57
Copper	**1.82**	J	**1.70**	**20.0**	**ug/L**	10	17-Jun-2021 15:57
Iron	< 500		500	2000	ug/L	10	17-Jun-2021 15:57
Lead	< 1.20		1.20	20.0	ug/L	10	17-Jun-2021 15:57
Magnesium	**1,060,000**		**78.0**	**5000**	**ug/L**	10	17-Jun-2021 15:57
Manganese	**4.78**	J	**0.660**	**50.0**	**ug/L**	10	17-Jun-2021 15:57
Molybdenum	**8.86**	J	**4.90**	**50.0**	**ug/L**	10	17-Jun-2021 15:57
Nickel	**1.63**	J	**1.10**	**20.0**	**ug/L**	10	17-Jun-2021 15:57
Potassium	**318,000**		**330**	**5000**	**ug/L**	10	17-Jun-2021 15:57
Selenium	< 8.60		8.60	20.0	ug/L	10	17-Jun-2021 15:57
Silver	< 0.440		0.440	20.0	ug/L	10	17-Jun-2021 15:57
Sodium	**9,490,000**		**21000**	**200000**	**ug/L**	1000	17-Jun-2021 16:19
Thallium	< 2.50		2.50	20.0	ug/L	10	17-Jun-2021 15:57
Tin	< 0.580		0.580	50.0	ug/L	10	17-Jun-2021 15:57
Titanium	< 3.90		3.90	50.0	ug/L	10	17-Jun-2021 15:57
Zinc	< 10.0		10.0	40.0	ug/L	10	17-Jun-2021 15:57
OIL & GREASE (HEM) BY E1664A		**Method:E1664A**					Analyst: KAH
Oil and Grease	**3.00**			**2.00**	**mg/L**	1	17-Jun-2021 14:00

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**	
Project:	Parsons - POCC Flow	WorkOrder:HS21060521	
Sample ID:	POCC - INTAKE-1	Lab ID:HS21060521-01	
Collection Date:	09-Jun-2021 09:55	Matrix:Water	

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
ANIONS BY E300.0		**Method:E300**				Analyst: YP
Bromide	**48.3**		**10.0**	**mg/L**	100	10-Jun-2021 17:49
Chloride	**16,400**		**500**	**mg/L**	1000	10-Jun-2021 17:57
Fluoride	< 10.0		10.0	mg/L	100	10-Jun-2021 17:49
Nitrogen, Nitrate (As N)	< 10.0		10.0	mg/L	100	10-Jun-2021 17:49
Nitrogen, Nitrite (As N)	< 10.0		10.0	mg/L	100	10-Jun-2021 17:49
Nitrate/Nitrite (as N)	< 20.0		20.0	mg/L	100	10-Jun-2021 17:49
Sulfate	**2,340**		**50.0**	**mg/L**	100	10-Jun-2021 17:49
PHOSPHORUS BY E365.3		**Method:E365.3**		Prep:E365.3 / 11-Jun-2021		Analyst: KVL
Phosphorus, Total (As P)	< 0.0500		0.0500	mg/L	1	11-Jun-2021 14:45
CHEMICAL OXYGEN DEMAND BY E410.4		**Method:E410.4**				Analyst: TH
Chemical Oxygen Demand	**60.0**		**15.0**	**mg/L**	1	16-Jun-2021 15:00
TOTAL ORGANIC CARBON BY E415.1		**Method:E415.1**				Analyst: JAC
Organic Carbon, Total	**2.09**		**1.00**	**mg/L**	1	10-Jun-2021 19:29
TOTAL DISSOLVED SOLIDS BY SM2540C		**Method:M2540C**				Analyst: KAH
Total Dissolved Solids (Residue, Filterable)	**33,400**		**10.0**	**mg/L**	1	16-Jun-2021 17:50
TOTAL SUSPENDED SOLIDS BY SM 2540D		**Method:M2540D**				Analyst: KAH
Suspended Solids (Residue, Non -Filterable)	**8.40**		**2.00**	**mg/L**	1	15-Jun-2021 09:50
HEXAVALENT CHROMIUM BY SM3500-CR B		**Method:M3500-Cr B**				Analyst: KVL
Chromium, Hexavalent	< 0.0200		0.0200	mg/L	1	10-Jun-2021 08:40
TOTAL KJELDAHL NITROGEN BY SM4500 NH3 D		**Method:M4500 NH3 D**		Prep:M4500-N C / 15-Jun-2021		Analyst: KVL
Nitrogen, Total Kjeldahl	< 0.50		0.50	mg/L	1	15-Jun-2021 13:00
ORGANIC NITROGEN BY SM4500-N C		**Method:M4500-N C**				Analyst: KVL
Nitrogen, Organic	< 0.50	n	0.50	mg/L	1	18-Jun-2021 15:38
COLOR BY SM 2120B - 2011		**Method:SM2120B**				Analyst: JAC
Color, Apparent	**15.0**		**5.00**	**Color Units**	1	10-Jun-2021 14:27
pH	7		0.100	pH Units	1	10-Jun-2021 14:27
ALKALINITY BY SM2320B		**Method:SM2320B**				Analyst: TH
Alkalinity, Bicarbonate (As CaCO3)	**118**		**5.00**	**mg/L**	1	14-Jun-2021 20:02
Alkalinity, Carbonate (As CaCO3)	< 5.00		5.00	mg/L	1	14-Jun-2021 20:02
Alkalinity, Hydroxide (As CaCO3)	< 5.00		5.00	mg/L	1	14-Jun-2021 20:02
Alkalinity, Total (As CaCO3)	**118**		**5.00**	**mg/L**	1	14-Jun-2021 20:02
AMMONIA AS N BY SM4500 NH3-B-F		**Method:SM4500 NH3-B-F**		Prep:M4500-NH3 B / 18-Jun-2021		Analyst: KVL
Nitrogen, Ammonia (as N)	< 0.050		0.050	mg/L	1	18-Jun-2021 15:00
SULFIDE METHYLENE BLUE BY SM4500 S2- D		**Method:SM4500 S2-D**		Prep:SM4500 S2-D / 15-Jun-2021		Analyst: KVL
Sulfide	< 0.0500		0.0500	mg/L	1	15-Jun-2021 16:40

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons		**ANALYTICAL REPORT**
Project:	Parsons - POCC Flow		WorkOrder:HS21060521
Sample ID:	POCC - INTAKE-1		Lab ID:HS21060521-01
Collection Date:	09-Jun-2021 09:55		Matrix:Water

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
BOD		**Method:SM5210 B**		Prep:SM5210 B / 10-Jun-2021		Analyst: TH
Biochemical Oxygen Demand	< 2.00		2.00	mg/L	1	15-Jun-2021 11:04
CBOD		**Method:SM5210 B**		Prep:SM5210 B / 10-Jun-2021		Analyst: TH
Carbonaceous Biochemical Oxygen Demand	< 2.00		2.00	mg/L	1	15-Jun-2021 11:45
SURFACTANTS (MBAS) BY SM5540C		**Method:SM5540C**		Prep:SM5540C / 10-Jun-2021		Analyst: TH
MBAS	< 0.0500		0.0500	mg/L 340 MW LAS	1	10-Jun-2021 19:00
SUB ANALYSIS AVAILABLE CYANIDE - EPA OIA-1667		**Method:NA**				Analyst: SUB
Subcontract Analysis	See Attached			NA	1	17-Jun-2021 12:53
SUBCONTRACT ANALYSIS - MERCURY LOW		**Method:NA**				Analyst: SUB
Subcontract Analysis	See Attached			NA	1	17-Jun-2021 12:53

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**
Project:	Parsons - POCC Flow	WorkOrder:HS21060521
Sample ID:	LL Mercury Field Blank	Lab ID:HS21060521-03
Collection Date:	09-Jun-2021 09:55	Matrix:Water

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
SUBCONTRACT ANALYSIS - MERCURY LOW		**Method:NA**				Analyst: SUB
Subcontract Analysis	See Attached			NA	1	17-Jun-2021 12:53

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Weight / Prep Log

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

Batch ID: 166765 **Start Date:** 10 Jun 2021 14:00 **End Date:**
Method: WETCHEMPREP, BOD **Prep Code:** BOD_PR 5210B

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060521-01		300 (mL)	300 (mL)	1	1-L plastic, Neat

Batch ID: 166766 **Start Date:** 10 Jun 2021 16:06 **End Date:**
Method: CBOD PREP **Prep Code:** CBOD_PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060521-01		300 (mL)	300 (mL)	1	1-L plastic, Neat

Batch ID: 166767 **Start Date:** 10 Jun 2021 17:30 **End Date:** 10 Jun 2021 18:30
Method: MBAS - PREPARATION **Prep Code:** MBAS_PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060521-01		400 (mL)	400 (mL)	1	1-L plastic, Neat

Batch ID: 166779 **Start Date:** 11 Jun 2021 07:00 **End Date:** 11 Jun 2021 14:00
Method: 625 AQ SEP FUNNEL EXTRACTION **Prep Code:** 625PRF

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060521-01	1	1000 (mL)	1 (mL)	0.001	1-liter amber glass, Neat

Batch ID: 166825 **Start Date:** 11 Jun 2021 11:30 **End Date:** 11 Jun 2021 14:00
Method: PHOSPHOROUS **Prep Code:** P_TW_PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060521-01		50 (mg/L)	50 (mL)	1	500 mL plastic, H2SO4 to pH <2

Batch ID: 166899 **Start Date:** 15 Jun 2021 10:30 **End Date:** 15 Jun 2021 14:00
Method: AQPREP SEP FUNNEL: PEST/PCB **Prep Code:** 608_W_LOWPR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060521-01	1	1000 (mL)	1 (mL)	0.001	1-liter amber glass, Neat

Batch ID: 166904 **Start Date:** 15 Jun 2021 11:00 **End Date:** 15 Jun 2021 15:00
Method: TKN WATER - PREP **Prep Code:** TKN_W_PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060521-01		25 (mL)	50 (mL)	2	500 mL plastic, H2SO4 to pH <2

Batch ID: 166918 **Start Date:** 16 Jun 2021 09:00 **End Date:** 16 Jun 2021 13:00
Method: TOTAL METALS PREP BY EPA 200.8 **Prep Code:** 200.8PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060521-01		10 (mL)	10 (mL)	1	120 plastic HNO3

Weight / Prep Log

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

Batch ID: 166930 **Start Date:** 15 Jun 2021 15:00 **End Date:** 15 Jun 2021 16:00
Method: SULFIDE METHLYENE BLUE PREP SM4500 S2 D **Prep Code:** SULFIDE_W_METHYLENE PREP

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060521-01		50 (mL)	50 (mL)	1	500 mL plastic, NaOH/ZnAc

Batch ID: 167030 **Start Date:** 17 Jun 2021 10:00 **End Date:** 17 Jun 2021 14:30
Method: PHOSPHOROUS **Prep Code:** P_TW_PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060521-01		50 (mg/L)	50 (mL)	1	500 mL plastic, H2SO4 to pH <2

Batch ID: 167044 **Start Date:** 18 Jun 2021 09:00 **End Date:** 18 Jun 2021 10:30
Method: NITROGEN AMMONIA - WATER - PREP **Prep Code:** NIT_AMM_W_PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060521-01		25 (mL)	25 (mL)	1	500 mL plastic, H2SO4 to pH <2

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

DATES REPORT

Sample ID	Client Samp ID	Collection Date	Leachate Date	Prep Date	Analysis Date	DF
Batch ID: 166765 (0)	**Test Name :** BOD				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55		10 Jun 2021 14:00	15 Jun 2021 11:04	1
Batch ID: 166766 (0)	**Test Name :** CBOD				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55		10 Jun 2021 16:06	15 Jun 2021 11:45	1
Batch ID: 166767 (0)	**Test Name :** SURFACTANTS (MBAS) BY SM5540C				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55		10 Jun 2021 17:30	10 Jun 2021 19:00	1
Batch ID: 166779 (0)	**Test Name :** SEMIVOLATILE				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55		11 Jun 2021 11:35	11 Jun 2021 14:58	1
Batch ID: 166825 (0)	**Test Name :** PHOSPHORUS BY E365.3				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55		11 Jun 2021 11:30	11 Jun 2021 14:45	1
Batch ID: 166899 (0)	**Test Name :** CHLORINATED PEST/PCBS BY E608				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55		15 Jun 2021 13:31	15 Jun 2021 16:11	1
Batch ID: 166904 (0)	**Test Name :** TOTAL KJELDAHL NITROGEN BY SM4500 NH3 D				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55		15 Jun 2021 11:00	15 Jun 2021 13:00	1
Batch ID: 166918 (0)	**Test Name :** TOTAL METALS BY E200.8				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55		16 Jun 2021 13:00	17 Jun 2021 16:19	1000
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55		16 Jun 2021 13:00	17 Jun 2021 15:57	10
Batch ID: 166930 (0)	**Test Name :** SULFIDE METHYLENE BLUE BY SM4500 S2- D				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55		15 Jun 2021 15:00	15 Jun 2021 16:40	1
Batch ID: 167044 (0)	**Test Name :** AMMONIA AS N BY SM4500 NH3-B-F				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55		18 Jun 2021 09:00	18 Jun 2021 15:00	1
Batch ID: R385335 (0)	**Test Name :** COLOR BY SM 2120B - 2011				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			10 Jun 2021 14:27	1
Batch ID: R385353 (0)	**Test Name :** HEXAVALENT CHROMIUM BY SM3500-CR B				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			10 Jun 2021 08:40	1
Batch ID: R385387 (0)	**Test Name :** TOTAL ORGANIC CARBON BY E415.1				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			10 Jun 2021 19:29	1
Batch ID: R385410 (0)	**Test Name :** VOLATILES				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			10 Jun 2021 14:36	1
Batch ID: R385426 (0)	**Test Name :** ANIONS BY E300.0				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			10 Jun 2021 17:57	1000
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			10 Jun 2021 17:49	100
Batch ID: R385528 (0)	**Test Name :** ALKALINITY BY SM2320B				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			14 Jun 2021 20:02	1

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

DATES REPORT

Sample ID	Client Samp ID	Collection Date	Leachate Date	Prep Date	Analysis Date	DF
Batch ID: R385585 (0)	**Test Name :** TOTAL SUSPENDED SOLIDS BY SM 2540D				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			15 Jun 2021 09:50	1
Batch ID: R385686 (0)	**Test Name :** CHEMICAL OXYGEN DEMAND BY E410.4				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			16 Jun 2021 15:00	1
Batch ID: R385732 (0)	**Test Name :** SUB ANALYSIS AVAILABLE CYANIDE - EPA OIA-1667				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			17 Jun 2021 12:53	1
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			17 Jun 2021 12:53	1
HS21060521-03	LL Mercury Field Blank	09 Jun 2021 09:55			17 Jun 2021 12:53	1
Batch ID: R385765 (0)	**Test Name :** TOTAL DISSOLVED SOLIDS BY SM2540C				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			16 Jun 2021 17:50	1
Batch ID: R385769 (0)	**Test Name :** OIL & GREASE (HEM) BY E1664A				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			17 Jun 2021 14:00	1
Batch ID: R385823 (0)	**Test Name :** TRIVALENT CHROMIUM				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			18 Jun 2021 12:18	1
Batch ID: R385851 (0)	**Test Name :** ORGANIC NITROGEN BY SM4500-N C				**Matrix:** Water	
HS21060521-01	POCC - INTAKE-1	09 Jun 2021 09:55			18 Jun 2021 15:38	1

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: 166899 (0) **Instrument: ECD_13** **Method: CHLORINATED PEST/PCBS BY E608**

MBLK Sample ID: **MBLK-166899** Units: **UG/L** Analysis Date: **15-Jun-2021 17:35**
Client ID: Run ID: **ECD_13_385662** SeqNo: **6139072** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aroclor 1016	< 0.0125	0.0125								
Aroclor 1221	< 0.0125	0.0125								
Aroclor 1232	< 0.0125	0.0125								
Aroclor 1242	< 0.0125	0.0125								
Aroclor 1248	< 0.0125	0.0125								
Aroclor 1254	< 0.0125	0.0125								
Aroclor 1260	< 0.0125	0.0125								
Surr: Decachlorobiphenyl	*0.01637*	*0*	*0.02*	*0*	*81.8*	*61 - 154*				
Surr: Tetrachloro-m-xylene	*0.01594*	*0*	*0.02*	*0*	*79.7*	*60 - 144*				

LCS Sample ID: **LCS-166899** Units: **UG/L** Analysis Date: **15-Jun-2021 17:49**
Client ID: Run ID: **ECD_13_385662** SeqNo: **6139073** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aroclor 1016	0.4113	0.0125	0.5	0	82.3	54 - 138				
Aroclor 1260	0.3869	0.0125	0.5	0	77.4	57 - 136				
Surr: Decachlorobiphenyl	*0.01679*	*0*	*0.02*	*0*	*83.9*	*61 - 154*				
Surr: Tetrachloro-m-xylene	*0.01586*	*0*	*0.02*	*0*	*79.3*	*60 - 144*				

MS Sample ID: **HS21060616-01MS** Units: **UG/L** Analysis Date: **15-Jun-2021 16:39**
Client ID: Run ID: **ECD_13_385662** SeqNo: **6139069** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aroclor 1016	0.3677	0.0125	0.5	0	73.5	54 - 138				
Aroclor 1260	0.3455	0.0125	0.5	0	69.1	57 - 136				
Surr: Decachlorobiphenyl	*0.01547*	*0*	*0.02*	*0*	*77.4*	*61 - 154*				
Surr: Tetrachloro-m-xylene	*0.01682*	*0*	*0.02*	*0*	*84.1*	*60 - 144*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **166899 (0)** **Instrument:** **ECD_13** **Method:** **CHLORINATED PEST/PCBS BY E608**

MSD Sample ID: **HS21060616-01MSD** Units: **UG/L** Analysis Date: **15-Jun-2021 17:06**
Client ID: Run ID: **ECD_13_385662** SeqNo: **6139070** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aroclor 1016	0.36	0.0125	0.5	0	72.0	54 - 138	0.3677	2.09	20	
Aroclor 1260	0.3466	0.0125	0.5	0	69.3	57 - 136	0.3455	0.316	20	
Surr: Decachlorobiphenyl	*0.0152*	*0*	*0.02*	*0*	*76.0*	*61 - 154*	*0.01547*	*1.77*	*20*	
Surr: Tetrachloro-m-xylene	*0.01673*	*0*	*0.02*	*0*	*83.6*	*60 - 144*	*0.01682*	*0.548*	*20*	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **166918 (0)** **Instrument:** **ICPMS06** **Method:** **TOTAL METALS BY E200.8**

MBLK Sample ID: **MBLK-166918** Units: **ug/L** Analysis Date: **17-Jun-2021 15:35**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6141812** PrepDate: **16-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	< 10.0	10.0								
Antimony	< 5.00	5.00								
Arsenic	< 2.00	2.00								
Barium	< 4.00	4.00								
Beryllium	< 5.00	5.00								
Boron	< 20.0	20.0								
Cadmium	< 2.00	2.00								
Calcium	< 500	500								
Chromium	< 4.00	4.00								
Cobalt	< 5.00	5.00								
Copper	< 2.00	2.00								
Iron	< 200	200								
Lead	< 2.00	2.00								
Magnesium	< 500	500								
Manganese	< 5.00	5.00								
Molybdenum	< 5.00	5.00								
Nickel	< 2.00	2.00								
Potassium	< 500	500								
Selenium	< 2.00	2.00								
Silver	< 2.00	2.00								
Sodium	< 200	200								
Thallium	< 2.00	2.00								
Tin	< 5.00	5.00								
Titanium	< 5.00	5.00								
Zinc	< 4.00	4.00								

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: 166918 (0) **Instrument: ICPMS06** **Method: TOTAL METALS BY E200.8**

LCS Sample ID: **LCS-166918** Units: **ug/L** Analysis Date: **17-Jun-2021 15:37**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6141813** PrepDate: **16-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	107.3	10.0	100	0	107	85 - 115				
Antimony	49.01	5.00	50	0	98.0	85 - 115				
Arsenic	48.76	2.00	50	0	97.5	85 - 115				
Barium	51.31	4.00	50	0	103	85 - 115				
Beryllium	48.91	5.00	50	0	97.8	85 - 115				
Boron	263.5	20.0	250	0	105	85 - 115				
Cadmium	53.4	2.00	50	0	107	85 - 115				
Calcium	5244	500	5000	0	105	85 - 115				
Chromium	48.4	4.00	50	0	96.8	85 - 115				
Cobalt	48.33	5.00	50	0	96.7	85 - 115				
Copper	50.58	2.00	50	0	101	85 - 115				
Iron	4920	200	5000	0	98.4	85 - 115				
Lead	50.39	2.00	50	0	101	85 - 115				
Magnesium	5230	500	5000	0	105	85 - 115				
Manganese	48.93	5.00	50	0	97.9	85 - 115				
Molybdenum	48.56	5.00	50	0	97.1	85 - 115				
Nickel	52.65	2.00	50	0	105	85 - 115				
Potassium	5142	500	5000	0	103	85 - 115				
Selenium	51.35	2.00	50	0	103	85 - 115				
Silver	53.93	2.00	50	0	108	85 - 115				
Sodium	5170	200	5000	0	103	85 - 115				
Thallium	50.62	2.00	50	0	101	85 - 115				
Tin	105.7	5.00	100	0	106	85 - 115				
Titanium	146.3	5.00	150	0	97.5	85 - 115				

LCS Sample ID: **LCS-166918** Units: **ug/L** Analysis Date: **17-Jun-2021 16:40**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6141976** PrepDate: **16-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Zinc	55.72	4.00	50	0	111	85 - 115				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **166918 (0)** **Instrument:** **ICPMS06** **Method:** **TOTAL METALS BY E200.8**

MS Sample ID: **HS21060616-01MS** Units: **ug/L** Analysis Date: **17-Jun-2021 15:51**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6141820** PrepDate: **16-Jun-2021** DF: **10**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	228.2	100	100	121.9	106	70 - 130				
Antimony	45.38	50.0	50	0.462	89.8	70 - 130				J
Arsenic	52.55	20.0	50	2.425	100	70 - 130				
Barium	72.22	40.0	50	20.83	103	70 - 130				
Beryllium	46.51	50.0	50	-0.024	93.1	70 - 130				J
Boron	4119	200	500	3714	81.0	70 - 130				O
Cadmium	49.32	20.0	50	0.034	98.6	70 - 130				
Calcium	376500	5000	5000	351800	494	70 - 130				SO
Chromium	48.14	40.0	50	0.35	95.6	70 - 130				
Cobalt	46	50.0	50	0.105	91.8	70 - 130				J
Copper	48.69	20.0	50	1.802	93.8	70 - 130				
Iron	5015	2000	5000	114.6	98.0	70 - 130				
Lead	48.34	20.0	50	0.049	96.6	70 - 130				
Magnesium	1113000	5000	5000	1065000	968	70 - 130				SO
Manganese	56.54	50.0	50	8.287	96.5	70 - 130				
Molybdenum	62.64	50.0	50	9.268	107	70 - 130				
Nickel	49.67	20.0	50	1.689	96.0	70 - 130				
Potassium	342700	5000	5000	320500	446	70 - 130				SO
Selenium	48.4	20.0	50	0.352	96.1	70 - 130				
Silver	51.2	20.0	50	-0.111	103	70 - 130				
Sodium	9108000	2000	5000	8814000	5890	70 - 130				SEO
Thallium	47.03	20.0	50	-0.092	94.2	70 - 130				
Tin	96.21	50.0	100	0.041	96.2	70 - 130				
Titanium	153.9	50.0	150	6.656	98.1	70 - 130				
Zinc	56.55	40.0	50	6.741	99.6	70 - 130				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **166918 (0)** **Instrument:** **ICPMS06** **Method:** **TOTAL METALS BY E200.8**

MSD Sample ID: **HS21060616-01MSD** Units: **ug/L** Analysis Date: **17-Jun-2021 15:55**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6141822** PrepDate: **16-Jun-2021** DF: **10**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	201	100	100	121.9	79.1	70 - 130	228.2	12.7	20	
Antimony	46.22	50.0	50	0.462	91.5	70 - 130	45.38	0	20	J
Arsenic	53.04	20.0	50	2.425	101	70 - 130	52.55	0.93	20	
Barium	72.56	40.0	50	20.83	103	70 - 130	72.22	0.472	20	
Beryllium	47.47	50.0	50	-0.024	95.0	70 - 130	46.51	0	20	J
Boron	4113	200	500	3714	79.8	70 - 130	4119	0.151	20	O
Cadmium	49.86	20.0	50	0.034	99.7	70 - 130	49.32	1.09	20	
Calcium	382900	5000	5000	351800	622	70 - 130	376500	1.68	20	SO
Chromium	49.74	40.0	50	0.35	98.8	70 - 130	48.14	3.27	20	
Cobalt	46.75	50.0	50	0.105	93.3	70 - 130	46	0	20	J
Copper	48.08	20.0	50	1.802	92.6	70 - 130	48.69	1.25	20	
Iron	5127	2000	5000	114.6	100	70 - 130	5015	2.2	20	
Lead	49.36	20.0	50	0.049	98.6	70 - 130	48.34	2.1	20	
Magnesium	1131000	5000	5000	1065000	1330	70 - 130	1113000	1.61	20	SO
Manganese	55.1	50.0	50	8.287	93.6	70 - 130	56.54	2.58	20	
Molybdenum	62.56	50.0	50	9.268	107	70 - 130	62.64	0.142	20	
Nickel	52.09	20.0	50	1.689	101	70 - 130	49.67	4.74	20	
Potassium	347300	5000	5000	320500	537	70 - 130	342700	1.33	20	SO
Selenium	53.71	20.0	50	0.352	107	70 - 130	48.4	10.4	20	
Silver	50.84	20.0	50	-0.111	102	70 - 130	51.2	0.71	20	
Sodium	9386000	2000	5000	8814000	11400	70 - 130	9108000	3	20	SEO
Thallium	47.7	20.0	50	-0.092	95.6	70 - 130	47.03	1.42	20	
Tin	98.13	50.0	100	0.041	98.1	70 - 130	96.21	1.98	20	
Titanium	159.1	50.0	150	6.656	102	70 - 130	153.9	3.38	20	
Zinc	53.42	40.0	50	6.741	93.4	70 - 130	56.55	5.68	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **166779 (0)** **Instrument:** **SV-4** **Method:** **SEMIVOLATILE**

MBLK Sample ID: **MBLK-166779** Units: **ug/L** Analysis Date: **11-Jun-2021 14:36**
Client ID: Run ID: **SV-4_385434** SeqNo: **6134820** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4,5-Tetrachlorobenzene	< 5.00	5.00								
2,4,5-Trichlorophenol	< 5.00	5.00								
2,4-Dimethylphenol	< 5.00	5.00								
2-Methylphenol	< 5.00	5.00								
3&4-Methylphenol	< 5.00	5.00								
3,3´-Dichlorobenzidine	< 5.00	5.00								
Anthracene	< 5.00	5.00								
Benz(a)anthracene	< 5.00	5.00								
Benzidine	< 5.00	5.00								
Benzo(a)pyrene	< 5.00	5.00								
Bis(2-chloroethyl)ether	< 5.00	5.00								
Bis(2-ethylhexyl)phthalate	< 5.00	5.00								
Chrysene	< 5.00	5.00								
Di-n-butyl phthalate	< 5.00	5.00								
Hexachlorobenzene	< 5.00	5.00								
Hexachlorocyclopentadiene	< 5.00	5.00								
Hexachloroethane	< 5.00	5.00								
Nitrobenzene	< 5.00	5.00								
N-Nitrosodiethylamine	< 5.00	5.00								
N-Nitroso-di-n-butylamine	< 5.00	5.00								
Nonylphenol	< 5.00	5.00								
Pentachlorobenzene	< 5.00	5.00								
Pentachlorophenol	< 5.00	5.00								
Phenanthrene	< 5.00	5.00								
Pyridine	< 5.00	5.00								
Surr: 2,4,6-Tribromophenol	*76.71*	*5.00*	*100*	*0*	*76.7*	*42 - 124*				
Surr: 2-Fluorobiphenyl	*87.87*	*5.00*	*100*	*0*	*87.9*	*48 - 120*				
Surr: 2-Fluorophenol	*74.75*	*5.00*	*100*	*0*	*74.7*	*20 - 120*				
Surr: 4-Terphenyl-d14	*89.39*	*5.00*	*100*	*0*	*89.4*	*51 - 135*				
Surr: Nitrobenzene-d5	*84.03*	*5.00*	*100*	*0*	*84.0*	*41 - 120*				
Surr: Phenol-d6	*70.75*	*5.00*	*100*	*0*	*70.7*	*20 - 120*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: 166779 (0) **Instrument: SV-4** **Method: SEMIVOLATILE**

LCS Sample ID: **LCS-166779** Units: **ug/L** Analysis Date: **11-Jun-2021 13:10**
Client ID: Run ID: **SV-4_385434** SeqNo: **6134817** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4,5-Tetrachlorobenzene	66.11	5.00	100	0	66.1	49 - 120				
2,4,5-Trichlorophenol	80.58	5.00	100	0	80.6	52 - 115				
2,4-Dimethylphenol	73.57	5.00	100	0	73.6	53 - 115				
2-Methylphenol	64.86	5.00	100	0	64.9	53 - 115				
3&4-Methylphenol	86.5	5.00	100	0	86.5	48 - 115				
3,3´-Dichlorobenzidine	83.55	5.00	100	0	83.5	25 - 115				
Anthracene	80.65	5.00	100	0	80.6	65 - 115				
Benz(a)anthracene	83.89	5.00	100	0	83.9	53 - 115				
Benzidine	29.24	5.00	100	0	29.2	10 - 115				
Benzo(a)pyrene	78.66	5.00	100	0	78.7	57 - 115				
Bis(2-chloroethyl)ether	73.05	5.00	100	0	73.1	56 - 115				
Bis(2-ethylhexyl)phthalate	77.06	5.00	100	0	77.1	50 - 115				
Chrysene	78.41	5.00	100	0	78.4	52 - 120				
Di-n-butyl phthalate	87.86	5.00	100	0	87.9	54 - 115				
Hexachlorobenzene	80.28	5.00	100	0	80.3	54 - 115				
Hexachlorocyclopentadiene	60.82	5.00	100	0	60.8	48 - 115				
Hexachloroethane	73.36	5.00	100	0	73.4	54 - 115				
Nitrobenzene	72.91	5.00	100	0	72.9	40 - 124				
N-Nitrosodiethylamine	44.43	5.00	50	0	88.9	40 - 130				
N-Nitroso-di-n-butylamine	39.87	5.00	50	0	79.7	40 - 130				
Pentachlorobenzene	58.31	5.00	100	0	58.3	50 - 117				
Pentachlorophenol	85.72	5.00	100	0	85.7	45 - 125				
Phenanthrene	79.62	5.00	100	0	79.6	57 - 115				
Pyridine	59.64	5.00	100	0	59.6	34 - 115				
Surr: 2,4,6-Tribromophenol	*81.77*	*5.00*	*100*	*0*	*81.8*	*42 - 124*				
Surr: 2-Fluorobiphenyl	*83.45*	*5.00*	*100*	*0*	*83.5*	*48 - 120*				
Surr: 2-Fluorophenol	*61.8*	*5.00*	*100*	*0*	*61.8*	*20 - 120*				
Surr: 4-Terphenyl-d14	*84.19*	*5.00*	*100*	*0*	*84.2*	*51 - 135*				
Surr: Nitrobenzene-d5	*77.96*	*5.00*	*100*	*0*	*78.0*	*41 - 120*				
Surr: Phenol-d6	*58.95*	*5.00*	*100*	*0*	*58.9*	*20 - 120*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **166779 (0)** **Instrument:** **SV-4** **Method:** **SEMIVOLATILE**

MS Sample ID: **HS21060616-01MS** Units: **ug/L** Analysis Date: **11-Jun-2021 16:02**
Client ID: Run ID: **SV-4_385434** SeqNo: **6134866** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4,5-Tetrachlorobenzene	64.56	5.00	100	0	64.6	49 - 120				
2,4,5-Trichlorophenol	82.81	5.00	100	0	82.8	52 - 115				
2,4-Dimethylphenol	71.21	5.00	100	0	71.2	53 - 115				
2-Methylphenol	61.44	5.00	100	0	61.4	53 - 115				
3&4-Methylphenol	60.55	5.00	100	0	60.5	48 - 115				
3,3´-Dichlorobenzidine	88.29	5.00	100	0	88.3	25 - 115				
Anthracene	84.18	5.00	100	0	84.2	65 - 115				
Benz(a)anthracene	86.46	5.00	100	0	86.5	53 - 115				
Benzidine	32.01	5.00	100	0	32.0	10 - 115				
Benzo(a)pyrene	82.35	5.00	100	0	82.3	57 - 115				
Bis(2-chloroethyl)ether	66.07	5.00	100	0	66.1	56 - 115				
Bis(2-ethylhexyl)phthalate	83.54	5.00	100	0	83.5	50 - 115				
Chrysene	82.08	5.00	100	0	82.1	52 - 120				
Di-n-butyl phthalate	89.24	5.00	100	0	89.2	54 - 115				
Hexachlorobenzene	85.45	5.00	100	0	85.5	54 - 115				
Hexachlorocyclopentadiene	60.2	5.00	100	0	60.2	48 - 115				
Hexachloroethane	64.9	5.00	100	0	64.9	54 - 115				
Nitrobenzene	68.78	5.00	100	0	68.8	40 - 124				
N-Nitrosodiethylamine	39.74	5.00	50	0	79.5	40 - 130				
N-Nitroso-di-n-butylamine	37.14	5.00	50	0	74.3	40 - 130				
Nonylphenol	40.48	5.00	50	0	81.0	40 - 140				
Pentachlorobenzene	57.98	5.00	100	0	58.0	50 - 117				
Pentachlorophenol	88.67	5.00	100	0	88.7	45 - 125				
Phenanthrene	84.06	5.00	100	0	84.1	57 - 115				
Pyridine	49.99	5.00	100	0	50.0	34 - 115				
Surr: 2,4,6-Tribromophenol	*80.76*	*5.00*	*100*	*0*	*80.8*	*42 - 124*				
Surr: 2-Fluorobiphenyl	*84.37*	*5.00*	*100*	*0*	*84.4*	*48 - 120*				
Surr: 2-Fluorophenol	*57.42*	*5.00*	*100*	*0*	*57.4*	*20 - 120*				
Surr: 4-Terphenyl-d14	*94.76*	*5.00*	*100*	*0*	*94.8*	*51 - 135*				
Surr: Nitrobenzene-d5	*74.75*	*5.00*	*100*	*0*	*74.7*	*41 - 120*				
Surr: Phenol-d6	*57.41*	*5.00*	*100*	*0*	*57.4*	*20 - 120*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: 166779 (0) **Instrument: SV-4** **Method: SEMIVOLATILE**

MSD Sample ID: **HS21060616-01MSD** Units: **ug/L** Analysis Date: **11-Jun-2021 16:23**
Client ID: Run ID: **SV-4_385434** SeqNo: **6134867** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4,5-Tetrachlorobenzene	59.9	5.00	100	0	59.9	49 - 120	64.56	7.5	20	
2,4,5-Trichlorophenol	80.39	5.00	100	0	80.4	52 - 115	82.81	2.97	20	
2,4-Dimethylphenol	64.91	5.00	100	0	64.9	53 - 115	71.21	9.27	20	
2-Methylphenol	56.98	5.00	100	0	57.0	53 - 115	61.44	7.52	20	
3&4-Methylphenol	55.33	5.00	100	0	55.3	48 - 115	60.55	9	20	
3,3´-Dichlorobenzidine	95.96	5.00	100	0	96.0	25 - 115	88.29	8.32	20	
Anthracene	84.5	5.00	100	0	84.5	65 - 115	84.18	0.382	20	
Benz(a)anthracene	86.29	5.00	100	0	86.3	53 - 115	86.46	0.204	20	
Benzidine	37.2	5.00	100	0	37.2	10 - 115	32.01	15	20	
Benzo(a)pyrene	83.52	5.00	100	0	83.5	57 - 115	82.35	1.41	20	
Bis(2-chloroethyl)ether	60.48	5.00	100	0	60.5	56 - 115	66.07	8.83	20	
Bis(2-ethylhexyl)phthalate	82.47	5.00	100	0	82.5	50 - 115	83.54	1.29	20	
Chrysene	84.36	5.00	100	0	84.4	52 - 120	82.08	2.73	20	
Di-n-butyl phthalate	87.9	5.00	100	0	87.9	54 - 115	89.24	1.52	20	
Hexachlorobenzene	86.49	5.00	100	0	86.5	54 - 115	85.45	1.21	20	
Hexachlorocyclopentadiene	57.22	5.00	100	0	57.2	48 - 115	60.2	5.07	20	
Hexachloroethane	61.91	5.00	100	0	61.9	54 - 115	64.9	4.73	20	
Nitrobenzene	64.64	5.00	100	0	64.6	40 - 124	68.78	6.2	20	
N-Nitrosodiethylamine	38.83	5.00	50	0	77.7	40 - 130	39.74	2.32	20	
N-Nitroso-di-n-butylamine	34.18	5.00	50	0	68.4	40 - 130	37.14	8.32	20	
Nonylphenol	42.79	5.00	50	0	85.6	40 - 140	40.48	5.55	20	
Pentachlorobenzene	55.12	5.00	100	0	55.1	50 - 117	57.98	5.05	20	
Pentachlorophenol	90.53	5.00	100	0	90.5	45 - 125	88.67	2.08	20	
Phenanthrene	83.98	5.00	100	0	84.0	57 - 115	84.06	0.0913	20	
Pyridine	46.43	5.00	100	0	46.4	34 - 115	49.99	7.38	20	
Surr: 2,4,6-Tribromophenol	*78.54*	*5.00*	*100*	*0*	*78.5*	*42 - 124*	*80.76*	*2.79*	*20*	
Surr: 2-Fluorobiphenyl	*76.08*	*5.00*	*100*	*0*	*76.1*	*48 - 120*	*84.37*	*10.3*	*20*	
Surr: 2-Fluorophenol	*53.53*	*5.00*	*100*	*0*	*53.5*	*20 - 120*	*57.42*	*7.01*	*20*	
Surr: 4-Terphenyl-d14	*92.73*	*5.00*	*100*	*0*	*92.7*	*51 - 135*	*94.76*	*2.16*	*20*	
Surr: Nitrobenzene-d5	*69.82*	*5.00*	*100*	*0*	*69.8*	*41 - 120*	*74.75*	*6.81*	*20*	
Surr: Phenol-d6	*53.5*	*5.00*	*100*	*0*	*53.5*	*20 - 120*	*57.41*	*7.06*	*20*	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **R385410 (0)** **Instrument:** **VOA9** **Method:** **VOLATILES**

MBLK Sample ID: **VBLKW-210610** Units: **ug/L** Analysis Date: **10-Jun-2021 12:50**
Client ID: Run ID: **VOA9_385410** SeqNo: **6133324** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,1,1-Trichloroethane	< 5.00	5.00								
1,1,2,2-Tetrachloroethane	< 5.00	5.00								
1,1,2-Trichloroethane	< 5.00	5.00								
1,1-Dichloroethene	< 5.00	5.00								
1,2-Dibromoethane	< 5.00	5.00								
1,2-Dichlorobenzene	< 5.00	5.00								
1,2-Dichloroethane	< 5.00	5.00								
1,2-Dichloropropane	< 5.00	5.00								
1,3-Dichlorobenzene	< 5.00	5.00								
1,4-Dichlorobenzene	< 5.00	5.00								
2-Butanone	< 10.0	10.0								
Acrylonitrile	< 10.0	10.0								
Benzene	< 5.00	5.00								
Bromodichloromethane	< 5.00	5.00								
Bromoform	< 5.00	5.00								
Carbon tetrachloride	< 5.00	5.00								
Chlorobenzene	< 5.00	5.00								
Chloroform	< 5.00	5.00								
Dibromochloromethane	< 5.00	5.00								
Ethylbenzene	< 5.00	5.00								
Hexachlorobutadiene	< 5.00	5.00								
Methylene chloride	< 10.0	10.0								
Tetrachloroethene	< 5.00	5.00								
Toluene	< 5.00	5.00								
Trichloroethene	< 5.00	5.00								
Vinyl chloride	< 2.00	2.00								
1,3-Dichloropropene, Total	< 5.00	5.00								
Total Trihalomethanes (TTHMs)	< 5.00	5.00								
Surr: 1,2-Dichloroethane-d4	*52.73*	*5.00*	*50*	*0*	*105*	*70 - 126*				
Surr: 4-Bromofluorobenzene	*50.19*	*5.00*	*50*	*0*	*100*	*82 - 124*				
Surr: Dibromofluoromethane	*49.47*	*5.00*	*50*	*0*	*98.9*	*77 - 123*				
Surr: Toluene-d8	*47.89*	*5.00*	*50*	*0*	*95.8*	*82 - 127*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **R385410 (0)** **Instrument:** **VOA9** **Method:** **VOLATILES**

LCS Sample ID: **VLCSW-210610** Units: **ug/L** Analysis Date: **10-Jun-2021 12:07**
Client ID: Run ID: **VOA9_385410** SeqNo: **6133323** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,1,1-Trichloroethane	20.03	5.00	20	0	100	70 - 130				
1,1,2,2-Tetrachloroethane	17.32	5.00	20	0	86.6	70 - 120				
1,1,2-Trichloroethane	18.39	5.00	20	0	91.9	77 - 113				
1,1-Dichloroethene	16.09	5.00	20	0	80.5	70 - 130				
1,2-Dibromoethane	20	5.00	20	0	100.0	76 - 123				
1,2-Dichlorobenzene	18.79	5.00	20	0	94.0	77 - 113				
1,2-Dichloroethane	21.42	5.00	20	0	107	70 - 124				
1,2-Dichloropropane	17.95	5.00	20	0	89.8	72 - 119				
1,3-Dichlorobenzene	18.77	5.00	20	0	93.9	78 - 118				
1,4-Dichlorobenzene	19.68	5.00	20	0	98.4	79 - 113				
2-Butanone	32.52	10.0	40	0	81.3	70 - 130				
Acrylonitrile	37.71	10.0	40	0	94.3	70 - 130				
Benzene	18.42	5.00	20	0	92.1	74 - 120				
Bromodichloromethane	21.62	5.00	20	0	108	74 - 122				
Bromoform	20.49	5.00	20	0	102	73 - 128				
Carbon tetrachloride	18.35	5.00	20	0	91.8	71 - 125				
Chlorobenzene	19.77	5.00	20	0	98.8	76 - 113				
Chloroform	19.98	5.00	20	0	99.9	71 - 121				
Dibromochloromethane	20.91	5.00	20	0	105	77 - 122				
Ethylbenzene	18.67	5.00	20	0	93.4	77 - 117				
Hexachlorobutadiene	18.65	5.00	20	0	93.2	70 - 130				
Methylene chloride	18.29	10.0	20	0	91.5	70 - 127				
Tetrachloroethene	19.21	5.00	20	0	96.1	76 - 119				
Toluene	18.41	5.00	20	0	92.1	77 - 118				
Trichloroethene	19.03	5.00	20	0	95.1	79 - 120				
Vinyl chloride	16.64	2.00	20	0	83.2	70 - 130				
1,3-Dichloropropene, Total	39.14	5.00	40	0	97.8	70 - 130				
Total Trihalomethanes (TTHMs)	82.99	5.00	80	0	104	65 - 135				
Surr: 1,2-Dichloroethane-d4	*51.12*	*5.00*	*50*	*0*	*102*	*70 - 130*				
Surr: 4-Bromofluorobenzene	*50.45*	*5.00*	*50*	*0*	*101*	*83 - 122*				
Surr: Dibromofluoromethane	*47.66*	*5.00*	*50*	*0*	*95.3*	*73 - 126*				
Surr: Toluene-d8	*48.55*	*5.00*	*50*	*0*	*97.1*	*81 - 119*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **R385410 (0)** **Instrument:** **VOA9** **Method:** **VOLATILES**

MS Sample ID: **HS21060472-02MS** Units: **ug/L** Analysis Date: **10-Jun-2021 15:40**
Client ID: Run ID: **VOA9_385410** SeqNo: **6133327** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,1,1-Trichloroethane	25.86	5.00	20	0	129	70 - 130				
1,1,2,2-Tetrachloroethane	18.21	5.00	20	0	91.0	70 - 123				
1,1,2-Trichloroethane	18.7	5.00	20	0	93.5	70 - 117				
1,1-Dichloroethene	19.75	5.00	20	0	98.7	70 - 130				
1,2-Dibromoethane	20.6	5.00	20	0	103	70 - 124				
1,2-Dichlorobenzene	21.04	5.00	20	0	105	70 - 115				
1,2-Dichloroethane	22.02	5.00	20	0	110	70 - 127				
1,2-Dichloropropane	18.58	5.00	20	0	92.9	70 - 122				
1,3-Dichlorobenzene	21.06	5.00	20	0	105	70 - 119				
1,4-Dichlorobenzene	21.24	5.00	20	0	106	70 - 114				
2-Butanone	34.99	10.0	40	0	87.5	70 - 130				
Acrylonitrile	38.7	10.0	40	0	96.8	70 - 130				
Benzene	20.43	5.00	20	0	102	70 - 127				
Bromodichloromethane	24.09	5.00	20	0	120	70 - 124				
Bromoform	21.83	5.00	20	0	109	70 - 129				
Carbon tetrachloride	26.24	5.00	20	0	131	70 - 130				S
Chlorobenzene	21.26	5.00	20	0	106	70 - 114				
Chloroform	21.14	5.00	20	0	106	70 - 125				
Dibromochloromethane	22.61	5.00	20	0	113	70 - 124				
Ethylbenzene	22.58	5.00	20	0	113	70 - 124				
Hexachlorobutadiene	24.47	5.00	20	0	122	70 - 130				
Methylene chloride	18.89	10.0	20	0	94.4	70 - 128				
Tetrachloroethene	25.82	5.00	20	1.631	121	70 - 130				
Toluene	20.63	5.00	20	0	103	70 - 123				
Trichloroethene	28.38	5.00	20	0.9372	137	70 - 129				S
Vinyl chloride	16.09	2.00	20	0	80.5	70 - 130				
1,3-Dichloropropene, Total	40.86	5.00	40	0	102	70 - 130				
Total Trihalomethanes (TTHMs)	89.66	5.00	80	0	112	65 - 135				
Surr: 1,2-Dichloroethane-d4	*52.7*	*5.00*	*50*	*0*	*105*	*70 - 126*				
Surr: 4-Bromofluorobenzene	*50.11*	*5.00*	*50*	*0*	*100*	*82 - 124*				
Surr: Dibromofluoromethane	*49.72*	*5.00*	*50*	*0*	*99.4*	*77 - 123*				
Surr: Toluene-d8	*48.4*	*5.00*	*50*	*0*	*96.8*	*82 - 127*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: R385410 (0) **Instrument:** VOA9 **Method:** VOLATILES

MSD Sample ID: **HS21060472-02MSD** Units: **ug/L** Analysis Date: **10-Jun-2021 16:01**
Client ID: Run ID: **VOA9_385410** SeqNo: **6133328** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,1,1-Trichloroethane	24.8	5.00	20	0	124	70 - 130	25.86	4.21	20	
1,1,2,2-Tetrachloroethane	17.67	5.00	20	0	88.3	70 - 123	18.21	3	20	
1,1,2-Trichloroethane	19.29	5.00	20	0	96.4	70 - 117	18.7	3.09	20	
1,1-Dichloroethene	18.21	5.00	20	0	91.1	70 - 130	19.75	8.07	20	
1,2-Dibromoethane	20.91	5.00	20	0	105	70 - 124	20.6	1.5	20	
1,2-Dichlorobenzene	20.68	5.00	20	0	103	70 - 115	21.04	1.72	20	
1,2-Dichloroethane	21.62	5.00	20	0	108	70 - 127	22.02	1.83	20	
1,2-Dichloropropane	18.21	5.00	20	0	91.1	70 - 122	18.58	2.02	20	
1,3-Dichlorobenzene	20.69	5.00	20	0	103	70 - 119	21.06	1.77	20	
1,4-Dichlorobenzene	20.92	5.00	20	0	105	70 - 114	21.24	1.48	20	
2-Butanone	35.09	10.0	40	0	87.7	70 - 130	34.99	0.275	20	
Acrylonitrile	38.45	10.0	40	0	96.1	70 - 130	38.7	0.646	20	
Benzene	19.91	5.00	20	0	99.6	70 - 127	20.43	2.59	20	
Bromodichloromethane	22.82	5.00	20	0	114	70 - 124	24.09	5.43	20	
Bromoform	21.93	5.00	20	0	110	70 - 129	21.83	0.462	20	
Carbon tetrachloride	25.1	5.00	20	0	126	70 - 130	26.24	4.45	20	
Chlorobenzene	20.55	5.00	20	0	103	70 - 114	21.26	3.4	20	
Chloroform	20.77	5.00	20	0	104	70 - 125	21.14	1.72	20	
Dibromochloromethane	22.27	5.00	20	0	111	70 - 124	22.61	1.48	20	
Ethylbenzene	21.23	5.00	20	0	106	70 - 124	22.58	6.16	20	
Hexachlorobutadiene	24.69	5.00	20	0	123	70 - 130	24.47	0.863	20	
Methylene chloride	18.98	10.0	20	0	94.9	70 - 128	18.89	0.5	20	
Tetrachloroethene	25.1	5.00	20	1.631	117	70 - 130	25.82	2.82	20	
Toluene	20.31	5.00	20	0	102	70 - 123	20.63	1.6	20	
Trichloroethene	24.19	5.00	20	0.9372	116	70 - 129	28.38	16	20	
Vinyl chloride	16	2.00	20	0	80.0	70 - 130	16.09	0.584	20	
1,3-Dichloropropene, Total	40.04	5.00	40	0	100	70 - 130	40.86	2.02	30	
Total Trihalomethanes (TTHMs)	87.79	5.00	80	0	110	65 - 135	89.66	2.1	30	
Surr: 1,2-Dichloroethane-d4	*52.23*	*5.00*	*50*	*0*	*104*	*70 - 126*	*52.7*	*0.886*	*20*	
Surr: 4-Bromofluorobenzene	*51.22*	*5.00*	*50*	*0*	*102*	*82 - 124*	*50.11*	*2.19*	*20*	
Surr: Dibromofluoromethane	*48.89*	*5.00*	*50*	*0*	*97.8*	*77 - 123*	*49.72*	*1.7*	*20*	
Surr: Toluene-d8	*49.64*	*5.00*	*50*	*0*	*99.3*	*82 - 127*	*48.4*	*2.52*	*20*	

The following samples were analyzed in this batch: HS21060521-01

Revision: 2

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: 166765 (0) **Instrument: ManTech01** **Method: BOD**

MBLK Sample ID: **MBLK-166765** Units: **mg/L** Analysis Date: **15-Jun-2021 11:04**
Client ID: Run ID: **ManTech01_385546** SeqNo: **6136575** PrepDate: **10-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Biochemical Oxygen Demand	< 2.00	2.00								

LCS Sample ID: **LCS-166765** Units: **mg/L** Analysis Date: **15-Jun-2021 11:04**
Client ID: Run ID: **ManTech01_385546** SeqNo: **6136574** PrepDate: **10-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Biochemical Oxygen Demand	174.5	2.00	198	0	88.1	85 - 115				

DUP Sample ID: **HS21060553-01DUP** Units: **mg/L** Analysis Date: **15-Jun-2021 11:04**
Client ID: Run ID: **ManTech01_385546** SeqNo: **6136573** PrepDate: **10-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Biochemical Oxygen Demand	2.17	2.00					2.28	4.94	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **166766 (0)** **Instrument:** **ManTech01** **Method:** **CBOD**

MBLK Sample ID: **MBLK-166766** Units: **mg/L** Analysis Date: **15-Jun-2021 11:45**
Client ID: Run ID: **ManTech01_385553** SeqNo: **6136658** PrepDate: **10-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Carbonaceous Biochemical Oxygen Demand	< 2.00	2.00								

LCS Sample ID: **LCS-166766** Units: **mg/L** Analysis Date: **15-Jun-2021 11:45**
Client ID: Run ID: **ManTech01_385553** SeqNo: **6136657** PrepDate: **10-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Carbonaceous Biochemical Oxygen Demand	176.4	2.00	198	0	89.1	85 - 115				

DUP Sample ID: **HS21060545-01DUP** Units: **mg/L** Analysis Date: **15-Jun-2021 11:45**
Client ID: Run ID: **ManTech01_385553** SeqNo: **6136656** PrepDate: **10-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Carbonaceous Biochemical Oxygen Demand	2.97	2.00					3.05	2.66	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: 166767 (0) **Instrument:** UV-2450 **Method:** SURFACTANTS (MBAS) BY SM5540C

MBLK Sample ID: **MBLK-166767** Units: **mg/L 340 MW LAS** Analysis Date: **10-Jun-2021 19:00**
Client ID: Run ID: **UV-2450_385364** SeqNo: **6132442** PrepDate: **10-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
MBAS	< 0.0500	0.0500								

LCS Sample ID: **LCS-166767** Units: **mg/L 340 MW LAS** Analysis Date: **10-Jun-2021 19:00**
Client ID: Run ID: **UV-2450_385364** SeqNo: **6132440** PrepDate: **10-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
MBAS	0.498	0.0500	0.5	0	99.6	85 - 115				

LCSD Sample ID: **LCSD-166767** Units: **mg/L 340 MW LAS** Analysis Date: **10-Jun-2021 19:00**
Client ID: Run ID: **UV-2450_385364** SeqNo: **6132441** PrepDate: **10-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
MBAS	0.495	0.0500	0.5	0	99.0	85 - 115	0.498	0.604	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: 166825 (0) **Instrument: UV-2450** **Method: PHOSPHORUS BY E365.3**

MBLK Sample ID: **MBLK-166825** Units: **mg/L** Analysis Date: **11-Jun-2021 14:45**
Client ID: Run ID: **UV-2450_385487** SeqNo: **6134854** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Phosphorus, Total (As P)	< 0.0500	0.0500								

LCS Sample ID: **LCS-166825** Units: **mg/L** Analysis Date: **11-Jun-2021 14:45**
Client ID: Run ID: **UV-2450_385487** SeqNo: **6134853** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Phosphorus, Total (As P)	0.247	0.0500	0.25	0	98.8	80 - 120				

MS Sample ID: **HS21060521-01MS** Units: **mg/L** Analysis Date: **11-Jun-2021 14:45**
Client ID: **POCC - INTAKE-1** Run ID: **UV-2450_385487** SeqNo: **6134851** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Phosphorus, Total (As P)	0.204	0.0500	0.25	-0.004	83.2	80 - 120				

MSD Sample ID: **HS21060521-01MSD** Units: **mg/L** Analysis Date: **11-Jun-2021 14:45**
Client ID: **POCC - INTAKE-1** Run ID: **UV-2450_385487** SeqNo: **6134852** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Phosphorus, Total (As P)	0.21	0.0500	0.25	-0.004	85.6	80 - 120	0.204	2.9	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: 166904 (0) **Instrument:** WetChem_HS **Method:** TOTAL KJELDAHL NITROGEN BY SM4500 NH3 D

MBLK Sample ID: **MBLK-166904** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: Run ID: **WetChem_HS_385582** SeqNo: **6137248** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	< 0.50	0.50								

LCS Sample ID: **LCS-166904** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: Run ID: **WetChem_HS_385582** SeqNo: **6137247** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	21.76	0.50	20	0	109	85 - 115				

MS Sample ID: **HS21060699-01MS** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: Run ID: **WetChem_HS_385582** SeqNo: **6137245** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	22.84	0.50	20	0.602	111	75 - 125				

MS Sample ID: **HS21060521-01MS** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: **POCC - INTAKE-1** Run ID: **WetChem_HS_385582** SeqNo: **6140641** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	17.5	0.50	20	0.422	85.4	75 - 125				

MSD Sample ID: **HS21060699-01MSD** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: Run ID: **WetChem_HS_385582** SeqNo: **6137246** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	22.01	0.50	20	0.602	107	75 - 125	22.84	3.69	20	

MSD Sample ID: **HS21060521-01MSD** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: **POCC - INTAKE-1** Run ID: **WetChem_HS_385582** SeqNo: **6140640** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	17.58	0.50	20	0.422	85.8	75 - 125	17.5	0.456	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: 166930 (0) **Instrument:** UV-2450 **Method:** SULFIDE METHYLENE BLUE BY SM4500 S2- D

MBLK Sample ID: **MBLK-166930** Units: **mg/L** Analysis Date: **15-Jun-2021 16:40**
Client ID: Run ID: **UV-2450_385654** SeqNo: **6138842** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Sulfide	< 0.0500	0.0500								

LCS Sample ID: **LCS-166930** Units: **mg/L** Analysis Date: **15-Jun-2021 16:40**
Client ID: Run ID: **UV-2450_385654** SeqNo: **6138840** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Sulfide	0.21	0.0500	0.2	0	105	85 - 115				

LCSD Sample ID: **LCSD-166930** Units: **mg/L** Analysis Date: **15-Jun-2021 16:40**
Client ID: Run ID: **UV-2450_385654** SeqNo: **6138841** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Sulfide	0.207	0.0500	0.2	0	104	85 - 115	0.21	1.44	20	

MS Sample ID: **HS21060616-02MS** Units: **mg/L** Analysis Date: **15-Jun-2021 16:40**
Client ID: Run ID: **UV-2450_385654** SeqNo: **6138838** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Sulfide	0.182	0.0500	0.2	0.007	87.5	77 - 124				

MSD Sample ID: **HS21060616-02MSD** Units: **mg/L** Analysis Date: **15-Jun-2021 16:40**
Client ID: Run ID: **UV-2450_385654** SeqNo: **6138839** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Sulfide	0.177	0.0500	0.2	0.007	85.0	77 - 124	0.182	2.79	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: 167044 (0) **Instrument: UV-2450** **Method: AMMONIA AS N BY SM4500 NH3-B-F**

MBLK Sample ID: **MBLK-167044** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: Run ID: **UV-2450_385848** SeqNo: **6143967** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	< 0.050	0.050								

LCS Sample ID: **LCS-167044** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: Run ID: **UV-2450_385848** SeqNo: **6143966** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	0.446	0.050	0.5	0	89.2	85 - 115				

MS Sample ID: **HS21060746-01MS** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: Run ID: **UV-2450_385848** SeqNo: **6143964** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	0.939	0.050	0.5	0.555	76.8	80 - 120				S

MS Sample ID: **HS21060616-01MS** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: Run ID: **UV-2450_385848** SeqNo: **6143962** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	0.453	0.050	0.5	0.022	86.2	80 - 120				

MSD Sample ID: **HS21060746-01MSD** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: Run ID: **UV-2450_385848** SeqNo: **6143965** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	0.931	0.050	0.5	0.555	75.2	80 - 120	0.939	0.856	20	S

MSD Sample ID: **HS21060616-01MSD** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: Run ID: **UV-2450_385848** SeqNo: **6143963** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	0.464	0.050	0.5	0.022	88.4	80 - 120	0.453	2.4	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: R385335 (0) **Instrument:** WetChem_HS **Method:** COLOR BY SM 2120B - 2011

MBLK Sample ID: **MBLK-R385335** Units: **Color Units** Analysis Date: **10-Jun-2021 14:27**
Client ID: Run ID: **WetChem_HS_385335** SeqNo: **6131673** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Color, Apparent	< 5.00	5.00								
pH	5	0.100								

LCS Sample ID: **LCS-R385335** Units: **Color Units** Analysis Date: **10-Jun-2021 14:27**
Client ID: Run ID: **WetChem_HS_385335** SeqNo: **6131672** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Color, Apparent	50	5.00	50	0	100	85 - 115				

LCSD Sample ID: **LCSD-R385335** Units: **Color Units** Analysis Date: **10-Jun-2021 14:27**
Client ID: Run ID: **WetChem_HS_385335** SeqNo: **6131671** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Color, Apparent	50	5.00	50	0	100	85 - 115	50	0	20	

DUP Sample ID: **HS21060521-01DUP** Units: **Color Units** Analysis Date: **10-Jun-2021 14:27**
Client ID: **POCC - INTAKE-1** Run ID: **WetChem_HS_385335** SeqNo: **6131674** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Color, Apparent	15	5.00					15	0	20	
pH	7	0.100					0	0		

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: R385353 (0) **Instrument:** UV-2450 **Method:** HEXAVALENT CHROMIUM BY SM3500-CR B

MBLK Sample ID: **MBLK-R385353** Units: **mg/L** Analysis Date: **10-Jun-2021 08:30**
Client ID: Run ID: **UV-2450_385353** SeqNo: **6132025** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chromium, Hexavalent	< 0.0200	0.0200								

LCS Sample ID: **LCS-R385353** Units: **mg/L** Analysis Date: **10-Jun-2021 08:30**
Client ID: Run ID: **UV-2450_385353** SeqNo: **6132024** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chromium, Hexavalent	0.263	0.0200	0.25	0	105	80 - 120				

MS Sample ID: **HS21060521-01MS** Units: **mg/L** Analysis Date: **10-Jun-2021 08:41**
Client ID: **POCC - INTAKE-1** Run ID: **UV-2450_385353** SeqNo: **6132027** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chromium, Hexavalent	0.25	0.0200	0.25	0	100	75 - 125				

MSD Sample ID: **HS21060521-01MSD** Units: **mg/L** Analysis Date: **10-Jun-2021 08:42**
Client ID: **POCC - INTAKE-1** Run ID: **UV-2450_385353** SeqNo: **6132026** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chromium, Hexavalent	0.257	0.0200	0.25	0	103	75 - 125	0.25	2.76	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: R385387 (0) **Instrument:** TOC_04 **Method:** TOTAL ORGANIC CARBON BY E415.1

MBLK Sample ID: **MBLK-06102021** Units: **mg/L** Analysis Date: **10-Jun-2021 18:25**
Client ID: Run ID: **TOC_04_385387** SeqNo: **6132898** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Organic Carbon, Total	< 1.00	1.00								

LCS Sample ID: **LCS-06102021** Units: **mg/L** Analysis Date: **10-Jun-2021 18:37**
Client ID: Run ID: **TOC_04_385387** SeqNo: **6132899** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Organic Carbon, Total	10.75	1.00	10	0	108	85 - 115				

LCSD Sample ID: **LCSD-06102021** Units: **mg/L** Analysis Date: **10-Jun-2021 18:48**
Client ID: Run ID: **TOC_04_385387** SeqNo: **6132900** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Organic Carbon, Total	10.47	1.00	10	0	105	85 - 115	10.75	2.64	20	

MS Sample ID: **HS21060488-01MS** Units: **mg/L** Analysis Date: **10-Jun-2021 19:15**
Client ID: Run ID: **TOC_04_385387** SeqNo: **6132902** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Organic Carbon, Total	23.3	1.00	10	12.27	110	80 - 120				

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **R385426 (0)** **Instrument:** **ICS-Integrion** **Method:** **ANIONS BY E300.0**

MBLK Sample ID: **MBLK** Units: **mg/L** Analysis Date: **10-Jun-2021 15:43**
Client ID: Run ID: **ICS-Integrion_385426** SeqNo: **6133626** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	< 0.100	0.100								
Chloride	< 0.500	0.500								
Fluoride	< 0.100	0.100								
Nitrogen, Nitrate (As N)	< 0.100	0.100								
Nitrogen, Nitrite (As N)	< 0.100	0.100								
Nitrate/Nitrite (as N)	< 0.200	0.200								
Sulfate	< 0.500	0.500								

LCS Sample ID: **LCS** Units: **mg/L** Analysis Date: **10-Jun-2021 15:51**
Client ID: Run ID: **ICS-Integrion_385426** SeqNo: **6133627** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	3.886	0.100	4	0	97.1	90 - 110				
Chloride	19.82	0.500	20	0	99.1	90 - 110				
Fluoride	4.249	0.100	4	0	106	90 - 110				
Nitrogen, Nitrate (As N)	3.751	0.100	4	0	93.8	90 - 110				
Nitrogen, Nitrite (As N)	4.255	0.100	4	0	106	90 - 110				
Nitrate/Nitrite (as N)	8.006	0.200	8	0	100	90 - 110				
Sulfate	19.85	0.500	20	0	99.3	90 - 110				

MS Sample ID: **HS21060529-08MS** Units: **mg/L** Analysis Date: **10-Jun-2021 17:20**
Client ID: Run ID: **ICS-Integrion_385426** SeqNo: **6133637** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	2.061	0.100	2	0.1351	96.3	80 - 120				
Chloride	24.04	0.500	10	13.71	103	80 - 120				
Fluoride	2.897	0.100	2	0.7066	110	80 - 120				
Nitrogen, Nitrate (As N)	2.061	0.100	2	0.0242	102	80 - 120				
Nitrogen, Nitrite (As N)	2.252	0.100	2	0.1245	106	80 - 120				
Nitrate/Nitrite (as N)	4.313	0.200	4	0.1245	105	80 - 120				
Sulfate	43.43	0.500	10	32.78	106	80 - 120				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: R385426 (0) **Instrument:** ICS-Integrion **Method:** ANIONS BY E300.0

MS Sample ID: **HS21060527-13MS** Units: **mg/L** Analysis Date: **10-Jun-2021 15:03**
Client ID: Run ID: **ICS-Integrion_385426** SeqNo: **6133621** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	3.886	0.100	2	2.002	94.2	80 - 120				
Chloride	151.3	0.500	10	148.4	28.7	80 - 120				SEO
Fluoride	2.97	0.100	2	0.8736	105	80 - 120				
Nitrogen, Nitrate (As N)	2.018	0.100	2	0.0312	99.3	80 - 120				
Nitrogen, Nitrite (As N)	2.191	0.100	2	0.0961	105	80 - 120				
Nitrate/Nitrite (as N)	4.209	0.200	4	0.1273	102	80 - 120				
Sulfate	34.19	0.500	10	25.75	84.4	80 - 120				

MSD Sample ID: **HS21060529-08MSD** Units: **mg/L** Analysis Date: **10-Jun-2021 17:27**
Client ID: Run ID: **ICS-Integrion_385426** SeqNo: **6133638** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	1.996	0.100	2	0.1351	93.1	80 - 120	2.061	3.16	20	
Chloride	23.23	0.500	10	13.71	95.2	80 - 120	24.04	3.42	20	
Fluoride	2.778	0.100	2	0.7066	104	80 - 120	2.897	4.19	20	
Nitrogen, Nitrate (As N)	1.994	0.100	2	0.0242	98.5	80 - 120	2.061	3.34	20	
Nitrogen, Nitrite (As N)	2.186	0.100	2	0.1245	103	80 - 120	2.252	2.97	20	
Nitrate/Nitrite (as N)	4.179	0.200	4	0.1245	101	80 - 120	4.313	3.15	20	
Sulfate	41.78	0.500	10	32.78	89.9	80 - 120	43.43	3.89	20	

MSD Sample ID: **HS21060527-13MSD** Units: **mg/L** Analysis Date: **10-Jun-2021 15:11**
Client ID: Run ID: **ICS-Integrion_385426** SeqNo: **6133622** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	4.003	0.100	2	2.002	100	80 - 120	3.886	2.95	20	
Chloride	155.8	0.500	10	148.4	73.3	80 - 120	151.3	2.91	20	SEO
Fluoride	3.068	0.100	2	0.8736	110	80 - 120	2.97	3.22	20	
Nitrogen, Nitrate (As N)	2.084	0.100	2	0.0312	103	80 - 120	2.018	3.2	20	
Nitrogen, Nitrite (As N)	2.26	0.100	2	0.0961	108	80 - 120	2.191	3.1	20	
Nitrate/Nitrite (as N)	4.344	0.200	4	0.1273	105	80 - 120	4.209	3.15	20	
Sulfate	35.43	0.500	10	25.75	96.8	80 - 120	34.19	3.57	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: R385528 (0) **Instrument:** ManTech01 **Method:** ALKALINITY BY SM2320B

MBLK Sample ID: **WBLKW1-210614** Units: **mg/L** Analysis Date: **14-Jun-2021 16:48**
Client ID: Run ID: **ManTech01_385528** SeqNo: **6135922** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	< 5.00	5.00								
Alkalinity, Carbonate (As CaCO3)	< 5.00	5.00								
Alkalinity, Hydroxide (As CaCO3)	< 5.00	5.00								
Alkalinity, Total (As CaCO3)	< 5.00	5.00								

LCS Sample ID: **LCS1-210614** Units: **mg/L** Analysis Date: **14-Jun-2021 16:57**
Client ID: Run ID: **ManTech01_385528** SeqNo: **6135923** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Carbonate (As CaCO3)	1023	5.00	1000	0	102	85 - 115				
Alkalinity, Total (As CaCO3)	1030	5.00	1000	0	103	85 - 115				

LCSD Sample ID: **LCSD1-210614** Units: **mg/L** Analysis Date: **14-Jun-2021 17:05**
Client ID: Run ID: **ManTech01_385528** SeqNo: **6135926** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Carbonate (As CaCO3)	1016	5.00	1000	0	102	85 - 115	1023	0.715	20	
Alkalinity, Total (As CaCO3)	1024	5.00	1000	0	102	85 - 115	1030	0.601	20	

DUP Sample ID: **HS21060479-02DUP** Units: **mg/L** Analysis Date: **14-Jun-2021 17:21**
Client ID: Run ID: **ManTech01_385528** SeqNo: **6135928** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	633.5	5.00					652.6	2.98	20	
Alkalinity, Carbonate (As CaCO3)	< 5.00	5.00					0	0	20	
Alkalinity, Hydroxide (As CaCO3)	< 5.00	5.00					0	0	20	
Alkalinity, Total (As CaCO3)	633.5	5.00					652.6	2.98	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: R385585 (0) **Instrument:** Balance1 **Method:** TOTAL SUSPENDED SOLIDS BY SM 2540D

MBLK Sample ID: **WBLKW1-061521** Units: **mg/L** Analysis Date: **15-Jun-2021 09:50**
Client ID: Run ID: **Balance1_385585** SeqNo: **6137317** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Suspended Solids (Residue, Non-Filterable)	< 2.00	2.00								

LCS Sample ID: **WLCSW1-061521** Units: **mg/L** Analysis Date: **15-Jun-2021 09:50**
Client ID: Run ID: **Balance1_385585** SeqNo: **6137318** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Suspended Solids (Residue, Non-Filterable)	98	2.00	100	0	98.0	85 - 115				

DUP Sample ID: **HS21060486-01DUP** Units: **mg/L** Analysis Date: **15-Jun-2021 09:50**
Client ID: Run ID: **Balance1_385585** SeqNo: **6137307** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Suspended Solids (Residue, Non-Filterable)	7.333	2.00					7.111	3.08	5	

DUP Sample ID: **HS21060468-01DUP** Units: **mg/L** Analysis Date: **15-Jun-2021 09:50**
Client ID: Run ID: **Balance1_385585** SeqNo: **6137301** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Suspended Solids (Residue, Non-Filterable)	122	2.00					120	1.65	5	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: R385686 (0) **Instrument:** WetChem_HS **Method:** CHEMICAL OXYGEN DEMAND BY E410.4

MBLK Sample ID: **MBLK-R385686** Units: **mg/L** Analysis Date: **16-Jun-2021 15:00**
Client ID: Run ID: **WetChem_HS_385686** SeqNo: **6139533** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chemical Oxygen Demand	< 15.0	15.0								

LCS Sample ID: **LCS-R385686** Units: **mg/L** Analysis Date: **16-Jun-2021 15:00**
Client ID: Run ID: **WetChem_HS_385686** SeqNo: **6139532** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chemical Oxygen Demand	99	15.0	100	0	99.0	85 - 115				

MS Sample ID: **HS21060563-02MS** Units: **mg/L** Analysis Date: **16-Jun-2021 15:00**
Client ID: Run ID: **WetChem_HS_385686** SeqNo: **6139535** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chemical Oxygen Demand	70	15.0	50	21	98.0	80 - 120				

MSD Sample ID: **HS21060563-02MSD** Units: **mg/L** Analysis Date: **16-Jun-2021 15:00**
Client ID: Run ID: **WetChem_HS_385686** SeqNo: **6139534** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chemical Oxygen Demand	72	15.0	50	21	102	80 - 120	70	2.82	20	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: **R385765 (0)** **Instrument:** **Balance1** **Method:** **TOTAL DISSOLVED SOLIDS BY SM2540C**

MBLK Sample ID: **WBLK-061621** Units: **mg/L** Analysis Date: **16-Jun-2021 17:50**
Client ID: Run ID: **Balance1_385765** SeqNo: **6141581** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Filterable)	< 10.0	10.0								

LCS Sample ID: **WLCS-061621** Units: **mg/L** Analysis Date: **16-Jun-2021 17:50**
Client ID: Run ID: **Balance1_385765** SeqNo: **6141582** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Filterable)	998	10.0	1000	0	99.8	85 - 115				

DUP Sample ID: **HS21060547-01DUP** Units: **mg/L** Analysis Date: **16-Jun-2021 17:50**
Client ID: Run ID: **Balance1_385765** SeqNo: **6141577** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Filterable)	670	10.0					658	1.81	5	

DUP Sample ID: **HS21060521-01DUP** Units: **mg/L** Analysis Date: **16-Jun-2021 17:50**
Client ID: **POCC - INTAKE-1** Run ID: **Balance1_385765** SeqNo: **6141566** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Filterable)	33120	10.0					33440	0.962	5	

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060521

QC BATCH REPORT

Batch ID: R385769 (0) **Instrument:** Balance1 **Method:** OIL & GREASE (HEM) BY E1664A

MBLK Sample ID: **WBLKW-061721** Units: **mg/L** Analysis Date: **17-Jun-2021 14:00**
Client ID: Run ID: **Balance1_385769** SeqNo: **6141772** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Oil and Grease	< 2.00	2.00								

LCS Sample ID: **WLCSW-061721** Units: **mg/L** Analysis Date: **17-Jun-2021 14:00**
Client ID: Run ID: **Balance1_385769** SeqNo: **6141774** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Oil and Grease	33.5	2.00	40	0	83.8	78 - 114				

LCSD Sample ID: **WLCSDW-061721** Units: **mg/L** Analysis Date: **17-Jun-2021 14:00**
Client ID: Run ID: **Balance1_385769** SeqNo: **6141773** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Oil and Grease	33.4	2.00	40	0	83.5	78 - 114	33.5	0.299	18	

MS Sample ID: **HS21060535-01MS** Units: **mg/L** Analysis Date: **17-Jun-2021 14:00**
Client ID: Run ID: **Balance1_385769** SeqNo: **6141764** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Oil and Grease	36.3	2.00	40	0.8696	88.6	78 - 114				

The following samples were analyzed in this batch: HS21060521-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: **HS21060521**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
M	Manually integrated, see raw data for justification
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL/SDL

Acronym	Description
DCS	Detectability Check Study
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitaion Limit
SD	Serial Dilution
SDL	Sample Detection Limit
TRRP	Texas Risk Reduction Program

Unit Reported	Description
µg/L	Micrograms per Liter
Date	
ug/L	Micrograms per Liter

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CERTIFICATIONS,ACCREDITATIONS & LICENSES

Agency	Number	Expire Date
Arkansas	21-022-0	26-Mar-2022
Dept of Defense	PJLA L20-507-R2	22-Dec-2021
Florida	E87611-30-07/01/2020	30-Jun-2021
Illinois	2000322021-7	09-May-2022
Kansas	E-10352 2020-2021	31-Jul-2021
Kentucky	123043, 2021-2022	30-Apr-2022
Louisiana	03087, 2020-2021	30-Jun-2021
Louisiana	03087, 2021-2022	30-Jun-2022
North Carolina	624-2021	31-Dec-2021
Oklahoma	2020-165	31-Aug-2021
Texas	T104704231-21-27	30-Apr-2022
Utah	TX026932021-10	31-Jul-2021

Sample Receipt Checklist

Work Order ID: HS21060521 **Date/Time Received:** **10-Jun-2021 08:00**

Client Name: Parsons **Received by:** **Jared R. Makan**

Completed By: /S/ Jared R. Makan (eSignature) 10-Jun-2021 08:49 (Date/Time) **Reviewed by:** /S/ Corey Grandits (eSignature) 15-Jun-2021 12:16 (Date/Time)

Matrices: **Water** Carrier name: **Greyhound**

	Yes	No	Not Present
Shipping container/cooler in good condition?	☑	☐	☐
Custody seals intact on shipping container/cooler?	☑	☐	☐
Custody seals intact on sample bottles?	☐	☐	☑
VOA/TX1005/TX1006 Solids in hermetically sealed vials?	☐	☐	☑
Chain of custody present?	☑	☐	1 Page(s)
Chain of custody signed when relinquished and received?	☑	☐	COC IDs:246679
Samplers name present on COC?	☑	☐	
Chain of custody agrees with sample labels?	☑	☐	
Samples in proper container/bottle?	☑	☐	
Sample containers intact?	☑	☐	
Sufficient sample volume for indicated test?	☑	☐	
All samples received within holding time?	☑	☐	
Container/Temp Blank temperature in compliance?	☑	☐	

Temperature(s)/Thermometer(s):	1.3°C UC/C	IR31
Cooler(s)/Kit(s):	45447	
Date/Time sample(s) sent to storage:	06/10/2021 08:50	

	Yes	No	
Water - VOA vials have zero headspace?	☑	☐	No VOA vials submitted ☐
Water - pH acceptable upon receipt?	☑	☐	N/A ☐
pH adjusted?	☐	☑	N/A ☐

pH adjusted by:

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

Corrective Action:

Cincinnati, OH +1 513 733 5336 | Fort Collins, CO +1 970 490 1511 | Everett, WA +1 425 356 2600 | Holland, MI +1 616 399 6070 | Houston, TX +1 281 530 5656 | Spring City, PA +1 610 948 4903 | Middletown, PA +1 717 944 5541 | Salt Lake City, UT +1 801 266 7700 | South ... WV

Chain of Custody Form

Page 1 of 1

COC ID: 246679

SHORT HOLDING TIME

512 656 9879 CURT BURDORF (CAB)

ALS Project Manager:

ALS Work Order #:

Customer Information		Project Information	
Purchase Order	TBD	Project Name	PARSONS - POCC FLOW
Work Order		Project Number	451565.04000
Company Name	Parsons	Bill To Company	Parsons
Send Report To	Curt Burdorf	Invoice Attn	AP
Address	9101 Burnet Rd Ste 210	Address	9101 Burnet Rd Ste 210
City/State/Zip	Austin , TX 78758	City/State/Zip	Austin TX 78758
Phone	(512) 656-9879	Phone	(512) 656-9879
Fax		Fax	COLOR SURFACTANT
e-Mail Address	Curt.Burdorf@parsons.com	e-Mail Address	

	Parameter/Method Request for Analysis
A	300 - Anions (Br, Cl, F, *NO2*, *NO3*, SO4)
B	624 VOCs - includes *Acrylonitrile*
C	625 SVOCs & 608 PCBs
D	*CBOD*, *BOD*, *Cr6 - HexChrome*, Cr3 - TriChrome
E	Total Alkalinity, TSS, TDS
F	Oil & Grease, COD, Total Organic Nitrogen, TOC
G	200.8 Metals (19) & Total Phosphorus
H	Sulfide (MethyleneBlue)
	Sub LL Hg 1631 Holland
J	Sub Available Cyanide 1667 Holland

ON ICE.

ANALYZE COLOR & SURFACTANT ALSO

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	POCC-INTAKE-1	6/9/2021	0955	H_2O			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	~~FIELD BLANK~~	6/9/2021	0955	H_2O	CAB												
3																	
4																	
5																	
6																	
7																	
8																	
9																	
0																	

HS21060521

Parsons

Parsons - POCC Flow

Sampler(s) Please Print & Sign: CURT BURDORF Curt A. Burdorf

Shipment Method: ALS COURIER

Required Turnaround Time: (Check Box) [X] STD 10 Wk Days [ ] 5 Wk Days [ ] 2 Wk Days [ ] 24 Hour [ ] Other

Results Due Date:

Relinquished by:	Date:	Time:	Received by:
Curt Burdorf	6/9/21		[signature]
[signature]	6-9-21	5:00	Received by (Laboratory): J. Wilson 6/10/21 08:00
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):

Notes: Parsons - Gulf of Mexico

Cooler ID	Cooler Temp.
	4.6
45447	4.3

QC Package: (Check One Box Below)

[X] Level II Std QC
[ ] Level III Std QC/Raw Data
[ ] Level IV SW846/CLP
[ ] Other
[ ] TRRP Checklist
[ ] TRRP Level V

1231 CFU

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

Note:
1. Any changes must be made in writing once samples and COC Form have been submitted to ALS Environmental.
2. Unless otherwise agreed in a formal contract, services provided by ALS Environmental are expressly limited to the terms and conditions stated on the reverse.
3. The Chain of Custody is a legal document. All information must be completed accurately.

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Revision 2

ALS
10450 Stancliff Rd., Suite 210
Houston, Texas 77099
Tel. +1 281 530 5656
Fax. +1 281 530 5887

Date:
Name:
Company:

CUSTODY SEAL
6-9-21 Time: 5:15 pm
Corrine Diaz
ALS EA: [illegible]

Seal Broken By: Jm
Date: 6/10/21

09JUN21 06:40P ** LABEL **

Schd: VLP 0852

GLI 3089367776

HOUSTON, TX

: ALS CORPUS
000-000-0000

: A L S

N/A

Manual Wght:
238.7

Tariff Wght:
240.0

HOUSTON, TX 77002

Phone: 281-530-5656

PO/Ref #:

Priority

Agency Phone: (713)759-6593

WWW.SHIPGREYHOUND.COM

RIGHT SOLUTIONS | RIGHT PARTNER

17-Jun-2021

Corey Grandits
ALS Environmental
10450 Stancliff Rd
Suite 210
Houston, TX 77099

Re: **HS21060521** Work Order: **21061412**

Dear Corey,

ALS Environmental received 5 samples on 12-Jun-2021 10:00 AM for the analyses presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental - Holland and for only the analyses requested.

Sample results are compliant with industry accepted practices and Quality Control results achieved laboratory specifications. Any exceptions are noted in the Case Narrative, or noted with qualifiers in the report or QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained from ALS Environmental. Samples will be disposed in 30 days unless storage arrangements are made.

The total number of pages in this report is ZZ.

If you have any questions regarding this report, please feel free to contact me:

ADDRESS: 3352 128th Avenue, Holland, MI, USA
PHONE: +1 (616) 399-6070 FAX: +1 (616) 399-6185

Sincerely,

Electronically approved by: Alex J. Csaszar

Chad Whelton
Project Manager

ALS Group, USA

Date: 17-Jun-21

Client: ALS Environmental
Project: HS21060521 and HS21050516
Work Order: **21061412**

Work Order Sample Summary

Lab Samp ID	Client Sample ID	Matrix	Tag Number	Collection Date	Date Received	Hold
21061412-01	Pocc-Intake-1	Water		6/9/2021 09:55	6/12/2021 10:00	☐
21061412-02	Field Blank	Water		6/9/2021 09:55	6/12/2021 10:00	☐

RIGHT SOLUTIONS | RIGHT PARTNER

Client: ALS Environmental
Project: HS21060521 and HS21050516
Work Order: 21061412

Case Narrative

Samples for the above noted Work Order were received on 06/12/2021. The attached "Sample Receipt Checklist" documents the status of custody seals, container integrity, preservation, and temperature compliance.

Samples were analyzed according to the analytical methodology previously transmitted in the "Work Order Acknowledgement". Methodologies are also documented in the "Analytical Result" section for each sample. Quality control results are listed in the "QC Report" section. Sample association for the reported quality control is located at the end of each batch summary. If applicable, results are appropriately qualified in the Analytical Result and QC Report sections. The "Qualifiers" section documents the various qualifiers, units, and acronyms utilized in reporting. A copy of the laboratory's scope of accreditation is available upon request.

All sample analyses achieved analytical criteria.

Client: ALS Environmental
Project: HS21060521 and HS21050516
WorkOrder: **21061412**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
**	Estimated Value
a	Analyte is non-accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
Hr	BOD/CBOD - Sample was reset outside Hold Time, value should be considered estimated.
J	Analyte is present at an estimated concentration between the MDL and Report Limit
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL
X	Analyte was detected in the Method Blank between the MDL and Reporting Limit, sample results may exhibit background or reagent contamination at the observed level.

Acronym	Description
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection (see MDL)
LOQ	Limit of Quantitation (see PQL)
MBLK	Method Blank
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PQL	Practical Quantitation Limit
RPD	Relative Percent Difference
TDL	Target Detection Limit
TNTC	Too Numerous To Count
A	APHA Standard Methods
D	ASTM
E	EPA
SW	SW-846 Update III

Units Reported	Description
µg/L	Micrograms per Liter

RIGHT SOLUTIONS | RIGHT PARTNER

ALS Group, USA

Date: *17-Jun-2021*

Client: ALS Environmental
Project: HS21060521 and HS21050516
Sample ID: Pocc-Intake-1
Collection Date: 6/9/2021 09:55 AM

Work Order: 21061412
Lab ID: 21061412-01
Matrix: WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY IN WATER			**E1631E**		Prep: E1631E 6/16/21 11:45	Analyst: **STP**
Mercury	**0.00058**		**0.00050**	**µg/L**	1	6/16/2021 04:37 PM
CYANIDE, AVAILABLE			**OIA 1677-09**			Analyst: **MB**
Cyanide, Available	ND		2.0	µg/L	1	6/16/2021 11:00 AM

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group, USA

Date: *17-Jun-2021*

Client: ALS Environmental
Project: HS21060521 and HS21050516
Sample ID: Field Blank
Collection Date: 6/9/2021 09:55 AM

Work Order: 21061412
Lab ID: 21061412-02
Matrix: WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY IN WATER			**E1631E**		Prep: E1631E 6/16/21 11:45	Analyst: **STP**
Mercury	ND		0.00050	µg/L	1	6/16/2021 05:55 PM

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group, USA

Date: 17-Jun-21

Client: ALS Environmental
Work Order: 21061412
Project: HS21060521 and HS21050516

QC BATCH REPORT

Batch ID: **178605** Instrument ID **HG3** Method: **E1631E**

MBLK1 Sample ID: **MBLK1-178605-178605** Units: **ng/L** Analysis Date: **6/16/2021 01:46 PM**
Client ID: Run ID: **HG3_210616A** SeqNo: **7495990** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	ND	0.50	0	0	0		0			

MBLK2 Sample ID: **MBLK2-178605-178605** Units: **ng/L** Analysis Date: **6/16/2021 02:48 PM**
Client ID: Run ID: **HG3_210616A** SeqNo: **7495998** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	0.39	0.50	0	0	0		0			J

MBLK3 Sample ID: **MBLK3-178605-178605** Units: **ng/L** Analysis Date: **6/16/2021 04:06 PM**
Client ID: Run ID: **HG3_210616A** SeqNo: **7496008** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	0.2	0.50	0	0	0		0			J

MS Sample ID: **21061412-01BMS** Units: **ng/L** Analysis Date: **6/16/2021 04:45 PM**
Client ID: **Pocc-Intake-1** Run ID: **HG3_210616A** SeqNo: **7496013** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.37	0.50	5	0.58	95.8	71-125	0			

MS Sample ID: **21061412-03BMS** Units: **ng/L** Analysis Date: **6/16/2021 05:24 PM**
Client ID: **Pocc-Intake-2** Run ID: **HG3_210616A** SeqNo: **7496018** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.63	0.50	5	0.66	99.4	71-125	0			

MSD Sample ID: **21061412-01BMSD** Units: **ng/L** Analysis Date: **6/16/2021 04:53 PM**
Client ID: **Pocc-Intake-1** Run ID: **HG3_210616A** SeqNo: **7496014** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.52	0.50	5	0.58	98.8	71-125	5.37	2.75	24	

MSD Sample ID: **21061412-03BMSD** Units: **ng/L** Analysis Date: **6/16/2021 05:32 PM**
Client ID: **Pocc-Intake-2** Run ID: **HG3_210616A** SeqNo: **7496019** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.63	0.50	5	0.66	99.4	71-125	5.63	0	24	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

RIGHT SOLUTIONS | RIGHT PARTNER

Client: ALS Environmental
Work Order: 21061412
Project: HS21060521 and HS21050516

QC BATCH REPORT

Batch ID: **178605** Instrument ID **HG3** Method: **E1631E**

LCS-OPR-START Sample ID: **OPR-START-178605-178605** Units: **ng/L** Analysis Date: **6/16/2021 01:38 PM**

Client ID: Run ID: **HG3_210616A** SeqNo: **7495989** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.43	0.50	5	0	109	77-123	0			

LCS-OPR-END Sample ID: **OPR-END-178605-178605** Units: **ng/L** Analysis Date: **6/16/2021 06:03 PM**

Client ID: Run ID: **HG3_210616A** SeqNo: **7496023** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.05	0.50	5	0	101	77-123	0			

The following samples were analyzed in this batch: 21061412-01B 21061412-02A

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

RIGHT SOLUTIONS | RIGHT PARTNER

Client: ALS Environmental
Work Order: 21061412
Project: HS21060521 and HS21050516

QC BATCH REPORT

Batch ID: **R319900** Instrument ID **FS3100** Method: **OIA 1677-09**

MBLK Sample ID: **MBLK-1-R319900** Units: **µg/L** Analysis Date: **6/16/2021 11:00 AM**
Client ID: Run ID: **FS3100_210616A** SeqNo: **7492163** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Cyanide, Available	ND	2.0								

LCS Sample ID: **LCS-1-R319900** Units: **µg/L** Analysis Date: **6/16/2021 11:00 AM**
Client ID: Run ID: **FS3100_210616A** SeqNo: **7492161** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Cyanide, Available	56.05	2.0	50	0	112	82-132	0			

MS Sample ID: **21061372-06B MS** Units: **µg/L** Analysis Date: **6/16/2021 11:00 AM**
Client ID: Run ID: **FS3100_210616A** SeqNo: **7492145** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Cyanide, Available	51.1	2.0	50	1.604	99	82-130	0			

MSD Sample ID: **21061372-06B MSD (A** Units: **µg/L** Analysis Date: **6/16/2021 11:00 AM**
Client ID: Run ID: **FS3100_210616A** SeqNo: **7492146** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Cyanide, Available	51.01	2.0	50	1.604	98.8	82-130	51.1	0.17	11	

The following samples were analyzed in this batch: 21061412-01A

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

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ALS Group, USA

Sample Receipt Checklist

Client Name: **ALS - HOUSTON** Date/Time Received: **12-Jun-21 10:00**

Work Order: **21061412** Received by: **DS**

Checklist completed by Diane Shaw (eSignature) 15-Jun-21 (Date) Reviewed by: Alex J. Csaszar (eSignature) 15-Jun-21 (Date)

Matrices: Water
Carrier name: FedEx

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	
Sample(s) received on ice?	Yes ☑	No ☐	
Temperature(s)/Thermometer(s):	5.8/5.8 c	IR1	
Cooler(s)/Kit(s):			
Date/Time sample(s) sent to storage:	6/15/2021 11:38:46 AM		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	N/A ☐
pH adjusted?	Yes ☐	No ☑	N/A ☐
pH adjusted by:	-		

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

CorrectiveAction:

SRC Page 1 of 1

RIGHT SOLUTIONS | RIGHT PARTNER

Revision 2

10450 Stancliff Rd. Suite 210
Houston, TX 77099
T: +1 281 530 5656
F: +1 281 530 5887

June 23, 2021

Curt Burdorf
Parsons
9101 Burnet Rd
Ste 210
Austin , TX 78758

Work Order: **HS21060616**

Laboratory Results for: **Parsons - POCC Flow**

Dear Curt Burdorf,

ALS Environmental received 4 sample(s) on Jun 11, 2021 for the analysis presented in the following report.

This is a REVISED REPORT. Please see the Case Narrative for discussion concerning this revision.

Regards,

Generated By: DANE.WACASEY

Ragen Giga
Project Manager

Client: Parsons
Project: Parsons - POCC Flow
Work Order: HS21060616

SAMPLE SUMMARY

Lab Samp ID	Client Sample ID	Matrix	TagNo	Collection Date	Date Received	Hold
HS21060616-01	POCC - INTAKE-2	Water		10-Jun-2021 10:57	11-Jun-2021 08:00	☐
HS21060616-02	POCC - INTAKE-2-DUP	Water		10-Jun-2021 10:57	11-Jun-2021 08:00	☐
HS21060616-03	LL Mercury Duplicate	Water		10-Jun-2021 10:57	11-Jun-2021 08:00	☐
HS21060616-04	LL Mercury Field Blank	Water		10-Jun-2021 10:57	11-Jun-2021 08:00	☐

Client: Parsons
Project: Parsons - POCC Flow
Work Order: HS21060616

CASE NARRATIVE

Work Order Comments

- Revision I - This report was revised to report down to the MDL.

  Revision 2 - This report was revised June 23, 2021 in order to report to the MDL for Metals and to the PQL for all other parameters.

- The analyses for Mercury & Cyanide was subcontracted to ALS Environmental in Holland, MI.

ECD Organics by Method E608

Batch ID: 166899

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

GCMS Semivolatiles by Method E625

Batch ID: 166779

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

GCMS Volatiles by Method E624

Batch ID: R385320

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

Metals by Method Calculation

Batch ID: R385823

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

Metals by Method E200.8

Batch ID: 166963

Sample ID: POCC - INTAKE-2-DUP (HS21060616-02)

- Sample ran at 10x due to high concentration of Sodium.

Sample ID: HS21060860-06MS

- MS and MSD are for an unrelated sample

Batch ID: 166918

Sample ID: POCC - INTAKE-2 (HS21060616-01)

- Sample ran at 10x due to high concentration of Sodium.

Sample ID: POCC - INTAKE-2 (HS21060616-01MSD)

- The MS and/or MSD recovery was outside of the control limits; however, the result in the parent sample is greater than 4x the spike amount. (Calcium,Magnesium,Potassium,Sodium)

Client: Parsons
Project: Parsons - POCC Flow
Work Order: HS21060616

CASE NARRATIVE

Wet Chemistry by Method E300

Batch ID: R385507

Sample ID: HS21060629-14MS

- MS and MSD are for an unrelated sample

WetChemistry by Method E300

Batch ID: R385507

Sample ID: HS21060629-04MS

- MS and MSD are for an unrelated sample

WetChemistry by Method E410.4

Batch ID: R385686

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method E415.1

Batch ID: R385728

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method M2540C

Batch ID: R385846

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method M4500-N C

Batch ID: R385851

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method E1664A

Batch ID: R385769

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method M2540D

Batch ID: R385691

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method SM2320B

Batch ID: R385528

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

Client: Parsons
Project: Parsons - POCC Flow
Work Order: HS21060616

CASE NARRATIVE

WetChemistry by Method SM2120B

Batch ID: R385443

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method M3500-Cr B

Batch ID: R385395

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method E365.3

Batch ID: 167030

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method SM4500 S2-D

Batch ID: 166930

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method SM4500 NH3-B-F

Batch ID: 167044

Sample ID: HS21060746-01MS

- MS and MSD are for an unrelated sample

WetChemistry by Method M4500 NH3 D

Batch ID: 166904

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method SM5540C

Batch ID: 166809

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

WetChemistry by Method SM5210 B

Batch ID: 166804,166807

- The test results meet requirements of the current NELAP standards, state requirements or programs where applicable.

Client:	Parsons	**ANALYTICAL REPORT**	
Project:	Parsons - POCC Flow	WorkOrder:HS21060616	
Sample ID:	POCC - INTAKE-2	Lab ID:HS21060616-01	
Collection Date:	10-Jun-2021 10:57	Matrix:Water	

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
VOLATILES		**Method:E624**				Analyst: PC
1,1,1-Trichloroethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
1,1,2,2-Tetrachloroethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
1,1,2-Trichloroethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
1,1-Dichloroethene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
1,2-Dibromoethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
1,2-Dichlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
1,2-Dichloroethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
1,2-Dichloropropane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
1,3-Dichlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
1,4-Dichlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
2-Butanone	< 10.0		10.0	ug/L	1	11-Jun-2021 14:29
Acrylonitrile	< 10.0		10.0	ug/L	1	11-Jun-2021 14:29
Benzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Bromodichloromethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Bromoform	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Carbon tetrachloride	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Chlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Chloroform	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Dibromochloromethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Ethylbenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Hexachlorobutadiene	< 5.00	n	5.00	ug/L	1	11-Jun-2021 14:29
Methylene chloride	< 10.0		10.0	ug/L	1	11-Jun-2021 14:29
Tetrachloroethene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Toluene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Trichloroethene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Vinyl chloride	< 2.00		2.00	ug/L	1	11-Jun-2021 14:29
1,3-Dichloropropene, Total	< 5.00		5.00	ug/L	1	11-Jun-2021 14:29
Total Trihalomethanes (TTHMs)	< 5.00	a	5.00	ug/L	1	11-Jun-2021 14:29
Surr: 1,2-Dichloroethane-d4	*107*		*70-126*	*%REC*	*1*	*11-Jun-2021 14:29*
Surr: 4-Bromofluorobenzene	*95.9*		*82-124*	*%REC*	*1*	*11-Jun-2021 14:29*
Surr: Dibromofluoromethane	*98.7*		*77-123*	*%REC*	*1*	*11-Jun-2021 14:29*
Surr: Toluene-d8	*97.6*		*82-127*	*%REC*	*1*	*11-Jun-2021 14:29*

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**
Project:	Parsons - POCC Flow	WorkOrder:HS21060616
Sample ID:	POCC - INTAKE-2	Lab ID:HS21060616-01
Collection Date:	10-Jun-2021 10:57	Matrix:Water

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
SEMIVOLATILE		**Method:E625**		Prep:E625 / 11-Jun-2021		Analyst: GEY
1,2,4,5-Tetrachlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
2,4,5-Trichlorophenol	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
2,4-Dimethylphenol	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
2-Methylphenol	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
3&4-Methylphenol	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
3,3´-Dichlorobenzidine	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Anthracene	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Benz(a)anthracene	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Benzidine	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Benzo(a)pyrene	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Bis(2-chloroethyl)ether	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Bis(2-ethylhexyl)phthalate	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Chrysene	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Di-n-butyl phthalate	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Hexachlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Hexachlorocyclopentadiene	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Hexachloroethane	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
N-Nitroso-di-n-butylamine	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
N-Nitrosodiethylamine	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Nitrobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Nonylphenol	< 5.00	n	5.00	ug/L	1	11-Jun-2021 15:40
Pentachlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Pentachlorophenol	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Phenanthrene	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Pyridine	< 5.00		5.00	ug/L	1	11-Jun-2021 15:40
Surr: 2,4,6-Tribromophenol	*57.9*		*42-124*	*%REC*	*1*	*11-Jun-2021 15:40*
Surr: 2-Fluorobiphenyl	*61.3*		*48-120*	*%REC*	*1*	*11-Jun-2021 15:40*
Surr: 2-Fluorophenol	*42.9*		*20-120*	*%REC*	*1*	*11-Jun-2021 15:40*
Surr: 4-Terphenyl-d14	*94.0*		*51-135*	*%REC*	*1*	*11-Jun-2021 15:40*
Surr: Nitrobenzene-d5	*59.4*		*41-120*	*%REC*	*1*	*11-Jun-2021 15:40*
Surr: Phenol-d6	*42.0*		*20-120*	*%REC*	*1*	*11-Jun-2021 15:40*

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**	
Project:	Parsons - POCC Flow	WorkOrder:HS21060616	
Sample ID:	POCC - INTAKE-2	Lab ID:HS21060616-01	
Collection Date:	10-Jun-2021 10:57	Matrix:Water	

ANALYSES	RESULT	QUAL	MDL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
CHLORINATED PEST/PCBS BY E608		**Method:E608**			Prep:E608 / 15-Jun-2021		Analyst: JBA
Aroclor 1016	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:25
Aroclor 1221	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:25
Aroclor 1232	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:25
Aroclor 1242	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:25
Aroclor 1248	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:25
Aroclor 1254	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:25
Aroclor 1260	< 0.0125			0.0125	ug/L	1	15-Jun-2021 16:25
Surr: Decachlorobiphenyl	*72.5*			*61-154*	*%REC*	*1*	*15-Jun-2021 16:25*
Surr: Tetrachloro-m-xylene	*63.9*			*60-144*	*%REC*	*1*	*15-Jun-2021 16:25*
TRIVALENT CHROMIUM		**Method:Calculation**					Analyst: JHD
Chromium, Trivalent	< 0.0100	n		0.0100	mg/L	1	18-Jun-2021 12:18
TOTAL METALS BY E200.8		**Method:E200.8**			Prep:E200.8 / 16-Jun-2021		Analyst: JHD
Aluminum	**122**		**8.00**	**100**	**ug/L**	10	17-Jun-2021 15:49
Antimony	< 5.30		5.30	50.0	ug/L	10	17-Jun-2021 15:49
Arsenic	< 2.50		2.50	20.0	ug/L	10	17-Jun-2021 15:49
Barium	**20.8**	J	**0.840**	**40.0**	**ug/L**	10	17-Jun-2021 15:49
Beryllium	< 0.910		0.910	50.0	ug/L	10	17-Jun-2021 15:49
Boron	**3,710**		**167**	**200**	**ug/L**	10	17-Jun-2021 15:49
Cadmium	< 0.770		0.770	20.0	ug/L	10	17-Jun-2021 15:49
Calcium	**352,000**		**180**	**5000**	**ug/L**	10	17-Jun-2021 15:49
Chromium	< 2.51		2.51	40.0	ug/L	10	17-Jun-2021 15:49
Cobalt	< 0.400		0.400	50.0	ug/L	10	17-Jun-2021 15:49
Copper	**1.80**	J	**1.70**	**20.0**	**ug/L**	10	17-Jun-2021 15:49
Iron	< 500		500	2000	ug/L	10	17-Jun-2021 15:49
Lead	< 1.20		1.20	20.0	ug/L	10	17-Jun-2021 15:49
Magnesium	**1,060,000**		**78.0**	**5000**	**ug/L**	10	17-Jun-2021 15:49
Manganese	**8.29**	J	**0.660**	**50.0**	**ug/L**	10	17-Jun-2021 15:49
Molybdenum	**9.27**	J	**4.90**	**50.0**	**ug/L**	10	17-Jun-2021 15:49
Nickel	**1.69**	J	**1.10**	**20.0**	**ug/L**	10	17-Jun-2021 15:49
Potassium	**320,000**		**330**	**5000**	**ug/L**	10	17-Jun-2021 15:49
Selenium	< 8.60		8.60	20.0	ug/L	10	17-Jun-2021 15:49
Silver	< 0.440		0.440	20.0	ug/L	10	17-Jun-2021 15:49
Sodium	**9,780,000**		**21000**	**200000**	**ug/L**	1000	17-Jun-2021 16:13
Thallium	< 2.50		2.50	20.0	ug/L	10	17-Jun-2021 15:49
Tin	< 0.580		0.580	50.0	ug/L	10	17-Jun-2021 15:49
Titanium	**6.66**	J	**3.90**	**50.0**	**ug/L**	10	17-Jun-2021 15:49
Zinc	< 10.0		10.0	40.0	ug/L	10	17-Jun-2021 15:49
OIL & GREASE (HEM) BY E1664A		**Method:E1664A**					Analyst: KAH
Oil and Grease	**2.58**			**2.00**	**mg/L**	1	17-Jun-2021 14:00

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**	
Project:	Parsons - POCC Flow	WorkOrder:HS21060616	
Sample ID:	POCC - INTAKE-2	Lab ID:HS21060616-01	
Collection Date:	10-Jun-2021 10:57	Matrix:Water	

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
ANIONS BY E300.0		**Method:E300**				Analyst: YP
Bromide	**49.8**		**5.00**	**mg/L**	50	11-Jun-2021 17:55
Chloride	**16,200**		**500**	**mg/L**	1000	12-Jun-2021 13:51
Fluoride	< 5.00		5.00	mg/L	50	11-Jun-2021 17:55
Nitrogen, Nitrate (As N)	< 5.00		5.00	mg/L	50	11-Jun-2021 17:55
Nitrogen, Nitrite (As N)	< 5.00		5.00	mg/L	50	11-Jun-2021 17:55
Nitrate/Nitrite (as N)	< 10.0		10.0	mg/L	50	11-Jun-2021 17:55
Sulfate	**2,350**		**25.0**	**mg/L**	50	11-Jun-2021 17:55
PHOSPHORUS BY E365.3		**Method:E365.3**		Prep:E365.3 / 17-Jun-2021		Analyst: KVL
Phosphorus, Total (As P)	< 0.0500		0.0500	mg/L	1	17-Jun-2021 17:45
CHEMICAL OXYGEN DEMAND BY E410.4		**Method:E410.4**				Analyst: TH
Chemical Oxygen Demand	**55.0**		**15.0**	**mg/L**	1	16-Jun-2021 15:00
TOTAL ORGANIC CARBON BY E415.1		**Method:E415.1**				Analyst: JAC
Organic Carbon, Total	**2.08**		**1.00**	**mg/L**	1	16-Jun-2021 18:49
TOTAL DISSOLVED SOLIDS BY SM2540C		**Method:M2540C**				Analyst: KAH
Total Dissolved Solids (Residue, Filterable)	**33,800**		**10.0**	**mg/L**	1	17-Jun-2021 17:40
TOTAL SUSPENDED SOLIDS BY SM 2540D		**Method:M2540D**				Analyst: KAH
Suspended Solids (Residue, Non -Filterable)	**6.70**		**2.00**	**mg/L**	1	16-Jun-2021 09:50
HEXAVALENT CHROMIUM BY SM3500-CR B		**Method:M3500-Cr B**				Analyst: KVL
Chromium, Hexavalent	< 0.0200		0.0200	mg/L	1	11-Jun-2021 10:20
TOTAL KJELDAHL NITROGEN BY SM4500 NH3 D		**Method:M4500 NH3 D**		Prep:M4500-N C / 15-Jun-2021		Analyst: KVL
Nitrogen, Total Kjeldahl	< 0.50		0.50	mg/L	1	15-Jun-2021 13:00
ORGANIC NITROGEN BY SM4500-N C		**Method:M4500-N C**				Analyst: KVL
Nitrogen, Organic	< 0.50	n	0.50	mg/L	1	18-Jun-2021 15:38
COLOR BY SM 2120B - 2011		**Method:SM2120B**				Analyst: JAC
Color, Apparent	**15.0**		**5.00**	**Color Units**	1	11-Jun-2021 16:00
pH	7		0.100	pH Units	1	11-Jun-2021 16:00
ALKALINITY BY SM2320B		**Method:SM2320B**				Analyst: TH
Alkalinity, Bicarbonate (As CaCO3)	**119**		**5.00**	**mg/L**	1	14-Jun-2021 20:08
Alkalinity, Carbonate (As CaCO3)	< 5.00		5.00	mg/L	1	14-Jun-2021 20:08
Alkalinity, Hydroxide (As CaCO3)	< 5.00		5.00	mg/L	1	14-Jun-2021 20:08
Alkalinity, Total (As CaCO3)	**119**		**5.00**	**mg/L**	1	14-Jun-2021 20:08
AMMONIA AS N BY SM4500 NH3-B-F		**Method:SM4500 NH3-B-F**		Prep:M4500-NH3 B / 18-Jun-2021		Analyst: KVL
Nitrogen, Ammonia (as N)	< 0.050		0.050	mg/L	1	18-Jun-2021 15:00
SULFIDE METHYLENE BLUE BY SM4500 S2- D		**Method:SM4500 S2-D**		Prep:SM4500 S2-D / 15-Jun-2021		Analyst: KVL
Sulfide	< 0.0500		0.0500	mg/L	1	15-Jun-2021 16:40

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons		**ANALYTICAL REPORT**
Project:	Parsons - POCC Flow		WorkOrder:HS21060616
Sample ID:	POCC - INTAKE-2		Lab ID:HS21060616-01
Collection Date:	10-Jun-2021 10:57		Matrix:Water

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
BOD		**Method:SM5210 B**		Prep:SM5210 B / 11-Jun-2021		Analyst: TH
Biochemical Oxygen Demand	< 2.00		2.00	mg/L	1	16-Jun-2021 10:58
CBOD		**Method:SM5210 B**		Prep:SM5210 B / 11-Jun-2021		Analyst: TH
Carbonaceous Biochemical Oxygen Demand	**2.18**		**2.00**	**mg/L**	1	16-Jun-2021 12:02
SURFACTANTS (MBAS) BY SM5540C		**Method:SM5540C**		Prep:SM5540C / 11-Jun-2021		Analyst: TH
MBAS	< 0.0500		0.0500	mg/L 340 MW LAS	1	11-Jun-2021 18:12
SUB ANALYSIS AVAILABLE CYANIDE - EPA OIA-1667		**Method:NA**				Analyst: SUB
Subcontract Analysis	See Attached			NA	1	17-Jun-2021 12:53
SUBCONTRACT ANALYSIS - MERCURY LOW		**Method:NA**				Analyst: SUB
Subcontract Analysis	See Attached			NA	1	17-Jun-2021 12:53

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**	
Project:	Parsons - POCC Flow	WorkOrder:HS21060616	
Sample ID:	POCC - INTAKE-2-DUP	Lab ID:HS21060616-02	
Collection Date:	10-Jun-2021 10:57	Matrix:Water	

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
VOLATILES		**Method:E624**				Analyst: PC
1,1,1-Trichloroethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
1,1,2,2-Tetrachloroethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
1,1,2-Trichloroethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
1,1-Dichloroethene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
1,2-Dibromoethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
1,2-Dichlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
1,2-Dichloroethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
1,2-Dichloropropane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
1,3-Dichlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
1,4-Dichlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
2-Butanone	< 10.0		10.0	ug/L	1	11-Jun-2021 14:50
Acrylonitrile	< 10.0		10.0	ug/L	1	11-Jun-2021 14:50
Benzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Bromodichloromethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Bromoform	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Carbon tetrachloride	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Chlorobenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Chloroform	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Dibromochloromethane	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Ethylbenzene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Hexachlorobutadiene	< 5.00	n	5.00	ug/L	1	11-Jun-2021 14:50
Methylene chloride	< 10.0		10.0	ug/L	1	11-Jun-2021 14:50
Tetrachloroethene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Toluene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Trichloroethene	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Vinyl chloride	< 2.00		2.00	ug/L	1	11-Jun-2021 14:50
1,3-Dichloropropene, Total	< 5.00		5.00	ug/L	1	11-Jun-2021 14:50
Total Trihalomethanes (TTHMs)	< 5.00	a	5.00	ug/L	1	11-Jun-2021 14:50
Surr: 1,2-Dichloroethane-d4	*105*		*70-126*	*%REC*	*1*	*11-Jun-2021 14:50*
Surr: 4-Bromofluorobenzene	*99.2*		*82-124*	*%REC*	*1*	*11-Jun-2021 14:50*
Surr: Dibromofluoromethane	*96.8*		*77-123*	*%REC*	*1*	*11-Jun-2021 14:50*
Surr: Toluene-d8	*96.9*		*82-127*	*%REC*	*1*	*11-Jun-2021 14:50*

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**
Project:	Parsons - POCC Flow	WorkOrder:HS21060616
Sample ID:	POCC - INTAKE-2-DUP	Lab ID:HS21060616-02
Collection Date:	10-Jun-2021 10:57	Matrix:Water

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
SEMIVOLATILE		**Method:E625**		Prep:E625 / 11-Jun-2021		Analyst: GEY
1,2,4,5-Tetrachlorobenzene	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
2,4,5-Trichlorophenol	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
2,4-Dimethylphenol	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
2-Methylphenol	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
3&4-Methylphenol	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
3,3´-Dichlorobenzidine	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Anthracene	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Benz(a)anthracene	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Benzidine	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Benzo(a)pyrene	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Bis(2-chloroethyl)ether	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Bis(2-ethylhexyl)phthalate	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Chrysene	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Di-n-butyl phthalate	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Hexachlorobenzene	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Hexachlorocyclopentadiene	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Hexachloroethane	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
N-Nitroso-di-n-butylamine	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
N-Nitrosodiethylamine	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Nitrobenzene	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Nonylphenol	< 5.00	n	5.00	ug/L	1	15-Jun-2021 17:18
Pentachlorobenzene	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Pentachlorophenol	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Phenanthrene	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Pyridine	< 5.00		5.00	ug/L	1	15-Jun-2021 17:18
Surr: 2,4,6-Tribromophenol	*72.6*		*42-124*	*%REC*	*1*	*15-Jun-2021 17:18*
Surr: 2-Fluorobiphenyl	*77.0*		*48-120*	*%REC*	*1*	*15-Jun-2021 17:18*
Surr: 2-Fluorophenol	*49.1*		*20-120*	*%REC*	*1*	*15-Jun-2021 17:18*
Surr: 4-Terphenyl-d14	*80.9*		*51-135*	*%REC*	*1*	*15-Jun-2021 17:18*
Surr: Nitrobenzene-d5	*70.7*		*41-120*	*%REC*	*1*	*15-Jun-2021 17:18*
Surr: Phenol-d6	*57.1*		*20-120*	*%REC*	*1*	*15-Jun-2021 17:18*

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**	
Project:	Parsons - POCC Flow	WorkOrder:HS21060616	
Sample ID:	POCC - INTAKE-2-DUP	Lab ID:HS21060616-02	
Collection Date:	10-Jun-2021 10:57	Matrix:Water	

ANALYSES	RESULT	QUAL	MDL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
CHLORINATED PEST/PCBS BY E608		**Method:E608**			Prep:E608 / 15-Jun-2021		Analyst: JBA
Aroclor 1016	< 0.0125			0.0125	ug/L	1	15-Jun-2021 17:21
Aroclor 1221	< 0.0125			0.0125	ug/L	1	15-Jun-2021 17:21
Aroclor 1232	< 0.0125			0.0125	ug/L	1	15-Jun-2021 17:21
Aroclor 1242	< 0.0125			0.0125	ug/L	1	15-Jun-2021 17:21
Aroclor 1248	< 0.0125			0.0125	ug/L	1	15-Jun-2021 17:21
Aroclor 1254	< 0.0125			0.0125	ug/L	1	15-Jun-2021 17:21
Aroclor 1260	< 0.0125			0.0125	ug/L	1	15-Jun-2021 17:21
Surr: Decachlorobiphenyl	*83.4*			*61-154*	*%REC*	*1*	*15-Jun-2021 17:21*
Surr: Tetrachloro-m-xylene	*115*			*60-144*	*%REC*	*1*	*15-Jun-2021 17:21*
TRIVALENT CHROMIUM		**Method:Calculation**					Analyst: JHD
Chromium, Trivalent	< 0.0100	n		0.0100	mg/L	1	18-Jun-2021 12:18
TOTAL METALS BY E200.8		**Method:E200.8**			Prep:E200.8 / 17-Jun-2021		Analyst: JHD
Aluminum	**183**		**8.00**	**100**	**ug/L**	10	17-Jun-2021 13:42
Antimony	< 5.30		5.30	50.0	ug/L	10	17-Jun-2021 13:42
Arsenic	**3.28**	J	**2.50**	**20.0**	**ug/L**	10	17-Jun-2021 13:42
Barium	**21.0**	J	**0.840**	**40.0**	**ug/L**	10	17-Jun-2021 13:42
Beryllium	< 0.910		0.910	50.0	ug/L	10	17-Jun-2021 13:42
Boron	**3,950**		**167**	**200**	**ug/L**	10	17-Jun-2021 13:42
Cadmium	< 0.770		0.770	20.0	ug/L	10	17-Jun-2021 13:42
Calcium	**382,000**		**180**	**5000**	**ug/L**	10	17-Jun-2021 13:42
Chromium	< 2.51		2.51	40.0	ug/L	10	17-Jun-2021 13:42
Cobalt	< 0.400		0.400	50.0	ug/L	10	17-Jun-2021 13:42
Copper	**2.34**	J	**1.70**	**20.0**	**ug/L**	10	17-Jun-2021 13:42
Iron	< 500		500	2000	ug/L	10	17-Jun-2021 13:42
Lead	< 1.20		1.20	20.0	ug/L	10	17-Jun-2021 13:42
Magnesium	**1,160,000**		**78.0**	**5000**	**ug/L**	10	17-Jun-2021 13:42
Manganese	**7.05**	J	**0.660**	**50.0**	**ug/L**	10	17-Jun-2021 13:42
Molybdenum	**9.82**	J	**4.90**	**50.0**	**ug/L**	10	17-Jun-2021 13:42
Nickel	**2.37**	J	**1.10**	**20.0**	**ug/L**	10	17-Jun-2021 13:42
Potassium	**347,000**		**330**	**5000**	**ug/L**	10	17-Jun-2021 13:42
Selenium	< 8.60		8.60	20.0	ug/L	10	17-Jun-2021 13:42
Silver	< 0.440		0.440	20.0	ug/L	10	17-Jun-2021 13:42
Sodium	**9,520,000**		**21000**	**200000**	**ug/L**	1000	17-Jun-2021 14:15
Thallium	< 2.50		2.50	20.0	ug/L	10	17-Jun-2021 13:42
Tin	< 0.580		0.580	50.0	ug/L	10	17-Jun-2021 13:42
Titanium	< 3.90		3.90	50.0	ug/L	10	17-Jun-2021 13:42
Zinc	< 10.0		10.0	40.0	ug/L	10	17-Jun-2021 13:42
OIL & GREASE (HEM) BY E1664A		**Method:E1664A**					Analyst: KAH
Oil and Grease	< 2.00			2.00	mg/L	1	17-Jun-2021 14:00

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**	
Project:	Parsons - POCC Flow	WorkOrder:HS21060616	
Sample ID:	POCC - INTAKE-2-DUP	Lab ID:HS21060616-02	
Collection Date:	10-Jun-2021 10:57	Matrix:Water	

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
ANIONS BY E300.0		**Method:E300**				Analyst: YP
Bromide	**51.2**		**5.00**	**mg/L**	50	11-Jun-2021 18:25
Chloride	**17,000**		**500**	**mg/L**	1000	12-Jun-2021 04:38
Fluoride	< 5.00		5.00	mg/L	50	11-Jun-2021 18:25
Nitrogen, Nitrate (As N)	< 5.00		5.00	mg/L	50	11-Jun-2021 18:25
Nitrogen, Nitrite (As N)	< 5.00		5.00	mg/L	50	11-Jun-2021 18:25
Nitrate/Nitrite (as N)	< 10.0		10.0	mg/L	50	11-Jun-2021 18:25
Sulfate	**2,360**		**25.0**	**mg/L**	50	11-Jun-2021 18:25
PHOSPHORUS BY E365.3		**Method:E365.3**		Prep:E365.3 / 17-Jun-2021		Analyst: KVL
Phosphorus, Total (As P)	< 0.0500		0.0500	mg/L	1	17-Jun-2021 17:45
CHEMICAL OXYGEN DEMAND BY E410.4		**Method:E410.4**				Analyst: TH
Chemical Oxygen Demand	**53.0**		**15.0**	**mg/L**	1	16-Jun-2021 15:00
TOTAL ORGANIC CARBON BY E415.1		**Method:E415.1**				Analyst: JAC
Organic Carbon, Total	**2.02**		**1.00**	**mg/L**	1	16-Jun-2021 19:13
TOTAL DISSOLVED SOLIDS BY SM2540C		**Method:M2540C**				Analyst: KAH
Total Dissolved Solids (Residue, Filterable)	**34,000**		**10.0**	**mg/L**	1	17-Jun-2021 17:40
TOTAL SUSPENDED SOLIDS BY SM 2540D		**Method:M2540D**				Analyst: KAH
Suspended Solids (Residue, Non -Filterable)	**7.00**		**2.00**	**mg/L**	1	16-Jun-2021 09:50
HEXAVALENT CHROMIUM BY SM3500-CR B		**Method:M3500-Cr B**				Analyst: KVL
Chromium, Hexavalent	< 0.0200		0.0200	mg/L	1	11-Jun-2021 10:21
TOTAL KJELDAHL NITROGEN BY SM4500 NH3 D		**Method:M4500 NH3 D**		Prep:M4500-N C / 15-Jun-2021		Analyst: KVL
Nitrogen, Total Kjeldahl	< 0.50		0.50	mg/L	1	15-Jun-2021 13:00
ORGANIC NITROGEN BY SM4500-N C		**Method:M4500-N C**				Analyst: KVL
Nitrogen, Organic	< 0.50	n	0.50	mg/L	1	18-Jun-2021 15:38
COLOR BY SM 2120B - 2011		**Method:SM2120B**				Analyst: JAC
Color, Apparent	**15.0**		**5.00**	**Color Units**	1	11-Jun-2021 16:00
pH	7		0.100	pH Units	1	11-Jun-2021 16:00
ALKALINITY BY SM2320B		**Method:SM2320B**				Analyst: TH
Alkalinity, Bicarbonate (As CaCO3)	**120**		**5.00**	**mg/L**	1	14-Jun-2021 20:14
Alkalinity, Carbonate (As CaCO3)	< 5.00		5.00	mg/L	1	14-Jun-2021 20:14
Alkalinity, Hydroxide (As CaCO3)	< 5.00		5.00	mg/L	1	14-Jun-2021 20:14
Alkalinity, Total (As CaCO3)	**120**		**5.00**	**mg/L**	1	14-Jun-2021 20:14
AMMONIA AS N BY SM4500 NH3-B-F		**Method:SM4500 NH3-B-F**		Prep:M4500-NH3 B / 18-Jun-2021		Analyst: KVL
Nitrogen, Ammonia (as N)	< 0.050		0.050	mg/L	1	18-Jun-2021 15:00
SULFIDE METHYLENE BLUE BY SM4500 S2- D		**Method:SM4500 S2-D**		Prep:SM4500 S2-D / 15-Jun-2021		Analyst: KVL
Sulfide	< 0.0500		0.0500	mg/L	1	15-Jun-2021 16:40

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons		**ANALYTICAL REPORT**
Project:	Parsons - POCC Flow	WorkOrder:	HS21060616
Sample ID:	POCC - INTAKE-2-DUP	Lab ID:	HS21060616-02
Collection Date:	10-Jun-2021 10:57	Matrix:	Water

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
BOD		**Method:SM5210 B**		Prep:SM5210 B / 11-Jun-2021		Analyst: TH
Biochemical Oxygen Demand	< 2.00		2.00	mg/L	1	16-Jun-2021 10:58
CBOD		**Method:SM5210 B**		Prep:SM5210 B / 11-Jun-2021		Analyst: TH
Carbonaceous Biochemical Oxygen Demand	< 2.00		2.00	mg/L	1	16-Jun-2021 12:02
SURFACTANTS (MBAS) BY SM5540C		**Method:SM5540C**		Prep:SM5540C / 11-Jun-2021		Analyst: TH
MBAS	< 0.0500		0.0500	mg/L 340 MW LAS	1	11-Jun-2021 18:12
SUB ANALYSIS AVAILABLE CYANIDE - EPA OIA-1667		**Method:NA**				Analyst: SUB
Subcontract Analysis	See Attached			NA	1	17-Jun-2021 12:53
SUBCONTRACT ANALYSIS - MERCURY LOW		**Method:NA**				Analyst: SUB
Subcontract Analysis	See Attached			NA	1	17-Jun-2021 12:53

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

Client:	Parsons	**ANALYTICAL REPORT**
Project:	Parsons - POCC Flow	WorkOrder:HS21060616
Sample ID:	LL Mercury Field Blank	Lab ID:HS21060616-04
Collection Date:	10-Jun-2021 10:57	Matrix:Water

ANALYSES	RESULT	QUAL	REPORT LIMIT	UNITS	DILUTION FACTOR	DATE ANALYZED
SUBCONTRACT ANALYSIS - MERCURY LOW		**Method:NA**				Analyst: SUB
Subcontract Analysis	See Attached			NA	1	17-Jun-2021 12:53

Note: See Qualifiers Page for a list of qualifiers and their explanation. **Revision:** 2

RIGHT SOLUTIONS | RIGHT PARTNER

Weight / Prep Log

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

Batch ID: 166779 **Start Date:** 11 Jun 2021 07:00 **End Date:** 11 Jun 2021 14:00
Method: 625 AQ SEP FUNNEL EXTRACTION **Prep Code:** 625PRF

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060616-01	1	1000 (mL)	1 (mL)	0.001	1-liter amber glass, Neat
HS21060616-02	1	1000 (mL)	1 (mL)	0.001	1-liter amber glass, Neat

Batch ID: 166804 **Start Date:** 11 Jun 2021 14:30 **End Date:**
Method: WETCHEMPREP, BOD **Prep Code:** BOD_PR 5210B

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060616-01		300 (mL)	300 (mL)	1	1-L plastic, Neat
HS21060616-02		300 (mL)	300 (mL)	1	1-L plastic, Neat

Batch ID: 166807 **Start Date:** 11 Jun 2021 15:30 **End Date:**
Method: CBOD PREP **Prep Code:** CBOD_PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060616-01		300 (mL)	300 (mL)	1	1-L plastic, Neat
HS21060616-02		300 (mL)	300 (mL)	1	1-L plastic, Neat

Batch ID: 166809 **Start Date:** 11 Jun 2021 16:30 **End Date:**
Method: MBAS - PREPARATION **Prep Code:** MBAS_PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060616-01		400 (mL)	400 (mL)	1	1-liter amber glass, Neat
HS21060616-02		400 (mL)	400 (mL)	1	1-liter amber glass, Neat

Batch ID: 166899 **Start Date:** 15 Jun 2021 10:30 **End Date:** 15 Jun 2021 14:00
Method: AQPREP SEP FUNNEL: PEST/PCB **Prep Code:** 608_W_LOWPR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060616-01	1	1000 (mL)	1 (mL)	0.001	1-liter amber glass, Neat
HS21060616-02	1	1000 (mL)	1 (mL)	0.001	1-liter amber glass, Neat

Batch ID: 166904 **Start Date:** 15 Jun 2021 11:00 **End Date:** 15 Jun 2021 15:00
Method: TKN WATER - PREP **Prep Code:** TKN_W_PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060616-01		25 (mL)	50 (mL)	2	500 mL plastic, H2SO4 to pH <2
HS21060616-02		25 (mL)	50 (mL)	2	500 mL plastic, H2SO4 to pH <2

Weight / Prep Log

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

Batch ID: 166918 **Start Date:** 16 Jun 2021 09:00 **End Date:** 16 Jun 2021 13:00
Method: TOTAL METALS PREP BY EPA 200.8 **Prep Code:** 200.8PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060616-01		10 (mL)	10 (mL)	1	120 plastic HNO3

Batch ID: 166930 **Start Date:** 15 Jun 2021 15:00 **End Date:** 15 Jun 2021 16:00
Method: SULFIDE METHLYENE BLUE PREP SM4500 S2 D **Prep Code:** SULFIDE_W_METHYLENE PREP

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060616-01		50 (mL)	50 (mL)	1	500 mL plastic, NaOH/ZnAc
HS21060616-02		50 (mL)	50 (mL)	1	500 mL plastic, NaOH/ZnAc

Batch ID: 166963 **Start Date:** 17 Jun 2021 07:30 **End Date:** 17 Jun 2021 11:30
Method: TOTAL METALS PREP BY EPA 200.8 **Prep Code:** 200.8PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060616-02		10 (mL)	10 (mL)	1	120 plastic HNO3

Batch ID: 167030 **Start Date:** 17 Jun 2021 10:00 **End Date:** 17 Jun 2021 14:30
Method: PHOSPHOROUS **Prep Code:** P_TW_PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060616-01		50 (mg/L)	50 (mL)	1	500 mL plastic, H2SO4 to pH <2
HS21060616-02		50 (mg/L)	50 (mL)	1	500 mL plastic, H2SO4 to pH <2

Batch ID: 167044 **Start Date:** 18 Jun 2021 09:00 **End Date:** 18 Jun 2021 10:30
Method: NITROGEN AMMONIA - WATER - PREP **Prep Code:** NIT_AMM_W_PR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS21060616-01		25 (mL)	25 (mL)	1	500 mL plastic, H2SO4 to pH <2
HS21060616-02		25 (mL)	25 (mL)	1	500 mL plastic, H2SO4 to pH <2

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

DATES REPORT

Sample ID	Client Samp ID	Collection Date	Leachate Date	Prep Date	Analysis Date	DF
Batch ID: 166779 (0)	**Test Name :** SEMIVOLATILE				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57		11 Jun 2021 11:35	11 Jun 2021 15:40	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57		11 Jun 2021 11:35	15 Jun 2021 17:18	1
Batch ID: 166804 (0)	**Test Name :** BOD				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57		11 Jun 2021 14:30	16 Jun 2021 10:58	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57		11 Jun 2021 14:30	16 Jun 2021 10:58	1
Batch ID: 166807 (0)	**Test Name :** CBOD				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57		11 Jun 2021 15:30	16 Jun 2021 12:02	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57		11 Jun 2021 15:30	16 Jun 2021 12:02	1
Batch ID: 166809 (0)	**Test Name :** SURFACTANTS (MBAS) BY SM5540C				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57		11 Jun 2021 16:30	11 Jun 2021 18:12	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57		11 Jun 2021 16:30	11 Jun 2021 18:12	1
Batch ID: 166899 (0)	**Test Name :** CHLORINATED PEST/PCBS BY E608				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57		15 Jun 2021 13:31	15 Jun 2021 16:25	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57		15 Jun 2021 13:31	15 Jun 2021 17:21	1
Batch ID: 166904 (0)	**Test Name :** TOTAL KJELDAHL NITROGEN BY SM4500 NH3 D				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57		15 Jun 2021 11:00	15 Jun 2021 13:00	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57		15 Jun 2021 11:00	15 Jun 2021 13:00	1
Batch ID: 166918 (0)	**Test Name :** TOTAL METALS BY E200.8				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57		16 Jun 2021 13:00	17 Jun 2021 16:13	1000
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57		16 Jun 2021 13:00	17 Jun 2021 15:49	10
Batch ID: 166930 (0)	**Test Name :** SULFIDE METHYLENE BLUE BY SM4500 S2- D				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57		15 Jun 2021 15:00	15 Jun 2021 16:40	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57		15 Jun 2021 15:00	15 Jun 2021 16:40	1
Batch ID: 166963 (0)	**Test Name :** TOTAL METALS BY E200.8				**Matrix:** Water	
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57		17 Jun 2021 11:30	17 Jun 2021 14:15	1000
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57		17 Jun 2021 11:30	17 Jun 2021 13:42	10
Batch ID: 167030 (0)	**Test Name :** PHOSPHORUS BY E365.3				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57		17 Jun 2021 10:00	17 Jun 2021 17:45	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57		17 Jun 2021 10:00	17 Jun 2021 17:45	1
Batch ID: 167044 (0)	**Test Name :** AMMONIA AS N BY SM4500 NH3-B-F				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57		18 Jun 2021 09:00	18 Jun 2021 15:00	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57		18 Jun 2021 09:00	18 Jun 2021 15:00	1
Batch ID: R385320 (0)	**Test Name :** VOLATILES				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			11 Jun 2021 14:29	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			11 Jun 2021 14:50	1

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

DATES REPORT

Sample ID	Client Samp ID	Collection Date	Leachate Date	Prep Date	Analysis Date	DF
Batch ID: R385395 (0)	**Test Name :** HEXAVALENT CHROMIUM BY SM3500-CR B				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			11 Jun 2021 10:20	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			11 Jun 2021 10:21	1
Batch ID: R385443 (0)	**Test Name :** COLOR BY SM 2120B - 2011				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			11 Jun 2021 16:00	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			11 Jun 2021 16:00	1
Batch ID: R385507 (0)	**Test Name :** ANIONS BY E300.0				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			12 Jun 2021 13:51	1000
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			11 Jun 2021 17:55	50
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			12 Jun 2021 04:38	1000
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			11 Jun 2021 18:25	50
Batch ID: R385528 (0)	**Test Name :** ALKALINITY BY SM2320B				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			14 Jun 2021 20:08	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			14 Jun 2021 20:14	1
Batch ID: R385686 (0)	**Test Name :** CHEMICAL OXYGEN DEMAND BY E410.4				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			16 Jun 2021 15:00	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			16 Jun 2021 15:00	1
Batch ID: R385691 (0)	**Test Name :** TOTAL SUSPENDED SOLIDS BY SM 2540D				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			16 Jun 2021 09:50	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			16 Jun 2021 09:50	1
Batch ID: R385728 (0)	**Test Name :** TOTAL ORGANIC CARBON BY E415.1				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			16 Jun 2021 18:49	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			16 Jun 2021 19:13	1
Batch ID: R385732 (0)	**Test Name :** SUB ANALYSIS AVAILABLE CYANIDE - EPA OIA-1667				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			17 Jun 2021 12:53	1
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			17 Jun 2021 12:53	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			17 Jun 2021 12:53	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			17 Jun 2021 12:53	1
HS21060616-04	LL Mercury Field Blank	10 Jun 2021 10:57			17 Jun 2021 12:53	1
Batch ID: R385769 (0)	**Test Name :** OIL & GREASE (HEM) BY E1664A				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			17 Jun 2021 14:00	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			17 Jun 2021 14:00	1
Batch ID: R385823 (0)	**Test Name :** TRIVALENT CHROMIUM				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			18 Jun 2021 12:18	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			18 Jun 2021 12:18	1

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

DATES REPORT

Sample ID	Client Samp ID	Collection Date	Leachate Date	Prep Date	Analysis Date	DF
Batch ID: R385846 (0)	**Test Name :** TOTAL DISSOLVED SOLIDS BY SM2540C				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			17 Jun 2021 17:40	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			17 Jun 2021 17:40	1
Batch ID: R385851 (0)	**Test Name :** ORGANIC NITROGEN BY SM4500-N C				**Matrix:** Water	
HS21060616-01	POCC - INTAKE-2	10 Jun 2021 10:57			18 Jun 2021 15:38	1
HS21060616-02	POCC - INTAKE-2-DUP	10 Jun 2021 10:57			18 Jun 2021 15:38	1

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: 166899 (0) **Instrument:** ECD_13 **Method:** CHLORINATED PEST/PCBS BY E608

MBLK Sample ID: **MBLK-166899** Units: **UG/L** Analysis Date: **15-Jun-2021 17:35**
Client ID: Run ID: **ECD_13_385662** SeqNo: **6139072** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aroclor 1016	< 0.0125	0.0125								
Aroclor 1221	< 0.0125	0.0125								
Aroclor 1232	< 0.0125	0.0125								
Aroclor 1242	< 0.0125	0.0125								
Aroclor 1248	< 0.0125	0.0125								
Aroclor 1254	< 0.0125	0.0125								
Aroclor 1260	< 0.0125	0.0125								
Surr: Decachlorobiphenyl	*0.01637*	*0*	*0.02*	*0*	*81.8*	*61 - 154*				
Surr: Tetrachloro-m-xylene	*0.01594*	*0*	*0.02*	*0*	*79.7*	*60 - 144*				

LCS Sample ID: **LCS-166899** Units: **UG/L** Analysis Date: **15-Jun-2021 17:49**
Client ID: Run ID: **ECD_13_385662** SeqNo: **6139073** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aroclor 1016	0.4113	0.0125	0.5	0	82.3	54 - 138				
Aroclor 1260	0.3869	0.0125	0.5	0	77.4	57 - 136				
Surr: Decachlorobiphenyl	*0.01679*	*0*	*0.02*	*0*	*83.9*	*61 - 154*				
Surr: Tetrachloro-m-xylene	*0.01586*	*0*	*0.02*	*0*	*79.3*	*60 - 144*				

MS Sample ID: **HS21060616-01MS** Units: **UG/L** Analysis Date: **15-Jun-2021 16:39**
Client ID: **POCC - INTAKE-2** Run ID: **ECD_13_385662** SeqNo: **6139069** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aroclor 1016	0.3677	0.0125	0.5	0	73.5	54 - 138				
Aroclor 1260	0.3455	0.0125	0.5	0	69.1	57 - 136				
Surr: Decachlorobiphenyl	*0.01547*	*0*	*0.02*	*0*	*77.4*	*61 - 154*				
Surr: Tetrachloro-m-xylene	*0.01682*	*0*	*0.02*	*0*	*84.1*	*60 - 144*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166899 (0)** **Instrument:** **ECD_13** **Method:** **CHLORINATED PEST/PCBS BY E608**

MSD Sample ID: **HS21060616-01MSD** Units: **UG/L** Analysis Date: **15-Jun-2021 17:06**
Client ID: **POCC - INTAKE-2** Run ID: **ECD_13_385662** SeqNo: **6139070** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aroclor 1016	0.36	0.0125	0.5	0	72.0	54 - 138	0.3677	2.09	20	
Aroclor 1260	0.3466	0.0125	0.5	0	69.3	57 - 136	0.3455	0.316	20	
Surr: Decachlorobiphenyl	*0.0152*	*0*	*0.02*	*0*	*76.0*	*61 - 154*	*0.01547*	*1.77*	*20*	
Surr: Tetrachloro-m-xylene	*0.01673*	*0*	*0.02*	*0*	*83.6*	*60 - 144*	*0.01682*	*0.548*	*20*	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166918 (0)** **Instrument:** **ICPMS06** **Method:** **TOTAL METALS BY E200.8**

MBLK Sample ID: **MBLK-166918** Units: **ug/L** Analysis Date: **17-Jun-2021 15:35**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6141812** PrepDate: **16-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	< 10.0	10.0								
Antimony	< 5.00	5.00								
Arsenic	< 2.00	2.00								
Barium	< 4.00	4.00								
Beryllium	< 5.00	5.00								
Boron	< 20.0	20.0								
Cadmium	< 2.00	2.00								
Calcium	< 500	500								
Chromium	< 4.00	4.00								
Cobalt	< 5.00	5.00								
Copper	< 2.00	2.00								
Iron	< 200	200								
Lead	< 2.00	2.00								
Magnesium	< 500	500								
Manganese	< 5.00	5.00								
Molybdenum	< 5.00	5.00								
Nickel	< 2.00	2.00								
Potassium	< 500	500								
Selenium	< 2.00	2.00								
Silver	< 2.00	2.00								
Sodium	< 200	200								
Thallium	< 2.00	2.00								
Tin	< 5.00	5.00								
Titanium	< 5.00	5.00								
Zinc	< 4.00	4.00								

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: 166918 (0) **Instrument: ICPMS06** **Method: TOTAL METALS BY E200.8**

LCS Sample ID: **LCS-166918** Units: **ug/L** Analysis Date: **17-Jun-2021 15:37**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6141813** PrepDate: **16-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	107.3	10.0	100	0	107	85 - 115				
Antimony	49.01	5.00	50	0	98.0	85 - 115				
Arsenic	48.76	2.00	50	0	97.5	85 - 115				
Barium	51.31	4.00	50	0	103	85 - 115				
Beryllium	48.91	5.00	50	0	97.8	85 - 115				
Boron	263.5	20.0	250	0	105	85 - 115				
Cadmium	53.4	2.00	50	0	107	85 - 115				
Calcium	5244	500	5000	0	105	85 - 115				
Chromium	48.4	4.00	50	0	96.8	85 - 115				
Cobalt	48.33	5.00	50	0	96.7	85 - 115				
Copper	50.58	2.00	50	0	101	85 - 115				
Iron	4920	200	5000	0	98.4	85 - 115				
Lead	50.39	2.00	50	0	101	85 - 115				
Magnesium	5230	500	5000	0	105	85 - 115				
Manganese	48.93	5.00	50	0	97.9	85 - 115				
Molybdenum	48.56	5.00	50	0	97.1	85 - 115				
Nickel	52.65	2.00	50	0	105	85 - 115				
Potassium	5142	500	5000	0	103	85 - 115				
Selenium	51.35	2.00	50	0	103	85 - 115				
Silver	53.93	2.00	50	0	108	85 - 115				
Sodium	5170	200	5000	0	103	85 - 115				
Thallium	50.62	2.00	50	0	101	85 - 115				
Tin	105.7	5.00	100	0	106	85 - 115				
Titanium	146.3	5.00	150	0	97.5	85 - 115				

LCS Sample ID: **LCS-166918** Units: **ug/L** Analysis Date: **17-Jun-2021 16:40**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6141976** PrepDate: **16-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Zinc	55.72	4.00	50	0	111	85 - 115				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166918 (0)** **Instrument:** **ICPMS06** **Method:** **TOTAL METALS BY E200.8**

MS Sample ID: **HS21060616-01MS** Units: **ug/L** Analysis Date: **17-Jun-2021 15:51**
Client ID: **POCC - INTAKE-2** Run ID: **ICPMS06_385723** SeqNo: **6141820** PrepDate: **16-Jun-2021** DF: **10**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	228.2	100	100	121.9	106	70 - 130				
Antimony	45.38	50.0	50	0.462	89.8	70 - 130				J
Arsenic	52.55	20.0	50	2.425	100	70 - 130				
Barium	72.22	40.0	50	20.83	103	70 - 130				
Beryllium	46.51	50.0	50	-0.024	93.1	70 - 130				J
Boron	4119	200	500	3714	81.0	70 - 130				O
Cadmium	49.32	20.0	50	0.034	98.6	70 - 130				
Calcium	376500	5000	5000	351800	494	70 - 130				SO
Chromium	48.14	40.0	50	0.35	95.6	70 - 130				
Cobalt	46	50.0	50	0.105	91.8	70 - 130				J
Copper	48.69	20.0	50	1.802	93.8	70 - 130				
Iron	5015	2000	5000	114.6	98.0	70 - 130				
Lead	48.34	20.0	50	0.049	96.6	70 - 130				
Magnesium	1113000	5000	5000	1065000	968	70 - 130				SO
Manganese	56.54	50.0	50	8.287	96.5	70 - 130				
Molybdenum	62.64	50.0	50	9.268	107	70 - 130				
Nickel	49.67	20.0	50	1.689	96.0	70 - 130				
Potassium	342700	5000	5000	320500	446	70 - 130				SO
Selenium	48.4	20.0	50	0.352	96.1	70 - 130				
Silver	51.2	20.0	50	-0.111	103	70 - 130				
Sodium	9108000	2000	5000	8814000	5890	70 - 130				SEO
Thallium	47.03	20.0	50	-0.092	94.2	70 - 130				
Tin	96.21	50.0	100	0.041	96.2	70 - 130				
Titanium	153.9	50.0	150	6.656	98.1	70 - 130				
Zinc	56.55	40.0	50	6.741	99.6	70 - 130				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166918 (0)** **Instrument:** **ICPMS06** **Method:** **TOTAL METALS BY E200.8**

MSD Sample ID: **HS21060616-01MSD** Units: **ug/L** Analysis Date: **17-Jun-2021 15:55**
Client ID: **POCC - INTAKE-2** Run ID: **ICPMS06_385723** SeqNo: **6141822** PrepDate: **16-Jun-2021** DF: **10**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	201	100	100	121.9	79.1	70 - 130	228.2	12.7	20	
Antimony	46.22	50.0	50	0.462	91.5	70 - 130	45.38	0	20	J
Arsenic	53.04	20.0	50	2.425	101	70 - 130	52.55	0.93	20	
Barium	72.56	40.0	50	20.83	103	70 - 130	72.22	0.472	20	
Beryllium	47.47	50.0	50	-0.024	95.0	70 - 130	46.51	0	20	J
Boron	4113	200	500	3714	79.8	70 - 130	4119	0.151	20	O
Cadmium	49.86	20.0	50	0.034	99.7	70 - 130	49.32	1.09	20	
Calcium	382900	5000	5000	351800	622	70 - 130	376500	1.68	20	SO
Chromium	49.74	40.0	50	0.35	98.8	70 - 130	48.14	3.27	20	
Cobalt	46.75	50.0	50	0.105	93.3	70 - 130	46	0	20	J
Copper	48.08	20.0	50	1.802	92.6	70 - 130	48.69	1.25	20	
Iron	5127	2000	5000	114.6	100	70 - 130	5015	2.2	20	
Lead	49.36	20.0	50	0.049	98.6	70 - 130	48.34	2.1	20	
Magnesium	1131000	5000	5000	1065000	1330	70 - 130	1113000	1.61	20	SO
Manganese	55.1	50.0	50	8.287	93.6	70 - 130	56.54	2.58	20	
Molybdenum	62.56	50.0	50	9.268	107	70 - 130	62.64	0.142	20	
Nickel	52.09	20.0	50	1.689	101	70 - 130	49.67	4.74	20	
Potassium	347300	5000	5000	320500	537	70 - 130	342700	1.33	20	SO
Selenium	53.71	20.0	50	0.352	107	70 - 130	48.4	10.4	20	
Silver	50.84	20.0	50	-0.111	102	70 - 130	51.2	0.71	20	
Sodium	9386000	2000	5000	8814000	11400	70 - 130	9108000	3	20	SEO
Thallium	47.7	20.0	50	-0.092	95.6	70 - 130	47.03	1.42	20	
Tin	98.13	50.0	100	0.041	98.1	70 - 130	96.21	1.98	20	
Titanium	159.1	50.0	150	6.656	102	70 - 130	153.9	3.38	20	
Zinc	53.42	40.0	50	6.741	93.4	70 - 130	56.55	5.68	20	

The following samples were analyzed in this batch: HS21060616-01

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166963 (0)** **Instrument:** **ICPMS06** **Method:** **TOTAL METALS BY E200.8**

MBLK Sample ID: **MBLK-166963** Units: **ug/L** Analysis Date: **17-Jun-2021 13:16**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6140900** PrepDate: **17-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	< 10.0	10.0								
Antimony	< 5.00	5.00								
Arsenic	< 2.00	2.00								
Barium	< 4.00	4.00								
Beryllium	< 5.00	5.00								
Boron	< 20.0	20.0								
Cadmium	< 2.00	2.00								
Calcium	< 500	500								
Chromium	< 4.00	4.00								
Cobalt	< 5.00	5.00								
Copper	< 2.00	2.00								
Iron	< 200	200								
Lead	< 2.00	2.00								
Magnesium	< 500	500								
Manganese	< 5.00	5.00								
Molybdenum	< 5.00	5.00								
Nickel	< 2.00	2.00								
Potassium	< 500	500								
Selenium	< 2.00	2.00								
Silver	< 2.00	2.00								
Sodium	< 200	200								
Thallium	< 2.00	2.00								
Tin	< 5.00	5.00								
Titanium	< 5.00	5.00								
Zinc	< 4.00	4.00								

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166963 (0)** **Instrument:** **ICPMS06** **Method:** **TOTAL METALS BY E200.8**

LCS Sample ID: **LCS-166963** Units: **ug/L** Analysis Date: **17-Jun-2021 13:18**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6140901** PrepDate: **17-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	107.9	10.0	100	0	108	85 - 115				
Antimony	50.54	5.00	50	0	101	85 - 115				
Arsenic	51.03	2.00	50	0	102	85 - 115				
Barium	52.42	4.00	50	0	105	85 - 115				
Beryllium	50.92	5.00	50	0	102	85 - 115				
Boron	274.2	20.0	250	0	110	85 - 115				
Cadmium	54.58	2.00	50	0	109	85 - 115				
Calcium	5274	500	5000	0	105	85 - 115				
Chromium	50.59	4.00	50	0	101	85 - 115				
Cobalt	49.29	5.00	50	0	98.6	85 - 115				
Copper	51.44	2.00	50	0	103	85 - 115				
Iron	5147	200	5000	0	103	85 - 115				
Lead	51.35	2.00	50	0	103	85 - 115				
Magnesium	5342	500	5000	0	107	85 - 115				
Manganese	49.96	5.00	50	0	99.9	85 - 115				
Molybdenum	51.2	5.00	50	0	102	85 - 115				
Nickel	53.19	2.00	50	0	106	85 - 115				
Potassium	5225	500	5000	0	104	85 - 115				
Selenium	52.27	2.00	50	0	105	85 - 115				
Silver	56.3	2.00	50	0	113	85 - 115				
Sodium	5178	200	5000	0	104	85 - 115				
Thallium	51.01	2.00	50	0	102	85 - 115				
Tin	107.2	5.00	100	0	107	85 - 115				
Titanium	151.3	5.00	150	0	101	85 - 115				
Zinc	56.08	4.00	50	0	112	85 - 115				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166963 (0)** **Instrument:** **ICPMS06** **Method:** **TOTAL METALS BY E200.8**

MS Sample ID: **HS21060860-06MS** Units: **ug/L** Analysis Date: **17-Jun-2021 14:11**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6141137** PrepDate: **17-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	113	10.0	100	6.759	106	70 - 130				
Antimony	50.81	5.00	50	0	102	70 - 130				
Arsenic	49.77	2.00	50	0	99.5	70 - 130				
Barium	53.91	4.00	50	0.555	107	70 - 130				
Beryllium	51.06	5.00	50	0	102	70 - 130				
Boron	286.6	20.0	250	0	115	70 - 130				
Cadmium	55.22	2.00	50	0	110	70 - 130				
Calcium	5245	500	5000	61.6	104	70 - 130				
Chromium	49.75	4.00	50	0	99.5	70 - 130				
Cobalt	48.61	5.00	50	0	97.2	70 - 130				
Copper	51.36	2.00	50	0	103	70 - 130				
Iron	5399	200	5000	247.8	103	70 - 130				
Lead	50.32	2.00	50	0.207	100	70 - 130				
Magnesium	5295	500	5000	17.21	106	70 - 130				
Manganese	63.67	5.00	50	6.438	114	70 - 130				
Molybdenum	51.64	5.00	50	0	103	70 - 130				
Nickel	52.94	2.00	50	0.251	105	70 - 130				
Potassium	5169	500	5000	0	103	70 - 130				
Selenium	52.79	2.00	50	0	106	70 - 130				
Silver	56.58	2.00	50	0	113	70 - 130				
Sodium	5175	200	5000	31.17	103	70 - 130				
Thallium	50.62	2.00	50	1.138	99.0	70 - 130				
Tin	104.2	5.00	100	0.211	104	70 - 130				
Titanium	147.8	5.00	150	0	98.5	70 - 130				
Zinc	2947	4.00	50	3007	-119	70 - 130				SEO

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166963 (0)** **Instrument:** **ICPMS06** **Method:** **TOTAL METALS BY E200.8**

MSD Sample ID: **HS21060860-06MSD** Units: **ug/L** Analysis Date: **17-Jun-2021 13:24**
Client ID: Run ID: **ICPMS06_385723** SeqNo: **6140904** PrepDate: **17-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Aluminum	115.8	10.0	100	6.759	109	70 - 130	113	2.47	20	
Antimony	50.27	5.00	50	0	101	70 - 130	50.81	1.08	20	
Arsenic	50.48	2.00	50	0	101	70 - 130	49.77	1.41	20	
Barium	53.71	4.00	50	0.555	106	70 - 130	53.91	0.379	20	
Beryllium	50.9	5.00	50	0	102	70 - 130	51.06	0.324	20	
Boron	286.3	20.0	250	0	115	70 - 130	286.6	0.101	20	
Cadmium	54.75	2.00	50	0	110	70 - 130	55.22	0.846	20	
Calcium	5346	500	5000	61.6	106	70 - 130	5245	1.89	20	
Chromium	50.57	4.00	50	0	101	70 - 130	49.75	1.64	20	
Cobalt	48.83	5.00	50	0	97.7	70 - 130	48.61	0.456	20	
Copper	51.48	2.00	50	0	103	70 - 130	51.36	0.224	20	
Iron	5400	200	5000	247.8	103	70 - 130	5399	0.0213	20	
Lead	50.9	2.00	50	0.207	101	70 - 130	50.32	1.15	20	
Magnesium	5212	500	5000	17.21	104	70 - 130	5295	1.57	20	
Manganese	64.31	5.00	50	6.438	116	70 - 130	63.67	1	20	
Molybdenum	51.81	5.00	50	0	104	70 - 130	51.64	0.321	20	
Nickel	53.35	2.00	50	0.251	106	70 - 130	52.94	0.771	20	
Potassium	5269	500	5000	0	105	70 - 130	5169	1.92	20	
Selenium	53	2.00	50	0	106	70 - 130	52.79	0.403	20	
Silver	56.52	2.00	50	0	113	70 - 130	56.58	0.115	20	
Sodium	5236	200	5000	31.17	104	70 - 130	5175	1.17	20	
Thallium	51.03	2.00	50	1.138	99.8	70 - 130	50.62	0.809	20	
Tin	106.4	5.00	100	0.211	106	70 - 130	104.2	2.09	20	
Titanium	150.6	5.00	150	0	100	70 - 130	147.8	1.87	20	
Zinc	2976	4.00	50	3007	-61.9	70 - 130	2947	0.965	20	SEO

The following samples were analyzed in this batch: HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166779 (0)** **Instrument:** **SV-4** **Method:** **SEMIVOLATILE**

MBLK Sample ID: **MBLK-166779** Units: **ug/L** Analysis Date: **11-Jun-2021 14:36**
Client ID: Run ID: **SV-4_385434** SeqNo: **6134820** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4,5-Tetrachlorobenzene	< 5.00	5.00								
2,4,5-Trichlorophenol	< 5.00	5.00								
2,4-Dimethylphenol	< 5.00	5.00								
2-Methylphenol	< 5.00	5.00								
3&4-Methylphenol	< 5.00	5.00								
3,3´-Dichlorobenzidine	< 5.00	5.00								
Anthracene	< 5.00	5.00								
Benz(a)anthracene	< 5.00	5.00								
Benzidine	< 5.00	5.00								
Benzo(a)pyrene	< 5.00	5.00								
Bis(2-chloroethyl)ether	< 5.00	5.00								
Bis(2-ethylhexyl)phthalate	< 5.00	5.00								
Chrysene	< 5.00	5.00								
Di-n-butyl phthalate	< 5.00	5.00								
Hexachlorobenzene	< 5.00	5.00								
Hexachlorocyclopentadiene	< 5.00	5.00								
Hexachloroethane	< 5.00	5.00								
Nitrobenzene	< 5.00	5.00								
N-Nitrosodiethylamine	< 5.00	5.00								
N-Nitroso-di-n-butylamine	< 5.00	5.00								
Nonylphenol	< 5.00	5.00								
Pentachlorobenzene	< 5.00	5.00								
Pentachlorophenol	< 5.00	5.00								
Phenanthrene	< 5.00	5.00								
Pyridine	< 5.00	5.00								
Surr: 2,4,6-Tribromophenol	*76.71*	*5.00*	*100*	*0*	*76.7*	*42 - 124*				
Surr: 2-Fluorobiphenyl	*87.87*	*5.00*	*100*	*0*	*87.9*	*48 - 120*				
Surr: 2-Fluorophenol	*74.75*	*5.00*	*100*	*0*	*74.7*	*20 - 120*				
Surr: 4-Terphenyl-d14	*89.39*	*5.00*	*100*	*0*	*89.4*	*51 - 135*				
Surr: Nitrobenzene-d5	*84.03*	*5.00*	*100*	*0*	*84.0*	*41 - 120*				
Surr: Phenol-d6	*70.75*	*5.00*	*100*	*0*	*70.7*	*20 - 120*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166779 (0)** **Instrument:** **SV-4** **Method:** **SEMIVOLATILE**

LCS Sample ID: **LCS-166779** Units: **ug/L** Analysis Date: **11-Jun-2021 13:10**
Client ID: Run ID: **SV-4_385434** SeqNo: **6134817** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4,5-Tetrachlorobenzene	66.11	5.00	100	0	66.1	49 - 120				
2,4,5-Trichlorophenol	80.58	5.00	100	0	80.6	52 - 115				
2,4-Dimethylphenol	73.57	5.00	100	0	73.6	53 - 115				
2-Methylphenol	64.86	5.00	100	0	64.9	53 - 115				
3&4-Methylphenol	86.5	5.00	100	0	86.5	48 - 115				
3,3´-Dichlorobenzidine	83.55	5.00	100	0	83.5	25 - 115				
Anthracene	80.65	5.00	100	0	80.6	65 - 115				
Benz(a)anthracene	83.89	5.00	100	0	83.9	53 - 115				
Benzidine	29.24	5.00	100	0	29.2	10 - 115				
Benzo(a)pyrene	78.66	5.00	100	0	78.7	57 - 115				
Bis(2-chloroethyl)ether	73.05	5.00	100	0	73.1	56 - 115				
Bis(2-ethylhexyl)phthalate	77.06	5.00	100	0	77.1	50 - 115				
Chrysene	78.41	5.00	100	0	78.4	52 - 120				
Di-n-butyl phthalate	87.86	5.00	100	0	87.9	54 - 115				
Hexachlorobenzene	80.28	5.00	100	0	80.3	54 - 115				
Hexachlorocyclopentadiene	60.82	5.00	100	0	60.8	48 - 115				
Hexachloroethane	73.36	5.00	100	0	73.4	54 - 115				
Nitrobenzene	72.91	5.00	100	0	72.9	40 - 124				
N-Nitrosodiethylamine	44.43	5.00	50	0	88.9	40 - 130				
N-Nitroso-di-n-butylamine	39.87	5.00	50	0	79.7	40 - 130				
Pentachlorobenzene	58.31	5.00	100	0	58.3	50 - 117				
Pentachlorophenol	85.72	5.00	100	0	85.7	45 - 125				
Phenanthrene	79.62	5.00	100	0	79.6	57 - 115				
Pyridine	59.64	5.00	100	0	59.6	34 - 115				
Surr: 2,4,6-Tribromophenol	*81.77*	*5.00*	*100*	*0*	*81.8*	*42 - 124*				
Surr: 2-Fluorobiphenyl	*83.45*	*5.00*	*100*	*0*	*83.5*	*48 - 120*				
Surr: 2-Fluorophenol	*61.8*	*5.00*	*100*	*0*	*61.8*	*20 - 120*				
Surr: 4-Terphenyl-d14	*84.19*	*5.00*	*100*	*0*	*84.2*	*51 - 135*				
Surr: Nitrobenzene-d5	*77.96*	*5.00*	*100*	*0*	*78.0*	*41 - 120*				
Surr: Phenol-d6	*58.95*	*5.00*	*100*	*0*	*58.9*	*20 - 120*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166779 (0)** **Instrument:** **SV-4** **Method:** **SEMIVOLATILE**

MS Sample ID: **HS21060616-01MS** Units: **ug/L** Analysis Date: **11-Jun-2021 16:02**
Client ID: **POCC - INTAKE-2** Run ID: **SV-4_385434** SeqNo: **6134866** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4,5-Tetrachlorobenzene	64.56	5.00	100	0	64.6	49 - 120				
2,4,5-Trichlorophenol	82.81	5.00	100	0	82.8	52 - 115				
2,4-Dimethylphenol	71.21	5.00	100	0	71.2	53 - 115				
2-Methylphenol	61.44	5.00	100	0	61.4	53 - 115				
3&4-Methylphenol	60.55	5.00	100	0	60.5	48 - 115				
3,3´-Dichlorobenzidine	88.29	5.00	100	0	88.3	25 - 115				
Anthracene	84.18	5.00	100	0	84.2	65 - 115				
Benz(a)anthracene	86.46	5.00	100	0	86.5	53 - 115				
Benzidine	32.01	5.00	100	0	32.0	10 - 115				
Benzo(a)pyrene	82.35	5.00	100	0	82.3	57 - 115				
Bis(2-chloroethyl)ether	66.07	5.00	100	0	66.1	56 - 115				
Bis(2-ethylhexyl)phthalate	83.54	5.00	100	0	83.5	50 - 115				
Chrysene	82.08	5.00	100	0	82.1	52 - 120				
Di-n-butyl phthalate	89.24	5.00	100	0	89.2	54 - 115				
Hexachlorobenzene	85.45	5.00	100	0	85.5	54 - 115				
Hexachlorocyclopentadiene	60.2	5.00	100	0	60.2	48 - 115				
Hexachloroethane	64.9	5.00	100	0	64.9	54 - 115				
Nitrobenzene	68.78	5.00	100	0	68.8	40 - 124				
N-Nitrosodiethylamine	39.74	5.00	50	0	79.5	40 - 130				
N-Nitroso-di-n-butylamine	37.14	5.00	50	0	74.3	40 - 130				
Nonylphenol	40.48	5.00	50	0	81.0	40 - 140				
Pentachlorobenzene	57.98	5.00	100	0	58.0	50 - 117				
Pentachlorophenol	88.67	5.00	100	0	88.7	45 - 125				
Phenanthrene	84.06	5.00	100	0	84.1	57 - 115				
Pyridine	49.99	5.00	100	0	50.0	34 - 115				
Surr: 2,4,6-Tribromophenol	*80.76*	*5.00*	*100*	*0*	*80.8*	*42 - 124*				
Surr: 2-Fluorobiphenyl	*84.37*	*5.00*	*100*	*0*	*84.4*	*48 - 120*				
Surr: 2-Fluorophenol	*57.42*	*5.00*	*100*	*0*	*57.4*	*20 - 120*				
Surr: 4-Terphenyl-d14	*94.76*	*5.00*	*100*	*0*	*94.8*	*51 - 135*				
Surr: Nitrobenzene-d5	*74.75*	*5.00*	*100*	*0*	*74.7*	*41 - 120*				
Surr: Phenol-d6	*57.41*	*5.00*	*100*	*0*	*57.4*	*20 - 120*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **166779 (0)** **Instrument:** **SV-4** **Method:** **SEMIVOLATILE**

MSD Sample ID: **HS21060616-01MSD** Units: **ug/L** Analysis Date: **11-Jun-2021 16:23**
Client ID: **POCC - INTAKE-2** Run ID: **SV-4_385434** SeqNo: **6134867** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4,5-Tetrachlorobenzene	59.9	5.00	100	0	59.9	49 - 120	64.56	7.5	20	
2,4,5-Trichlorophenol	80.39	5.00	100	0	80.4	52 - 115	82.81	2.97	20	
2,4-Dimethylphenol	64.91	5.00	100	0	64.9	53 - 115	71.21	9.27	20	
2-Methylphenol	56.98	5.00	100	0	57.0	53 - 115	61.44	7.52	20	
3&4-Methylphenol	55.33	5.00	100	0	55.3	48 - 115	60.55	9	20	
3,3´-Dichlorobenzidine	95.96	5.00	100	0	96.0	25 - 115	88.29	8.32	20	
Anthracene	84.5	5.00	100	0	84.5	65 - 115	84.18	0.382	20	
Benz(a)anthracene	86.29	5.00	100	0	86.3	53 - 115	86.46	0.204	20	
Benzidine	37.2	5.00	100	0	37.2	10 - 115	32.01	15	20	
Benzo(a)pyrene	83.52	5.00	100	0	83.5	57 - 115	82.35	1.41	20	
Bis(2-chloroethyl)ether	60.48	5.00	100	0	60.5	56 - 115	66.07	8.83	20	
Bis(2-ethylhexyl)phthalate	82.47	5.00	100	0	82.5	50 - 115	83.54	1.29	20	
Chrysene	84.36	5.00	100	0	84.4	52 - 120	82.08	2.73	20	
Di-n-butyl phthalate	87.9	5.00	100	0	87.9	54 - 115	89.24	1.52	20	
Hexachlorobenzene	86.49	5.00	100	0	86.5	54 - 115	85.45	1.21	20	
Hexachlorocyclopentadiene	57.22	5.00	100	0	57.2	48 - 115	60.2	5.07	20	
Hexachloroethane	61.91	5.00	100	0	61.9	54 - 115	64.9	4.73	20	
Nitrobenzene	64.64	5.00	100	0	64.6	40 - 124	68.78	6.2	20	
N-Nitrosodiethylamine	38.83	5.00	50	0	77.7	40 - 130	39.74	2.32	20	
N-Nitroso-di-n-butylamine	34.18	5.00	50	0	68.4	40 - 130	37.14	8.32	20	
Nonylphenol	42.79	5.00	50	0	85.6	40 - 140	40.48	5.55	20	
Pentachlorobenzene	55.12	5.00	100	0	55.1	50 - 117	57.98	5.05	20	
Pentachlorophenol	90.53	5.00	100	0	90.5	45 - 125	88.67	2.08	20	
Phenanthrene	83.98	5.00	100	0	84.0	57 - 115	84.06	0.0913	20	
Pyridine	46.43	5.00	100	0	46.4	34 - 115	49.99	7.38	20	
Surr: 2,4,6-Tribromophenol	*78.54*	*5.00*	*100*	*0*	*78.5*	*42 - 124*	*80.76*	*2.79*	*20*	
Surr: 2-Fluorobiphenyl	*76.08*	*5.00*	*100*	*0*	*76.1*	*48 - 120*	*84.37*	*10.3*	*20*	
Surr: 2-Fluorophenol	*53.53*	*5.00*	*100*	*0*	*53.5*	*20 - 120*	*57.42*	*7.01*	*20*	
Surr: 4-Terphenyl-d14	*92.73*	*5.00*	*100*	*0*	*92.7*	*51 - 135*	*94.76*	*2.16*	*20*	
Surr: Nitrobenzene-d5	*69.82*	*5.00*	*100*	*0*	*69.8*	*41 - 120*	*74.75*	*6.81*	*20*	
Surr: Phenol-d6	*53.5*	*5.00*	*100*	*0*	*53.5*	*20 - 120*	*57.41*	*7.06*	*20*	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Revision: 2

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **R385320 (0)** **Instrument:** **VOA9** **Method:** **VOLATILES**

MBLK Sample ID: **VBLKW-210611** Units: **ug/L** Analysis Date: **11-Jun-2021 13:25**
Client ID: Run ID: **VOA9_385320** SeqNo: **6134193** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,1,1-Trichloroethane	< 5.00	5.00								
1,1,2,2-Tetrachloroethane	< 5.00	5.00								
1,1,2-Trichloroethane	< 5.00	5.00								
1,1-Dichloroethene	< 5.00	5.00								
1,2-Dibromoethane	< 5.00	5.00								
1,2-Dichlorobenzene	< 5.00	5.00								
1,2-Dichloroethane	< 5.00	5.00								
1,2-Dichloropropane	< 5.00	5.00								
1,3-Dichlorobenzene	< 5.00	5.00								
1,4-Dichlorobenzene	< 5.00	5.00								
2-Butanone	< 10.0	10.0								
Acrylonitrile	< 10.0	10.0								
Benzene	< 5.00	5.00								
Bromodichloromethane	< 5.00	5.00								
Bromoform	< 5.00	5.00								
Carbon tetrachloride	< 5.00	5.00								
Chlorobenzene	< 5.00	5.00								
Chloroform	< 5.00	5.00								
Dibromochloromethane	< 5.00	5.00								
Ethylbenzene	< 5.00	5.00								
Hexachlorobutadiene	< 5.00	5.00								
Methylene chloride	< 10.0	10.0								
Tetrachloroethene	< 5.00	5.00								
Toluene	< 5.00	5.00								
Trichloroethene	< 5.00	5.00								
Vinyl chloride	< 2.00	2.00								
1,3-Dichloropropene, Total	< 5.00	5.00								
Total Trihalomethanes (TTHMs)	< 5.00	5.00								
Surr: 1,2-Dichloroethane-d4	*54.09*	*5.00*	*50*	*0*	*108*	*70 - 126*				
Surr: 4-Bromofluorobenzene	*50*	*5.00*	*50*	*0*	*100.0*	*82 - 124*				
Surr: Dibromofluoromethane	*49.69*	*5.00*	*50*	*0*	*99.4*	*77 - 123*				
Surr: Toluene-d8	*48.38*	*5.00*	*50*	*0*	*96.8*	*82 - 127*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **R385320 (0)** **Instrument:** **VOA9** **Method:** **VOLATILES**

LCS Sample ID: **VLCSW-210611** Units: **ug/L** Analysis Date: **11-Jun-2021 12:43**
Client ID: Run ID: **VOA9_385320** SeqNo: **6134192** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,1,1-Trichloroethane	17.44	5.00	20	0	87.2	70 - 130				
1,1,2,2-Tetrachloroethane	17.76	5.00	20	0	88.8	70 - 120				
1,1,2-Trichloroethane	19.05	5.00	20	0	95.3	77 - 113				
1,1-Dichloroethene	15.83	5.00	20	0	79.2	70 - 130				
1,2-Dibromoethane	20.7	5.00	20	0	103	76 - 123				
1,2-Dichlorobenzene	19.25	5.00	20	0	96.2	77 - 113				
1,2-Dichloroethane	21.52	5.00	20	0	108	70 - 124				
1,2-Dichloropropane	18.23	5.00	20	0	91.2	72 - 119				
1,3-Dichlorobenzene	19.18	5.00	20	0	95.9	78 - 118				
1,4-Dichlorobenzene	19.16	5.00	20	0	95.8	79 - 113				
2-Butanone	30.86	10.0	40	0	77.2	70 - 130				
Acrylonitrile	34.73	10.0	40	0	86.8	70 - 130				
Benzene	18.59	5.00	20	0	93.0	74 - 120				
Bromodichloromethane	23.36	5.00	20	0	117	74 - 122				
Bromoform	20.28	5.00	20	0	101	73 - 128				
Carbon tetrachloride	17.34	5.00	20	0	86.7	71 - 125				
Chlorobenzene	19.41	5.00	20	0	97.1	76 - 113				
Chloroform	19.09	5.00	20	0	95.4	71 - 121				
Dibromochloromethane	21.41	5.00	20	0	107	77 - 122				
Ethylbenzene	17.54	5.00	20	0	87.7	77 - 117				
Hexachlorobutadiene	17.5	5.00	20	0	87.5	70 - 130				
Methylene chloride	18.52	10.0	20	0	92.6	70 - 127				
Tetrachloroethene	18.06	5.00	20	0	90.3	76 - 119				
Toluene	17.98	5.00	20	0	89.9	77 - 118				
Trichloroethene	18.62	5.00	20	0	93.1	79 - 120				
Vinyl chloride	14.85	2.00	20	0	74.3	70 - 130				
1,3-Dichloropropene, Total	40.61	5.00	40	0	102	70 - 130				
Total Trihalomethanes (TTHMs)	84.13	5.00	80	0	105	65 - 135				
Surr: 1,2-Dichloroethane-d4	*50.1*	*5.00*	*50*	*0*	*100*	*70 - 130*				
Surr: 4-Bromofluorobenzene	*50.07*	*5.00*	*50*	*0*	*100*	*83 - 122*				
Surr: Dibromofluoromethane	*48.57*	*5.00*	*50*	*0*	*97.1*	*73 - 126*				
Surr: Toluene-d8	*49.41*	*5.00*	*50*	*0*	*98.8*	*81 - 119*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **R385320 (0)** **Instrument:** **VOA9** **Method:** **VOLATILES**

MS Sample ID: **HS21060616-01MS** Units: **ug/L** Analysis Date: **11-Jun-2021 16:36**
Client ID: **POCC - INTAKE-2** Run ID: **VOA9_385320** SeqNo: **6134199** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,1,1-Trichloroethane	24.2	5.00	20	0	121	70 - 130				
1,1,2,2-Tetrachloroethane	18.42	5.00	20	0	92.1	70 - 123				
1,1,2-Trichloroethane	19.53	5.00	20	0	97.7	70 - 117				
1,1-Dichloroethene	18.23	5.00	20	0	91.2	70 - 130				
1,2-Dibromoethane	20.87	5.00	20	0	104	70 - 124				
1,2-Dichlorobenzene	20.28	5.00	20	0	101	70 - 115				
1,2-Dichloroethane	21.44	5.00	20	0	107	70 - 127				
1,2-Dichloropropane	18.2	5.00	20	0	91.0	70 - 122				
1,3-Dichlorobenzene	20.13	5.00	20	0	101	70 - 119				
1,4-Dichlorobenzene	21.17	5.00	20	0	106	70 - 114				
2-Butanone	39.4	10.0	40	0	98.5	70 - 130				
Acrylonitrile	37.36	10.0	40	0	93.4	70 - 130				
Benzene	19.35	5.00	20	0	96.8	70 - 127				
Bromodichloromethane	22.3	5.00	20	0	112	70 - 124				
Bromoform	21.28	5.00	20	0	106	70 - 129				
Carbon tetrachloride	24	5.00	20	0	120	70 - 130				
Chlorobenzene	20.37	5.00	20	0	102	70 - 114				
Chloroform	20.06	5.00	20	0	100	70 - 125				
Dibromochloromethane	20.68	5.00	20	0	103	70 - 124				
Ethylbenzene	21.04	5.00	20	0	105	70 - 124				
Hexachlorobutadiene	22.45	5.00	20	0	112	70 - 130				
Methylene chloride	17.58	10.0	20	0	87.9	70 - 128				
Tetrachloroethene	24.6	5.00	20	0	123	70 - 130				
Toluene	19.95	5.00	20	0	99.8	70 - 123				
Trichloroethene	21.88	5.00	20	0	109	70 - 129				
Vinyl chloride	15.47	2.00	20	0	77.3	70 - 130				
1,3-Dichloropropene, Total	38.56	5.00	40	0	96.4	70 - 130				
Total Trihalomethanes (TTHMs)	84.32	5.00	80	0	105	65 - 135				
Surr: 1,2-Dichloroethane-d4	*51.47*	*5.00*	*50*	*0*	*103*	*70 - 126*				
Surr: 4-Bromofluorobenzene	*49.84*	*5.00*	*50*	*0*	*99.7*	*82 - 124*				
Surr: Dibromofluoromethane	*49.07*	*5.00*	*50*	*0*	*98.1*	*77 - 123*				
Surr: Toluene-d8	*49.26*	*5.00*	*50*	*0*	*98.5*	*82 - 127*				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **R385320 (0)** **Instrument:** **VOA9** **Method:** **VOLATILES**

MSD Sample ID: **HS21060616-01MSD** Units: **ug/L** Analysis Date: **11-Jun-2021 16:57**
Client ID: **POCC - INTAKE-2** Run ID: **VOA9_385320** SeqNo: **6134200** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,1,1-Trichloroethane	23.25	5.00	20	0	116	70 - 130	24.2	4	20	
1,1,2,2-Tetrachloroethane	18.42	5.00	20	0	92.1	70 - 123	18.42	0.018	20	
1,1,2-Trichloroethane	19	5.00	20	0	95.0	70 - 117	19.53	2.75	20	
1,1-Dichloroethene	17.72	5.00	20	0	88.6	70 - 130	18.23	2.85	20	
1,2-Dibromoethane	20.44	5.00	20	0	102	70 - 124	20.87	2.06	20	
1,2-Dichlorobenzene	19.68	5.00	20	0	98.4	70 - 115	20.28	3.02	20	
1,2-Dichloroethane	21.11	5.00	20	0	106	70 - 127	21.44	1.55	20	
1,2-Dichloropropane	17.73	5.00	20	0	88.6	70 - 122	18.2	2.65	20	
1,3-Dichlorobenzene	19.06	5.00	20	0	95.3	70 - 119	20.13	5.43	20	
1,4-Dichlorobenzene	19.95	5.00	20	0	99.8	70 - 114	21.17	5.94	20	
2-Butanone	41.11	10.0	40	0	103	70 - 130	39.4	4.23	20	
Acrylonitrile	37.48	10.0	40	0	93.7	70 - 130	37.36	0.33	20	
Benzene	18.69	5.00	20	0	93.5	70 - 127	19.35	3.47	20	
Bromodichloromethane	21.38	5.00	20	0	107	70 - 124	22.3	4.21	20	
Bromoform	20.54	5.00	20	0	103	70 - 129	21.28	3.54	20	
Carbon tetrachloride	22.29	5.00	20	0	111	70 - 130	24	7.38	20	
Chlorobenzene	19.38	5.00	20	0	96.9	70 - 114	20.37	5.01	20	
Chloroform	20.41	5.00	20	0	102	70 - 125	20.06	1.72	20	
Dibromochloromethane	20.2	5.00	20	0	101	70 - 124	20.68	2.34	20	
Ethylbenzene	19.89	5.00	20	0	99.5	70 - 124	21.04	5.62	20	
Hexachlorobutadiene	21.89	5.00	20	0	109	70 - 130	22.45	2.53	20	
Methylene chloride	17.08	10.0	20	0	85.4	70 - 128	17.58	2.91	20	
Tetrachloroethene	23.2	5.00	20	0	116	70 - 130	24.6	5.84	20	
Toluene	18.81	5.00	20	0	94.0	70 - 123	19.95	5.92	20	
Trichloroethene	21.29	5.00	20	0	106	70 - 129	21.88	2.7	20	
Vinyl chloride	14.54	2.00	20	0	72.7	70 - 130	15.47	6.17	20	
1,3-Dichloropropene, Total	37.47	5.00	40	0	93.7	70 - 130	38.56	2.85	30	
Total Trihalomethanes (TTHMs)	82.53	5.00	80	0	103	65 - 135	84.32	2.14	30	
Surr: 1,2-Dichloroethane-d4	*52.94*	*5.00*	*50*	*0*	*106*	*70 - 126*	*51.47*	*2.82*	*20*	
Surr: 4-Bromofluorobenzene	*51.01*	*5.00*	*50*	*0*	*102*	*82 - 124*	*49.84*	*2.31*	*20*	
Surr: Dibromofluoromethane	*49.44*	*5.00*	*50*	*0*	*98.9*	*77 - 123*	*49.07*	*0.75*	*20*	
Surr: Toluene-d8	*48.8*	*5.00*	*50*	*0*	*97.6*	*82 - 127*	*49.26*	*0.928*	*20*	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Revision: 2

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: 166804 (0) **Instrument: ManTech01** **Method: BOD**

MBLK Sample ID: **MBLK-166804** Units: **mg/L** Analysis Date: **16-Jun-2021 10:58**
Client ID: Run ID: **ManTech01_385615** SeqNo: **6138191** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Biochemical Oxygen Demand	< 2.00	2.00								

LCS Sample ID: **LCS-166804** Units: **mg/L** Analysis Date: **16-Jun-2021 10:58**
Client ID: Run ID: **ManTech01_385615** SeqNo: **6138190** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Biochemical Oxygen Demand	181.2	2.00	198	0	91.5	85 - 115				

DUP Sample ID: **HS21060635-01DUP** Units: **mg/L** Analysis Date: **16-Jun-2021 10:58**
Client ID: Run ID: **ManTech01_385615** SeqNo: **6138189** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Biochemical Oxygen Demand	< 2.00	2.00					0.48	0	20	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: 166807 (0) **Instrument: ManTech01** **Method: CBOD**

MBLK Sample ID: **MBLK-166807** Units: **mg/L** Analysis Date: **16-Jun-2021 12:02**
Client ID: Run ID: **ManTech01_385645** SeqNo: **6138648** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Carbonaceous Biochemical Oxygen Demand	< 2.00	2.00								

LCS Sample ID: **LCS-166807** Units: **mg/L** Analysis Date: **16-Jun-2021 12:02**
Client ID: Run ID: **ManTech01_385645** SeqNo: **6138647** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Carbonaceous Biochemical Oxygen Demand	189	2.00	198	0	95.4	85 - 115				

DUP Sample ID: **HS21060648-01DUP** Units: **mg/L** Analysis Date: **16-Jun-2021 12:02**
Client ID: Run ID: **ManTech01_385645** SeqNo: **6138646** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Carbonaceous Biochemical Oxygen Demand	9.72	2.00					9.51	2.18	20	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: 166809 (0) **Instrument:** UV-2450 **Method:** SURFACTANTS (MBAS) BY SM5540C

MBLK Sample ID: **MBLK-166809** Units: **mg/L 340 MW LAS** Analysis Date: **11-Jun-2021 18:12**
Client ID: Run ID: **UV-2450_385436** SeqNo: **6133823** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
MBAS	< 0.0500	0.0500								

LCS Sample ID: **LCS-166809** Units: **mg/L 340 MW LAS** Analysis Date: **11-Jun-2021 18:12**
Client ID: Run ID: **UV-2450_385436** SeqNo: **6133821** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
MBAS	0.486	0.0500	0.5	0	97.2	85 - 115				

LCSD Sample ID: **LCSD-166809** Units: **mg/L 340 MW LAS** Analysis Date: **11-Jun-2021 18:12**
Client ID: Run ID: **UV-2450_385436** SeqNo: **6133822** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
MBAS	0.485	0.0500	0.5	0	97.0	85 - 115	0.486	0.206	20	

MS Sample ID: **HS21060616-01MS** Units: **mg/L 340 MW LAS** Analysis Date: **11-Jun-2021 18:12**
Client ID: **POCC - INTAKE-2** Run ID: **UV-2450_385436** SeqNo: **6133820** PrepDate: **11-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
MBAS	0.515	0.0500	0.5	0.015	100	80 - 120				

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: 166904 (0) **Instrument:** WetChem_HS **Method:** TOTAL KJELDAHL NITROGEN BY SM4500 NH3 D

MBLK Sample ID: **MBLK-166904** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: Run ID: **WetChem_HS_385582** SeqNo: **6137248** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	< 0.50	0.50								

LCS Sample ID: **LCS-166904** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: Run ID: **WetChem_HS_385582** SeqNo: **6137247** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	21.76	0.50	20	0	109	85 - 115				

MS Sample ID: **HS21060699-01MS** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: Run ID: **WetChem_HS_385582** SeqNo: **6137245** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	22.84	0.50	20	0.602	111	75 - 125				

MS Sample ID: **HS21060521-01MS** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: Run ID: **WetChem_HS_385582** SeqNo: **6140641** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	17.5	0.50	20	0.422	85.4	75 - 125				

MSD Sample ID: **HS21060699-01MSD** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: Run ID: **WetChem_HS_385582** SeqNo: **6137246** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	22.01	0.50	20	0.602	107	75 - 125	22.84	3.69	20	

MSD Sample ID: **HS21060521-01MSD** Units: **mg/L** Analysis Date: **15-Jun-2021 13:00**
Client ID: Run ID: **WetChem_HS_385582** SeqNo: **6140640** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Total Kjeldahl	17.58	0.50	20	0.422	85.8	75 - 125	17.5	0.456	20	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: 166930 (0) **Instrument:** UV-2450 **Method:** SULFIDE METHYLENE BLUE BY SM4500 S2- D

MBLK Sample ID: **MBLK-166930** Units: **mg/L** Analysis Date: **15-Jun-2021 16:40**
Client ID: Run ID: **UV-2450_385654** SeqNo: **6138842** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Sulfide	< 0.0500	0.0500								

LCS Sample ID: **LCS-166930** Units: **mg/L** Analysis Date: **15-Jun-2021 16:40**
Client ID: Run ID: **UV-2450_385654** SeqNo: **6138840** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Sulfide	0.21	0.0500	0.2	0	105	85 - 115				

LCSD Sample ID: **LCSD-166930** Units: **mg/L** Analysis Date: **15-Jun-2021 16:40**
Client ID: Run ID: **UV-2450_385654** SeqNo: **6138841** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Sulfide	0.207	0.0500	0.2	0	104	85 - 115	0.21	1.44	20	

MS Sample ID: **HS21060616-02MS** Units: **mg/L** Analysis Date: **15-Jun-2021 16:40**
Client ID: **POCC - INTAKE-2-DUP** Run ID: **UV-2450_385654** SeqNo: **6138838** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Sulfide	0.182	0.0500	0.2	0.007	87.5	77 - 124				

MSD Sample ID: **HS21060616-02MSD** Units: **mg/L** Analysis Date: **15-Jun-2021 16:40**
Client ID: **POCC - INTAKE-2-DUP** Run ID: **UV-2450_385654** SeqNo: **6138839** PrepDate: **15-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Sulfide	0.177	0.0500	0.2	0.007	85.0	77 - 124	0.182	2.79	20	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: 167030 (0) **Instrument: UV-2450** **Method: PHOSPHORUS BY E365.3**

MBLK Sample ID: **MBLK-167030** Units: **mg/L** Analysis Date: **17-Jun-2021 17:45**
Client ID: Run ID: **UV-2450_385831** SeqNo: **6143607** PrepDate: **17-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Phosphorus, Total (As P)	< 0.0500	0.0500								

LCS Sample ID: **LCS-167030** Units: **mg/L** Analysis Date: **17-Jun-2021 17:45**
Client ID: Run ID: **UV-2450_385831** SeqNo: **6143605** PrepDate: **17-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Phosphorus, Total (As P)	0.262	0.0500	0.25	0	105	80 - 120				

LCSD Sample ID: **LCSD-167030** Units: **mg/L** Analysis Date: **17-Jun-2021 17:45**
Client ID: Run ID: **UV-2450_385831** SeqNo: **6143606** PrepDate: **17-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Phosphorus, Total (As P)	0.261	0.0500	0.25	0	104	80 - 120	0.262	0.382	20	

MS Sample ID: **HS21060836-03MS** Units: **mg/L** Analysis Date: **17-Jun-2021 17:45**
Client ID: Run ID: **UV-2450_385831** SeqNo: **6143603** PrepDate: **17-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Phosphorus, Total (As P)	0.271	0.0500	0.25	0.008	105	80 - 120				

MSD Sample ID: **HS21060836-03MSD** Units: **mg/L** Analysis Date: **17-Jun-2021 17:45**
Client ID: Run ID: **UV-2450_385831** SeqNo: **6143604** PrepDate: **17-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Phosphorus, Total (As P)	0.269	0.0500	0.25	0.008	104	80 - 120	0.271	0.741	20	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: 167044 (0) **Instrument: UV-2450** **Method: AMMONIA AS N BY SM4500 NH3-B-F**

MBLK Sample ID: **MBLK-167044** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: Run ID: **UV-2450_385848** SeqNo: **6143967** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	< 0.050	0.050								

LCS Sample ID: **LCS-167044** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: Run ID: **UV-2450_385848** SeqNo: **6143966** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	0.446	0.050	0.5	0	89.2	85 - 115				

MS Sample ID: **HS21060746-01MS** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: Run ID: **UV-2450_385848** SeqNo: **6143964** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	0.939	0.050	0.5	0.555	76.8	80 - 120				S

MS Sample ID: **HS21060616-01MS** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: **POCC - INTAKE-2** Run ID: **UV-2450_385848** SeqNo: **6143962** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	0.453	0.050	0.5	0.022	86.2	80 - 120				

MSD Sample ID: **HS21060746-01MSD** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: Run ID: **UV-2450_385848** SeqNo: **6143965** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	0.931	0.050	0.5	0.555	75.2	80 - 120	0.939	0.856	20	S

MSD Sample ID: **HS21060616-01MSD** Units: **mg/L** Analysis Date: **18-Jun-2021 15:00**
Client ID: **POCC - INTAKE-2** Run ID: **UV-2450_385848** SeqNo: **6143963** PrepDate: **18-Jun-2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Nitrogen, Ammonia (as N)	0.464	0.050	0.5	0.022	88.4	80 - 120	0.453	2.4	20	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Revision: 2

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: R385395 (0) **Instrument:** UV-2450 **Method:** HEXAVALENT CHROMIUM BY SM3500-CR B

MBLK Sample ID: **MBLK-R385395** Units: **mg/L** Analysis Date: **11-Jun-2021 10:15**
Client ID: Run ID: **UV-2450_385395** SeqNo: **6133056** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chromium, Hexavalent	< 0.0200	0.0200								

LCS Sample ID: **LCS-R385395** Units: **mg/L** Analysis Date: **11-Jun-2021 10:15**
Client ID: Run ID: **UV-2450_385395** SeqNo: **6133055** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chromium, Hexavalent	0.261	0.0200	0.25	0	104	80 - 120				

MS Sample ID: **HS21060616-02MS** Units: **mg/L** Analysis Date: **11-Jun-2021 10:22**
Client ID: **POCC - INTAKE-2-DUP** Run ID: **UV-2450_385395** SeqNo: **6133058** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chromium, Hexavalent	0.247	0.0200	0.25	0	98.8	75 - 125				

MSD Sample ID: **HS21060616-02MSD** Units: **mg/L** Analysis Date: **11-Jun-2021 10:23**
Client ID: **POCC - INTAKE-2-DUP** Run ID: **UV-2450_385395** SeqNo: **6133057** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chromium, Hexavalent	0.259	0.0200	0.25	0	104	75 - 125	0.247	4.74	20	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **R385443 (0)** **Instrument:** **WetChem_HS** **Method:** **COLOR BY SM 2120B - 2011**

MBLK Sample ID: **MBLK-R385443** Units: **Color Units** Analysis Date: **11-Jun-2021 16:00**
Client ID: Run ID: **WetChem_HS_385443** SeqNo: **6133977** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Color, Apparent	< 5.00	5.00								
pH	5	0.100								

LCS Sample ID: **LCS-R385443** Units: **Color Units** Analysis Date: **11-Jun-2021 16:00**
Client ID: Run ID: **WetChem_HS_385443** SeqNo: **6133976** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Color, Apparent	50	5.00	50	0	100	85 - 115				

LCSD Sample ID: **LCSD-R385443** Units: **Color Units** Analysis Date: **11-Jun-2021 16:00**
Client ID: Run ID: **WetChem_HS_385443** SeqNo: **6133975** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Color, Apparent	50	5.00	50	0	100	85 - 115	50	0	20	

DUP Sample ID: **HS21060616-01DUP** Units: **Color Units** Analysis Date: **11-Jun-2021 16:00**
Client ID: **POCC - INTAKE-2** Run ID: **WetChem_HS_385443** SeqNo: **6133978** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Color, Apparent	15	5.00					15	0	20	
pH	7	0.100					0	0		

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: R385507 (0) **Instrument:** ICS-Integrion **Method:** ANIONS BY E300.0

MBLK Sample ID: **MBLK** Units: **mg/L** Analysis Date: **11-Jun-2021 12:56**
Client ID: Run ID: **ICS-Integrion_385507** SeqNo: **6135280** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	< 0.100	0.100								
Chloride	< 0.500	0.500								
Fluoride	< 0.100	0.100								
Nitrogen, Nitrate (As N)	< 0.100	0.100								
Nitrogen, Nitrite (As N)	< 0.100	0.100								
Nitrate/Nitrite (as N)	< 0.200	0.200								
Sulfate	< 0.500	0.500								

LCS Sample ID: **LCS** Units: **mg/L** Analysis Date: **11-Jun-2021 13:04**
Client ID: Run ID: **ICS-Integrion_385507** SeqNo: **6135281** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	3.792	0.100	4	0	94.8	90 - 110				
Chloride	20.34	0.500	20	0	102	90 - 110				
Fluoride	4.382	0.100	4	0	110	90 - 110				
Nitrogen, Nitrate (As N)	4.106	0.100	4	0	103	90 - 110				
Nitrogen, Nitrite (As N)	3.976	0.100	4	0	99.4	90 - 110				
Nitrate/Nitrite (as N)	8.082	0.200	8	0	101	90 - 110				
Sulfate	20.3	0.500	20	0	101	90 - 110				

MS Sample ID: **HS21060629-14MS** Units: **mg/L** Analysis Date: **11-Jun-2021 16:34**
Client ID: Run ID: **ICS-Integrion_385507** SeqNo: **6135302** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	6.929	0.100	2	5.475	72.7	80 - 120				S
Chloride	210.3	0.500	10	210.8	-5.40	80 - 120				SEO
Fluoride	10.26	0.100	2	9.408	42.8	80 - 120				SO
Nitrogen, Nitrate (As N)	2.186	0.100	2	0.0803	105	80 - 120				
Nitrogen, Nitrite (As N)	1.776	0.100	2	0.0771	84.9	80 - 120				
Nitrate/Nitrite (as N)	3.961	0.200	4	0.1574	95.1	80 - 120				
Sulfate	9.275	0.500	10	0.0481	92.3	80 - 120				

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: R385507 (0) **Instrument:** ICS-Integrion **Method:** ANIONS BY E300.0

MS Sample ID: **HS21060629-04MS** Units: **mg/L** Analysis Date: **11-Jun-2021 14:50**
Client ID: Run ID: **ICS-Integrion_385507** SeqNo: **6135288** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	2.33	0.100	2	0.5072	91.1	80 - 120				
Chloride	90.15	0.500	10	84.13	60.2	80 - 120				SO
Fluoride	5.323	0.100	2	3.486	91.8	80 - 120				
Nitrogen, Nitrate (As N)	3.879	0.100	2	1.844	102	80 - 120				
Nitrogen, Nitrite (As N)	1.862	0.100	2	0.0754	89.3	80 - 120				
Nitrate/Nitrite (as N)	5.741	0.200	4	1.919	95.5	80 - 120				
Sulfate	97.42	0.500	10	92.84	45.8	80 - 120				SO

MSD Sample ID: **HS21060629-14MSD** Units: **mg/L** Analysis Date: **11-Jun-2021 16:41**
Client ID: Run ID: **ICS-Integrion_385507** SeqNo: **6135303** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	7.158	0.100	2	5.475	84.2	80 - 120	6.929	3.26	20	
Chloride	216.9	0.500	10	210.8	60.6	80 - 120	210.3	3.09	20	SEO
Fluoride	10.52	0.100	2	9.408	55.6	80 - 120	10.26	2.47	20	SO
Nitrogen, Nitrate (As N)	2.285	0.100	2	0.0803	110	80 - 120	2.186	4.46	20	
Nitrogen, Nitrite (As N)	1.785	0.100	2	0.0771	85.4	80 - 120	1.776	0.545	20	
Nitrate/Nitrite (as N)	4.07	0.200	4	0.1574	97.8	80 - 120	3.961	2.72	20	
Sulfate	9.599	0.500	10	0.0481	95.5	80 - 120	9.275	3.43	20	

MSD Sample ID: **HS21060629-04MSD** Units: **mg/L** Analysis Date: **11-Jun-2021 14:58**
Client ID: Run ID: **ICS-Integrion_385507** SeqNo: **6135289** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Bromide	2.382	0.100	2	0.5072	93.8	80 - 120	2.33	2.24	20	
Chloride	92.74	0.500	10	84.13	86.0	80 - 120	90.15	2.83	20	O
Fluoride	5.504	0.100	2	3.486	101	80 - 120	5.323	3.35	20	
Nitrogen, Nitrate (As N)	3.982	0.100	2	1.844	107	80 - 120	3.879	2.61	20	
Nitrogen, Nitrite (As N)	1.909	0.100	2	0.0754	91.7	80 - 120	1.862	2.49	20	
Nitrate/Nitrite (as N)	5.89	0.200	4	1.919	99.3	80 - 120	5.741	2.57	20	
Sulfate	101	0.500	10	92.84	81.8	80 - 120	97.42	3.63	20	EO

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: R385528 (0) **Instrument:** ManTech01 **Method:** ALKALINITY BY SM2320B

MBLK Sample ID: **WBLKW1-210614** Units: **mg/L** Analysis Date: **14-Jun-2021 16:48**
Client ID: Run ID: **ManTech01_385528** SeqNo: **6135922** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	< 5.00	5.00								
Alkalinity, Carbonate (As CaCO3)	< 5.00	5.00								
Alkalinity, Hydroxide (As CaCO3)	< 5.00	5.00								
Alkalinity, Total (As CaCO3)	< 5.00	5.00								

LCS Sample ID: **LCS1-210614** Units: **mg/L** Analysis Date: **14-Jun-2021 16:57**
Client ID: Run ID: **ManTech01_385528** SeqNo: **6135923** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Carbonate (As CaCO3)	1023	5.00	1000	0	102	85 - 115				
Alkalinity, Total (As CaCO3)	1030	5.00	1000	0	103	85 - 115				

LCSD Sample ID: **LCSD1-210614** Units: **mg/L** Analysis Date: **14-Jun-2021 17:05**
Client ID: Run ID: **ManTech01_385528** SeqNo: **6135926** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Carbonate (As CaCO3)	1016	5.00	1000	0	102	85 - 115	1023	0.715	20	
Alkalinity, Total (As CaCO3)	1024	5.00	1000	0	102	85 - 115	1030	0.601	20	

DUP Sample ID: **HS21060479-02DUP** Units: **mg/L** Analysis Date: **14-Jun-2021 17:21**
Client ID: Run ID: **ManTech01_385528** SeqNo: **6135928** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (As CaCO3)	633.5	5.00					652.6	2.98	20	
Alkalinity, Carbonate (As CaCO3)	< 5.00	5.00					0	0	20	
Alkalinity, Hydroxide (As CaCO3)	< 5.00	5.00					0	0	20	
Alkalinity, Total (As CaCO3)	633.5	5.00					652.6	2.98	20	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: R385686 (0) **Instrument:** WetChem_HS **Method:** CHEMICAL OXYGEN DEMAND BY E410.4

MBLK Sample ID: **MBLK-R385686** Units: **mg/L** Analysis Date: **16-Jun-2021 15:00**
Client ID: Run ID: **WetChem_HS_385686** SeqNo: **6139533** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chemical Oxygen Demand	< 15.0	15.0								

LCS Sample ID: **LCS-R385686** Units: **mg/L** Analysis Date: **16-Jun-2021 15:00**
Client ID: Run ID: **WetChem_HS_385686** SeqNo: **6139532** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chemical Oxygen Demand	99	15.0	100	0	99.0	85 - 115				

MS Sample ID: **HS21060563-02MS** Units: **mg/L** Analysis Date: **16-Jun-2021 15:00**
Client ID: Run ID: **WetChem_HS_385686** SeqNo: **6139535** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chemical Oxygen Demand	70	15.0	50	21	98.0	80 - 120				

MSD Sample ID: **HS21060563-02MSD** Units: **mg/L** Analysis Date: **16-Jun-2021 15:00**
Client ID: Run ID: **WetChem_HS_385686** SeqNo: **6139534** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chemical Oxygen Demand	72	15.0	50	21	102	80 - 120	70	2.82	20	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: R385691 (0) **Instrument:** Balance1 **Method:** TOTAL SUSPENDED SOLIDS BY SM 2540D

MBLK Sample ID: **WBLKW1-061621** Units: **mg/L** Analysis Date: **16-Jun-2021 09:50**
Client ID: Run ID: **Balance1_385691** SeqNo: **6139728** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Suspended Solids (Residue, Non-Filterable)	< 2.00	2.00								

LCS Sample ID: **WLCSW1-061621** Units: **mg/L** Analysis Date: **16-Jun-2021 09:50**
Client ID: Run ID: **Balance1_385691** SeqNo: **6139729** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Suspended Solids (Residue, Non-Filterable)	89	2.00	100	0	89.0	85 - 115				

DUP Sample ID: **HS21060736-01DUP** Units: **mg/L** Analysis Date: **16-Jun-2021 09:50**
Client ID: Run ID: **Balance1_385691** SeqNo: **6139726** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Suspended Solids (Residue, Non-Filterable)	328	2.00					318	3.1	5	

DUP Sample ID: **HS21060578-01DUP** Units: **mg/L** Analysis Date: **16-Jun-2021 09:50**
Client ID: Run ID: **Balance1_385691** SeqNo: **6139716** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Suspended Solids (Residue, Non-Filterable)	550	2.00					530	3.7	5	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: R385728 (0) **Instrument:** TOC_04 **Method:** TOTAL ORGANIC CARBON BY E415.1

MBLK Sample ID: **MBLK-06162021** Units: **mg/L** Analysis Date: **16-Jun-2021 18:13**
Client ID: Run ID: **TOC_04_385728** SeqNo: **6140592** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Organic Carbon, Total	< 1.00	1.00								

LCS Sample ID: **LCS-06162021** Units: **mg/L** Analysis Date: **16-Jun-2021 18:24**
Client ID: Run ID: **TOC_04_385728** SeqNo: **6140593** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Organic Carbon, Total	10.48	1.00	10	0	105	85 - 115				

LCSD Sample ID: **LCSD-06162021** Units: **mg/L** Analysis Date: **16-Jun-2021 18:35**
Client ID: Run ID: **TOC_04_385728** SeqNo: **6140594** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Organic Carbon, Total	10.6	1.00	10	0	106	85 - 115	10.48	1.14	20	

MS Sample ID: **HS21060616-01MS** Units: **mg/L** Analysis Date: **16-Jun-2021 19:01**
Client ID: **POCC - INTAKE-2** Run ID: **TOC_04_385728** SeqNo: **6140596** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Organic Carbon, Total	12.73	1.00	10	2.077	107	80 - 120				

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: R385769 (0) **Instrument:** Balance1 **Method:** OIL & GREASE (HEM) BY E1664A

MBLK Sample ID: **WBLKW-061721** Units: **mg/L** Analysis Date: **17-Jun-2021 14:00**
Client ID: Run ID: **Balance1_385769** SeqNo: **6141772** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Oil and Grease	< 2.00	2.00								

LCS Sample ID: **WLCSW-061721** Units: **mg/L** Analysis Date: **17-Jun-2021 14:00**
Client ID: Run ID: **Balance1_385769** SeqNo: **6141774** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Oil and Grease	33.5	2.00	40	0	83.8	78 - 114				

LCSD Sample ID: **WLCSDW-061721** Units: **mg/L** Analysis Date: **17-Jun-2021 14:00**
Client ID: Run ID: **Balance1_385769** SeqNo: **6141773** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Oil and Grease	33.4	2.00	40	0	83.5	78 - 114	33.5	0.299	18	

MS Sample ID: **HS21060535-01MS** Units: **mg/L** Analysis Date: **17-Jun-2021 14:00**
Client ID: Run ID: **Balance1_385769** SeqNo: **6141764** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Oil and Grease	36.3	2.00	40	0.8696	88.6	78 - 114				

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: HS21060616

QC BATCH REPORT

Batch ID: **R385846 (0)** **Instrument:** **Balance1** **Method:** **TOTAL DISSOLVED SOLIDS BY SM2540C**

MBLK Sample ID: **WBLK-061721** Units: **mg/L** Analysis Date: **17-Jun-2021 17:40**
Client ID: Run ID: **Balance1_385846** SeqNo: **6143926** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Filterable)	< 10.0	10.0								

LCS Sample ID: **WLCS-061721** Units: **mg/L** Analysis Date: **17-Jun-2021 17:40**
Client ID: Run ID: **Balance1_385846** SeqNo: **6143927** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Filterable)	1030	10.0	1000	0	103	85 - 115				

DUP Sample ID: **HS21060616-01DUP** Units: **mg/L** Analysis Date: **17-Jun-2021 17:40**
Client ID: **POCC - INTAKE-2** Run ID: **Balance1_385846** SeqNo: **6143917** PrepDate: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total Dissolved Solids (Residue, Filterable)	34180	10.0					33800	1.12	5	

The following samples were analyzed in this batch: HS21060616-01 HS21060616-02

Client: Parsons
Project: Parsons - POCC Flow
WorkOrder: **HS21060616**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
M	Manually integrated, see raw data for justification
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL/SDL

Acronym	Description
DCS	Detectability Check Study
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitaion Limit
SD	Serial Dilution
SDL	Sample Detection Limit
TRRP	Texas Risk Reduction Program

Unit Reported	Description
µg/L	Micrograms per Liter
Date	
ug/L	Micrograms per Liter

CERTIFICATIONS,ACCREDITATIONS & LICENSES

Agency	Number	Expire Date
Arkansas	21-022-0	26-Mar-2022
Dept of Defense	PJLA L20-507-R2	22-Dec-2021
Florida	E87611-30-07/01/2020	30-Jun-2021
Illinois	2000322021-7	09-May-2022
Kansas	E-10352 2020-2021	31-Jul-2021
Kentucky	123043, 2021-2022	30-Apr-2022
Louisiana	03087, 2020-2021	30-Jun-2021
Louisiana	03087, 2021-2022	30-Jun-2022
North Carolina	624-2021	31-Dec-2021
Oklahoma	2020-165	31-Aug-2021
Texas	T104704231-21-27	30-Apr-2022
Utah	TX026932021-10	31-Jul-2021

Client: Parsons
Project: Parsons - POCC Flow
Work Order: HS21060616

SAMPLE TRACKING

Lab Samp ID	Client Sample ID	Action	Date	Person	New Location
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	MET035
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	EXT044
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	EXT044
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	WET304
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	WET304
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	WET304
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	WET304
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	WET304
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	WET304
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	WET304
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	Sub
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	Sub
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	WET304
HS21060616-01	POCC - INTAKE-2	Login	6/11/2021 8:43:17 AM	JRM	VOA165
HS21060616-03	LL Mercury Duplicate	Login	6/11/2021 8:43:17 AM	JRM	Sub
HS21060616-04	LL Mercury Field Blank	Login	6/11/2021 8:43:17 AM	JRM	Sub
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	MET087
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	EXT073
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	EXT073
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	WET325
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	WET324
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	WET324
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	WET324
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	WET324
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	WET323
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	WET323
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	WET323
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	Sub
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	Sub
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	WET323
HS21060616-02	POCC - INTAKE-2-DUP	Login	6/11/2021 9:24:44 AM	JML	VOA230

Sample Receipt Checklist

Work Order ID: HS21060616 **Date/Time Received:** **11-Jun-2021 08:00**

Client Name: Parsons **Received by:** **Jared R. Makan**

Completed By: /S/ Jared R. Makan (eSignature) 10-Jun-2021 08:49 (Date/Time) **Reviewed by:** /S/ Corey Grandits (eSignature) 15-Jun-2021 12:26 (Date/Time)

Matrices: **Water** Carrier name: **Greyhound**

	Yes	No	Not Present
Shipping container/cooler in good condition?	☑	☐	☐
Custody seals intact on shipping container/cooler?	☑	☐	☐
Custody seals intact on sample bottles?	☐	☐	☑
VOA/TX1005/TX1006 Solids in hermetically sealed vials?	☐	☐	☑
Chain of custody present?	☑	☐	1 Page(s)
Chain of custody signed when relinquished and received?	☑	☐	COC IDs:24667
Samplers name present on COC?	☑	☐	
Chain of custody agrees with sample labels?	☑	☐	
Samples in proper container/bottle?	☑	☐	
Sample containers intact?	☑	☐	
Sufficient sample volume for indicated test?	☑	☐	
All samples received within holding time?	☑	☐	
Container/Temp Blank temperature in compliance?	☑	☐	

Temperature(s)/Thermometer(s): 1.1°C, 0.9°C, 1.2°C UC/C IR31

Cooler(s)/Kit(s): 47441, 46060, 47444

Date/Time sample(s) sent to storage: 06/11/2021 09:55

	Yes	No	
Water - VOA vials have zero headspace?	☑	☐	No VOA vials submitted ☐
Water - pH acceptable upon receipt?	☑	☐	N/A ☐
pH adjusted?	☐	☑	N/A ☐

pH adjusted by:

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

Corrective Action:

Cincinnati, OH +1 513 733 5336
Everett, WA +1 425 356 2600
Fort Collins, CO +1 970 490 1511
Holland, MI +1 616 399 6070

Chain of Custody Form

Page 1 of 1

COC ID: 246677

HS21060616

Parsons
Parsons - POCC Flow

ALS Project Manager:

Customer Information		Project Information	
Purchase Order	TBD	Project Name	
Work Order		Project Number	451565.04000
Company Name	Parsons	Bill To Company	Parsons
Send Report To	Curt Burdorf (CAB)	Invoice Attn	AP
Address	9101 Burnet Rd Ste 210	Address	9101 Burnet Rd Ste 210
City/State/Zip	Austin , TX 78758	City/State/Zip	Austin TX 78758
Phone	(512) 656-9879	Phone	(512) 656-9879
Fax		Fax	
e-Mail Address	Curt.Burdorf@parsons.com	e-Mail Address	

COLOR
SURFACTANT

A	300 - Anions (Br, Cl, F, *NO2*, *NO3*, SO4)
B	624 VOCs - includes *Acrylonitrile*
C	625 SVOCs & 608 PCBs
D	*CBOD*, *BOD*, *Cr6 - HexChrome*, Cr3 - TriChrome
E	Total Alkalinity, TSS, TDS
F	Oil & Grease, COD, Total Organic Nitrogen, TOC
G	200.8 Metals (19) & Total Phosphorus
H	Sulfide (MethyleneBlue)
I	Sub LL Hg 1631 Holland
J	Sub Available Cyanide 1667 Holland

ON ICE

COLOR & SURFACTANT

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	POCC-INTAKE-2	6/10/21	1057	H_2O			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	POCC-INTAKE-2-DUP		1057	H_2O			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	POCC-INTAKE-2-MS		1057	H_2O			PER CONTRACT & BOTTLES PROVIDED										
4	POCC-INTAKE-2-MSD		1057	H_2O			PER CONTRACT & BOTTLES PROVIDED										
5																	
6																	
7																	
8																	
9																	
10																	

Sampler(s) Please Print & Sign: CURT BURDORF Curt Burdorf

Shipment Method:

Required Turnaround Time: (Check Box) [X] STD 10 Wk Days [ ] 5 Wk Days [ ] 2 Wk Days [ ] 24 Hou [ ] Other

Results Due Date:

Relinquished by: Curt Burdorf	Date: 6/10/21	Time:	Received by: Rebecca
Relinquished by: Rebecca	Date: 6-9-21	Time: 5:30	Received by (Laboratory): Simmons 6/11/21 08:00
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):

Notes: Parsons - Gulf of Mexico

Cooler ID	Cooler Temp.
46060	
47444	
47444	

QC Package: (Check One Box Below)
[X] Level II Std QC
[ ] Level III Std QC/Raw Data
[ ] Level IV SW846/CLP
[ ] Other
[ ] TRRP Checklist
[ ] TRRP Level V

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

Note: 1. Any changes must be made in writing once samples and COC Form have been submitted to ALS Environmental.
2. Unless otherwise agreed in a formal contract, services provided by ALS Environmental are expressly limited to the terms and conditions stated on the reverse.
3. The Chain of Custody is a legal document. All information must be completed accurately.

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RIGHT SOLUTIONS | RIGHT PARTNER

Revision 2

ALS
10450 Stancliff Rd., Suite 210
Houston, Texas 77099
Tel. +1 281 530 5656
Fax. +1 281 530 5887

Date: 10
Name: Q
Company: A

CUSTODY SEAL
Time: 315
Seal Broken By:
Date: 6/11/2

10JUN21 03:21P ** LABEL **

Schd: VLP 0852

GLI 3089370207

HOUSTON, TX

ALS CORPUS
000-000-0000

A L S

N/A

Manual Wght:
236.2

Tariff Wght:
239.0

)USTON, TX 77002

ıone: 281-530-5656

PO/Ref #:

riority

ıency Phone: (713)759-6583

WWW.SHIPGREYHOUND.COM

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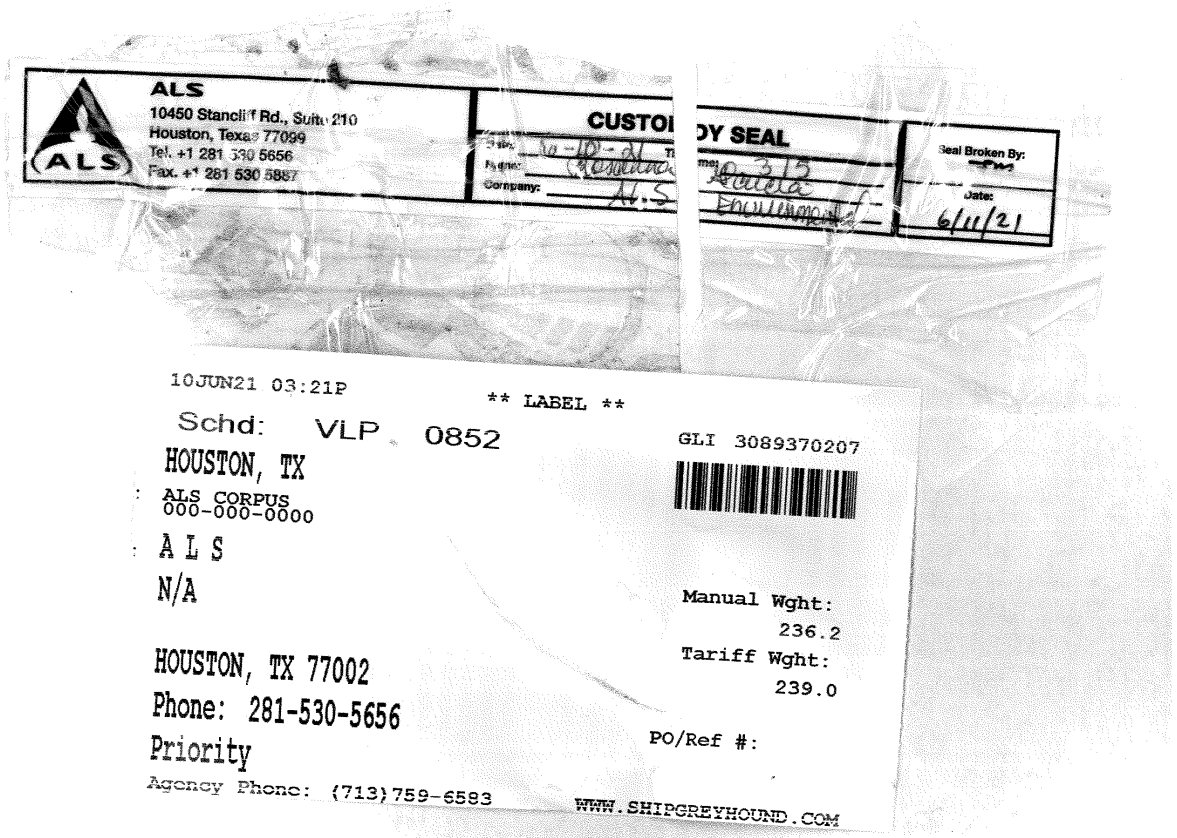

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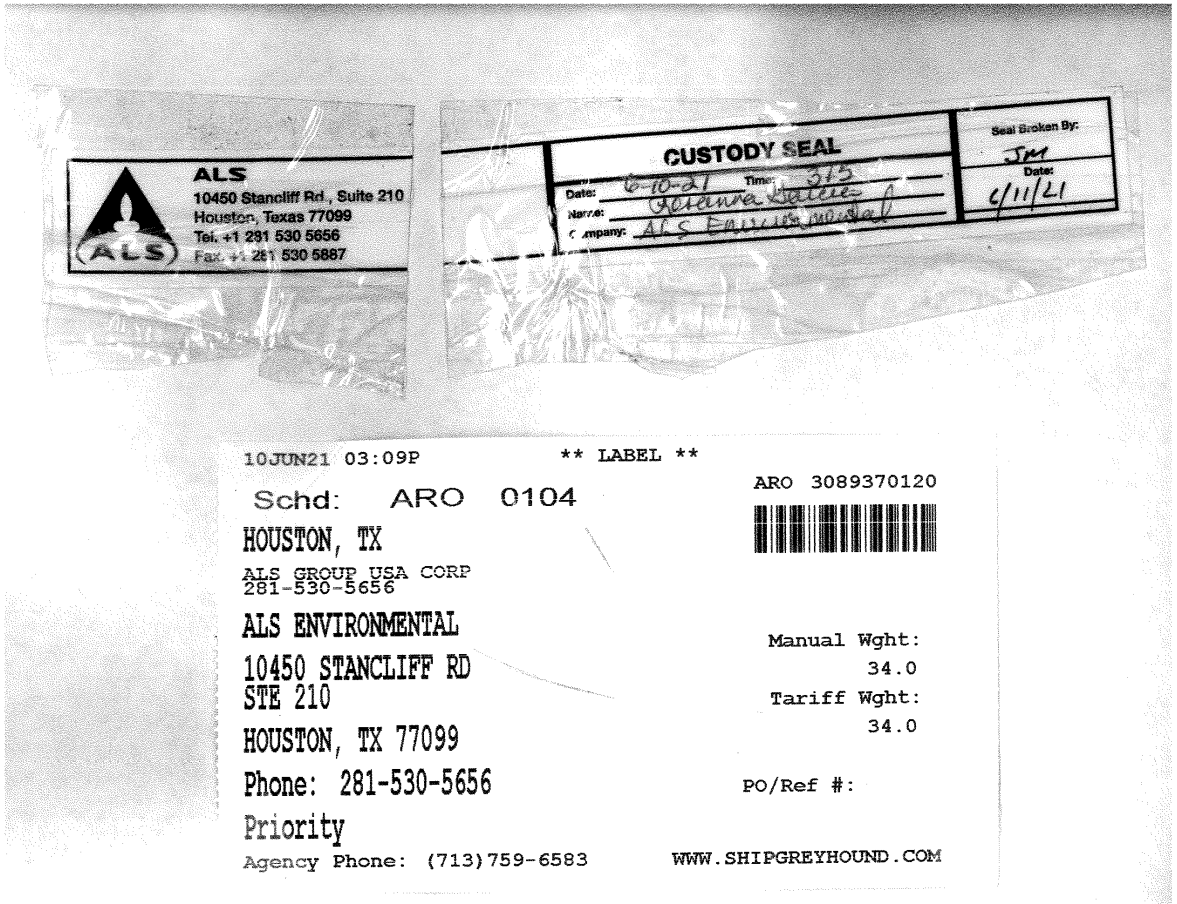

RIGHT SOLUTIONS | RIGHT PARTNER

17-Jun-2021

Corey Grandits
ALS Environmental
10450 Stancliff Rd
Suite 210
Houston, TX 77099

Re: **HS21050616** Work Order: **21061412**

Dear Corey,

ALS Environmental received 5 samples on 12-Jun-2021 10:00 AM for the analyses presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental - Holland and for only the analyses requested.

Sample results are compliant with industry accepted practices and Quality Control results achieved laboratory specifications. Any exceptions are noted in the Case Narrative, or noted with qualifiers in the report or QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained from ALS Environmental. Samples will be disposed in 30 days unless storage arrangements are made.

The total number of pages in this report is ZZ.

If you have any questions regarding this report, please feel free to contact me:

ADDRESS: 3352 128th Avenue, Holland, MI, USA
PHONE: +1 (616) 399-6070 FAX: +1 (616) 399-6185

Sincerely,

Electronically approved by: Alex J. Csaszar

Chad Whelton
Project Manager

Client: ALS Environmental
Project: HS21060521 and HS21050516
Work Order: **21061412**

Work Order Sample Summary

Lab Samp ID	Client Sample ID	Matrix	Tag Number	Collection Date	Date Received	Hold
21061412-03	Pocc-Intake-2	Water		6/10/2021 10:57	6/12/2021 10:00	☐
21061412-04	Pocc-Intake-2-DUP	Water		6/10/2021 10:57	6/12/2021 10:00	☐
21061412-05	Field Blank	Water		6/10/2021 10:57	6/12/2021 10:00	☐

Client: ALS Environmental
Project: HS21060521 and HS21050516
Work Order: 21061412

Case Narrative

Samples for the above noted Work Order were received on 06/12/2021. The attached "Sample Receipt Checklist" documents the status of custody seals, container integrity, preservation, and temperature compliance.

Samples were analyzed according to the analytical methodology previously transmitted in the "Work Order Acknowledgement". Methodologies are also documented in the "Analytical Result" section for each sample. Quality control results are listed in the "QC Report" section. Sample association for the reported quality control is located at the end of each batch summary. If applicable, results are appropriately qualified in the Analytical Result and QC Report sections. The "Qualifiers" section documents the various qualifiers, units, and acronyms utilized in reporting. A copy of the laboratory's scope of accreditation is available upon request.

All sample analyses achieved analytical criteria.

Client: ALS Environmental
Project: HS21060521 and HS21050516
WorkOrder: **21061412**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
**	Estimated Value
a	Analyte is non-accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
Hr	BOD/CBOD - Sample was reset outside Hold Time, value should be considered estimated.
J	Analyte is present at an estimated concentration between the MDL and Report Limit
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL
X	Analyte was detected in the Method Blank between the MDL and Reporting Limit, sample results may exhibit background or reagent contamination at the observed level.

Acronym	Description
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection (see MDL)
LOQ	Limit of Quantitation (see PQL)
MBLK	Method Blank
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PQL	Practical Quantitation Limit
RPD	Relative Percent Difference
TDL	Target Detection Limit
TNTC	Too Numerous To Count
A	APHA Standard Methods
D	ASTM
E	EPA
SW	SW-846 Update III

Units Reported	Description
µg/L	Micrograms per Liter

RIGHT SOLUTIONS | RIGHT PARTNER

ALS Group, USA

Date: *17-Jun-2021*

Client: ALS Environmental
Project: HS21060521 and HS21050516
Sample ID: Pocc-Intake-2
Collection Date: 6/10/2021 10:57 AM

Work Order: 21061412
Lab ID: 21061412-03
Matrix: WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY IN WATER			**E1631E**		Prep: E1631E 6/16/21 11:45	Analyst: **STP**
Mercury	0.00066		0.00050	µg/L	1	6/16/2021 05:16 PM
CYANIDE, AVAILABLE			**OIA 1677-09**			Analyst: **MB**
Cyanide, Available	2.6		2.0	µg/L	1	6/16/2021 11:00 AM

Cyanide was reanalyzed; results on next page.
Sd 6/25/21

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group, USA

Date: *24-Jun-2021*

Client:	ALS Environmental		
Project:	HS21060521 and HS21050516	**Work Order:**	21061412
Sample ID:	Pocc-Intake-2	**Lab ID:**	21061412-03
Collection Date:	6/10/2021 10:57 AM	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
CYANIDE, AVAILABLE			**OIA 1677-09**			Analyst: **MB**
Cyanide, Available	ND		2.0	µg/L	1	6/23/2021 01:31 PM

Note: See Qualifiers page for a list of qualifiers and their definitions.

ALS Group, USA

Date: *17-Jun-2021*

Client: ALS Environmental
Project: HS21060521 and HS21050516
Sample ID: Pocc-Intake-2-DUP
Collection Date: 6/10/2021 10:57 AM

Work Order: 21061412
Lab ID: 21061412-04
Matrix: WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY IN WATER			**E1631E**		Prep: E1631E 6/16/21 11:45	Analyst: **STP**
Mercury	**0.00065**		**0.00050**	**µg/L**	1	6/16/2021 05:40 PM
CYANIDE, AVAILABLE			**OIA 1677-09**			Analyst: **MB**
Cyanide, Available	ND		2.0	µg/L	1	6/16/2021 11:00 AM

Note: See Qualifiers page for a list of qualifiers and their definitions.

RIGHT SOLUTIONS | RIGHT PARTNER

ALS Group, USA

Date: *17-Jun-2021*

Client: ALS Environmental
Project: HS21060521 and HS21050516
Sample ID: Field Blank
Collection Date: 6/10/2021 10:57 AM

Work Order: 21061412
Lab ID: 21061412-05
Matrix: WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
MERCURY IN WATER			**E1631E**		Prep: E1631E 6/16/21 11:45	Analyst: **STP**
Mercury	ND		0.00050	µg/L	1	6/16/2021 05:08 PM

Note: See Qualifiers page for a list of qualifiers and their definitions.

RIGHT SOLUTIONS | RIGHT PARTNER

ALS Group, USA

Client: ALS Environmental
Work Order: 21061412
Project: HS21060521 and HS21050516

Date: 17-Jun-21

QC BATCH REPORT

Batch ID: **178605** Instrument ID **HG3** Method: **E1631E**

MBLK1 Sample ID: **MBLK1-178605-178605** Units: **ng/L** Analysis Date: **6/16/2021 01:46 PM**
Client ID: Run ID: **HG3_210616A** SeqNo: **7495990** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	ND	0.50	0	0	0		0			

MBLK2 Sample ID: **MBLK2-178605-178605** Units: **ng/L** Analysis Date: **6/16/2021 02:48 PM**
Client ID: Run ID: **HG3_210616A** SeqNo: **7495998** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	0.39	0.50	0	0	0		0			J

MBLK3 Sample ID: **MBLK3-178605-178605** Units: **ng/L** Analysis Date: **6/16/2021 04:06 PM**
Client ID: Run ID: **HG3_210616A** SeqNo: **7496008** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	0.2	0.50	0	0	0		0			J

MS Sample ID: **21061412-01BMS** Units: **ng/L** Analysis Date: **6/16/2021 04:45 PM**
Client ID: **Pocc-Intake-1** Run ID: **HG3_210616A** SeqNo: **7496013** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.37	0.50	5	0.58	95.8	71-125	0			

MS Sample ID: **21061412-03BMS** Units: **ng/L** Analysis Date: **6/16/2021 05:24 PM**
Client ID: **Pocc-Intake-2** Run ID: **HG3_210616A** SeqNo: **7496018** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.63	0.50	5	0.66	99.4	71-125	0			

MSD Sample ID: **21061412-01BMSD** Units: **ng/L** Analysis Date: **6/16/2021 04:53 PM**
Client ID: **Pocc-Intake-1** Run ID: **HG3_210616A** SeqNo: **7496014** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.52	0.50	5	0.58	98.8	71-125	5.37	2.75	24	

MSD Sample ID: **21061412-03BMSD** Units: **ng/L** Analysis Date: **6/16/2021 05:32 PM**
Client ID: **Pocc-Intake-2** Run ID: **HG3_210616A** SeqNo: **7496019** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.63	0.50	5	0.66	99.4	71-125	5.63	0	24	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

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Client: ALS Environmental
Work Order: 21061412
Project: HS21060521 and HS21050516

QC BATCH REPORT

Batch ID: **178605** Instrument ID **HG3** Method: **E1631E**

LCS-OPR-START Sample ID: **OPR-START-178605-178605** Units: **ng/L** Analysis Date: **6/16/2021 01:38 PM**

Client ID: Run ID: **HG3_210616A** SeqNo: **7495989** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.43	0.50	5	0	109	77-123	0			

LCS-OPR-END Sample ID: **OPR-END-178605-178605** Units: **ng/L** Analysis Date: **6/16/2021 06:03 PM**

Client ID: Run ID: **HG3_210616A** SeqNo: **7496023** Prep Date: **6/16/2021** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	5.05	0.50	5	0	101	77-123	0			

The following samples were analyzed in this batch:

21061412-03B
21061412-04B 21061412-05A

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

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Client: ALS Environmental
Work Order: 21061412
Project: HS21060521 and HS21050516

QC BATCH REPORT

Batch ID: **R319900** Instrument ID **FS3100** Method: **OIA 1677-09**

MBLK Sample ID: **MBLK-1-R319900** Units: **µg/L** Analysis Date: **6/16/2021 11:00 AM**
Client ID: Run ID: **FS3100_210616A** SeqNo: **7492163** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Cyanide, Available	ND	2.0								

LCS Sample ID: **LCS-1-R319900** Units: **µg/L** Analysis Date: **6/16/2021 11:00 AM**
Client ID: Run ID: **FS3100_210616A** SeqNo: **7492161** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Cyanide, Available	56.05	2.0	50	0	112	82-132	0			

MS Sample ID: **21061372-06B MS** Units: **µg/L** Analysis Date: **6/16/2021 11:00 AM**
Client ID: Run ID: **FS3100_210616A** SeqNo: **7492145** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Cyanide, Available	51.1	2.0	50	1.604	99	82-130	0			

MSD Sample ID: **21061372-06B MSD (A** Units: **µg/L** Analysis Date: **6/16/2021 11:00 AM**
Client ID: Run ID: **FS3100_210616A** SeqNo: **7492146** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Cyanide, Available	51.01	2.0	50	1.604	98.8	82-130	51.1	0.17	11	

The following samples were analyzed in this batch: 21061412-03A 21061412-04A

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

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ALS Group, USA

Sample Receipt Checklist

Client Name: **ALS - HOUSTON** Date/Time Received: **12-Jun-21 10:00**

Work Order: **21061412** Received by: **DS**

Checklist completed by Diane Shaw (eSignature) 15-Jun-21 (Date) Reviewed by: Alex J. Csaszar (eSignature) 15-Jun-21 (Date)

Matrices: Water
Carrier name: FedEx

	Yes	No	Not Present
Shipping container/cooler in good condition?	☑	☐	☐
Custody seals intact on shipping container/cooler?	☑	☐	☐
Custody seals intact on sample bottles?	☐	☐	☑
Chain of custody present?	☑	☐	
Chain of custody signed when relinquished and received?	☑	☐	
Chain of custody agrees with sample labels?	☑	☐	
Samples in proper container/bottle?	☑	☐	
Sample containers intact?	☑	☐	
Sufficient sample volume for indicated test?	☑	☐	
All samples received within holding time?	☑	☐	
Container/Temp Blank temperature in compliance?	☑	☐	
Sample(s) received on ice?	☑	☐	

Temperature(s)/Thermometer(s): 5.8/5.8 c IR1

Cooler(s)/Kit(s):

Date/Time sample(s) sent to storage: 6/15/2021 11:38:46 AM

	Yes	No		
Water - VOA vials have zero headspace?	☐	☐	No VOA vials submitted	☑
Water - pH acceptable upon receipt?	☑	☐	N/A	☐
pH adjusted?	☐	☑	N/A	☐

pH adjusted by: -

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

CorrectiveAction:

SRC Page 1 of 1

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Revision 2

TECHNICAL MEMORANDUM

To: Sarah Garza - Port of Corpus Christi Authority

Date: June 24, 2021

From: Parsons Environment and Infrastructure, Inc.

Cc: Earnest Wotring, John Muir, Esqs.; Baker Wotring, LLP

Subject: Field Sampling Technical Memorandum for Port of Corpus Christi Draft TPDES Permit No. WQ0005253000

Introduction

The Texas Commission on Environmental Quality (TCEQ) issued an Interim Order on May 26, 2021 in the matter of the Application of the Port of Corpus Christi Authority of Nueces County (Applicant) for a Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0005253000 and related Proposal for Final Decision (PFD). As a result of this interim order Parsons Environment & Infrastructure (Parsons) was contracted to collect site specific ambient velocity, bathymetry, and water quality data related to this application and draft TPDES permit. This Technical Memorandum details the findings from water velocity, bathymetry, and water quality data collected during the week of June 7 to June 10, 2021.

The following sections describe the goals, tasks and summary of this data collection.

Summary of Tasks Performed

The goal of this assessment is to provide additional site-specific data to TCEQ related to the permit application and draft TPDES permit listed above. The data collection included the following investigations:

- Water depths (Bathymetry) in the vicinity of the proposed discharge location,
- Vertical-downward-looking Acoustic Doppler Current Profiler (ADCP) transects at 5 locations across the Corpus Christi Ship Channel in the vicinity of the proposed discharge location,
- Horizontal-looking ADCP velocity collection focused in the “deep hole” and the proposed discharge area,
- Assessment of tide level including collection of local data and incorporation of NOAA tide data,
- Water quality sample collection of routine field parameters such as pH, water temperature, conductivity, and dissolved oxygen in the area of the proposed discharge location,
- Water quality sample collection of routine field parameters such as pH, water temperature, conductivity, and dissolved oxygen in the area of the proposed intake,
- Water quality sample collection in the area of the proposed intake location for parameters listed in the permit application, as applicable.

Study Area

The study area is a portion of the Corpus Christi Ship Channel between Harbor Island and Port Aransas, part of Segment 2481 (Corpus Christi Bay) listed in Texas Surface Water Quality Standards. The Corpus Christi Ship Channel is an

approximately 34-mile-long channel between the Corpus Christi Inner Harbor and the Gulf of Mexico. It is currently dredged to a minimum depth of 47 feet. In the study area, the dredged portion of the channel varies in width but is approximately 600 feet wide, and the total width is approximately 1200 feet. The proposed discharge from the desalination facility is on the north side of the channel (Harbor Island) at the location of a former Tank Terminal Facility. The tank farms have been removed and the area is now vacant. A bathymetric "deep hole" with a maximum depth of approximately 95 feet occurs on the south (channel) side of the proposed discharge location. The proposed water intake for the desalination facility is in the Gulf of Mexico on the north side of the north jetty. Figure 1 shows the waterway, land masses, proposed intake and proposed discharge locations.

FIGURE 1. STUDY AREA

Investigation Methods

The field investigation was conducted Monday, June 7, 2021 to Thursday, June 10, 2021 by staff from Parsons and T. Baker Smith, L.L.C., who provided and operated the survey vessel, collected bathymetry data, and installed the fixed horizontal ADCP. Parsons staff deployed and operated the ADCPs and tide gage as well as collected water quality measurements and samples at the proposed intake location in the Gulf of Mexico.

The meteorological conditions were typical for the area in June, with winds from the south-southeast at 5 to 15 knots and daytime air temperatures from 81 to 88 degrees Fahrenheit. Freshwater inflows to the bay system had recently been elevated due to 2.1 inches of rain in the previous week and 10.83 inches in May (at Corpus Christi). Daily flows in the

Nueces River at Calallen peaked at 700 cubic feet per second (cfs) on June 5, but declined to 40 to 50 cfs from June 7 to June 10. The long-term average flow at this gage in June is 301 cfs.

Table 1. Meteorological Summary at Port Aransas, TX

		June 7	June 8	June 9	June 10
High Temp	Degrees F	87	87	88	87
Low Temp	Degrees F	82	81	81	81
Precipitation	Inches	0.00	0.00	0.00	0.00
Max Wind Speed	Miles/Hour	21	20	18	17

Source: https://www.wunderground.com/history/daily/us/tx/port-aransas/KRAS/

SURVEY DATA

The survey was conducted in the Texas State Plane Coordinate System North American Datum of 1983 (NAD 83), Texas South Zone. The vertical datum was NAVD 88. The hydrographic data was collected and processed using HYPACK software. Real time kinematic global positioning system (GPS-RTK) survey equipment was used for positioning and tide corrections. A single-beam echo sounder at a nominal frequency of 200kHz was used to perform the bathymetric survey of the sea floor in the survey area. The echo sounder calibration, including bar check, was verified using manual lead line measurements on site. The data was later reduced to a spacing of 10 feet along transects.

WATER VELOCITY MEASUREMENTS

Two Acoustic Doppler Current Profilers (ADCPs) were employed to measure water velocities in the study area. An ADCP is a hydroacoustic current meter, similar to sonar, that measures water current velocities over a depth range using the Doppler effect of sound waves scattered back from particles within the water column. The term ADCP is used synonymously for all kind of acoustic current meters, although the abbreviation originates from the name of an instrument series developed by Teledyne. ADCPs contain multiple piezoelectric oscillators to transmit and receive sound signals. The traveling time of sound waves gives an estimate of the distance, and the frequency spectral shift can then be converted to a velocity. In order to measure 3-dimensional velocities at least three vector components have to be estimated. A micro-processor evaluates the sound velocity at the instrument position using the water equation of state based on integrated temperature and pressure sensors and user-supplied salinity to estimate the velocities and create an acoustic Doppler Velocity Log.

Two kinds of ADCPs were utilized in this study. A Teledyne RD Instruments Workhorse Horizontal 300 kHz ADCP was mounted in a fixed position at roughly 5 feet deep on a piling near the north bank and aimed south-southwest across the “deep hole” and channel. The ADCP was also oriented downward at an angle of 8.3 degrees to avoid surface interference from vessels. The measurement range extended from 4 meters to 204 meters from the ADCP. The signals were time-averaged for 60 seconds per reported reading in 50 distance “bins” of 4 meters each. High

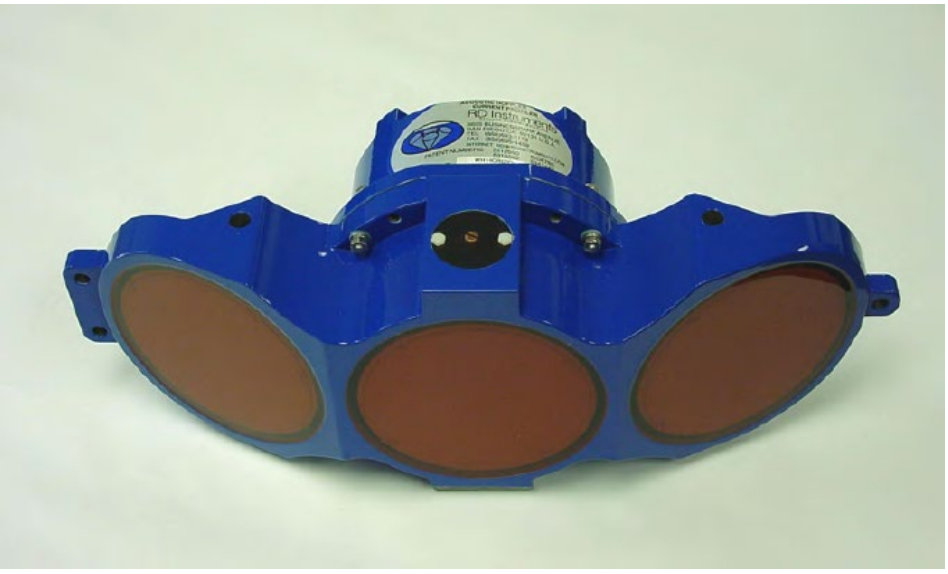


FIGURE 2. HORIZONTAL ADCP

waves and currents prevented safe installation of the fixed horizontal ADCP in the vicinity of the discharge location until the afternoon of June 8. This fixed horizontal ADCP was then operated continuously with a battery pack and internal data storage for approximately 48 hours from June 8th to June 10th. Horizontal ADCP data were collected by and processed using WinH-ADCP software (Teledyne RD Instruments, Poway, California).

A second ADCP, a Teledyne RD Instruments Workhorse Sentinel 600 kHz ADCP was mounted in a downward-looking vertical position on an aluminum post attached to the side of the survey boat. For vertical boat-mounted ADCPs, sound waves bouncing off the streambed are used to determine the velocity vector of the device transducer over the bottom. Combining this with a compass heading and data from the acceleration sensors (typically by use of a Kalman Filter), the relative position of the ADCP transducer can be determined in a process referred to as "bottom-tracking". To collect velocity measurements, the boat was navigated slowly along transects across the channel, perpendicular to the water flow path. The ADCP measures the water depth, northing and easting components of the current velocity vector and the vertical component for numerous "ensembles" or vertical profiles averaged each second as the boat travels along the transect. Approximately 350 ensembles comprise a typical transect. Each ensemble can also be subdivided vertically into horizontal "bins" of 0.5 m vertical thickness. The individual ensemble and bin velocities can be spatially averaged, weighted by bottom track distance traveled and total depth, to produce a composite average channel velocity and flow estimate. It should be mentioned that the water velocity is not measured in approximately the upper 1 meter nor the lower 2-3 meters of the water column, nor do transects extend to shallow near-bank areas. Water velocities in these margins are estimated in the data processing software based on pre-established power functions. Fortunately, these margins represent only a minor portions of the overall channel cross-sectional area.

FIGURE 3. BOAT-MOUNTED (DOWN-LOOKING) ADCP

For the boat-mounted ADCP, five primary transect locations were established, as shown in Figure 4. Transect 1 extended through the channel "deep hole". Transects 2 and 4 were approximately 200 feet upstream and downstream, respectively, of transect 1. Transect 3 was approximately 300 feet downstream of transect 2. Transect 5 was approximately 200 feet upstream of transect 4. Here, upstream is used to indicate the direction towards Corpus Christi Bay, and downstream indicates direction toward the Gulf of Mexico. Current profiles were measured along transects two or three times each day over the four-day study period, including a variety of tide conditions. Current data were collected by and processed using WinRiver II software (Teledyne RD Instruments, Poway, California).

TIDE LEVEL MEASUREMENTS

An In Situ Troll 700 water level data-logger was installed near the north bank to continuously record pressure (water depth) and water temperature. This data provided water level measurements during the study at the discharge location.

WATER QUALITY SAMPLING AND MEASUREMENTS

Water quality vertical profiles were collected each day at the "deep hole" adjacent to the proposed discharge location. These measurements were collected using a YSI (Yellow Springs Instruments) Model 6920 multi-parameter water quality sonde. The YSI sonde was calibrated before use each day following manufacturer's recommended procedures for dissolved oxygen, pH and specific conductance. Before each use, the device was turned on, the protective cage was installed and the unit was allowed to acclimate the sensors in ambient water. The sonde was then deployed to a safe

near-bottom depth, leaving greater than or equal to 5-feet of space between the sonde and the substrate bottom to prevent the sensors from being affected by or fouled by the substrate material. The sonde measurements were allowed to reach a steady state and measurements were documented. The sonde was then raised 5-feet and another round of measurements were documented when a steady state was measured. This was continued towards the water surface in 5-foot increments. The sonde was stored in the shade with the water-tight cup installed (the collection cage was removed) with water in the cup to maintain a moist environment for probe care.

The vessel was kept in position over the sampling point, with continuous monitoring of the water depth and in a manner to minimize horizontal vector of the sonde cable/sonde position (maintaining the sonde directly under the bow of the vessel).

Water quality vertical profiles were also collected at the proposed intake location each day that water sampling was performed (June 9 and 10). The procedure was the same as for in the deep hole (above).

Because the YSI was initially mistakenly shipped with only a 30-foot cable, the vertical profiles collected on June 7 and 8 only extend to that depth. After a 100-foot cable was received, the profiles on June 9 and 10 extended to the bottom of the deepest areas adjacent to the proposed discharge location. Also note that the waves in the Gulf were too high to access the intake location on June 7 and 8, thus no water quality measurements were collected those days.

Water quality grab samples were collected at the intake location on June 9 and June 10. Significant waves were still present on these days but to a lesser extent than June 7 and 8. Quality control samples for field blanks and field duplicate samples were also collected for quality control purposes.

The sample location GPS target coordinates was verified using the vessel's Trimble GeoXT GPS unit coordinates. Water depth was measured with a weight and rope line and verified with the boat's calibrated water depth transducer. Samples were collected using a 12-volt battery-powered peristaltic pump with new tubing for each day's sample collection. The tubing intake was positioned at half of the total water depth to keep the tubing intake away from the bottom and to get a representative sample of the water column. A small rigid plastic-coated weight was securely zip-tied 3-feet above the tubing intake to keep the intake end at mid water column depth. Due to high winds and large waves, the boat motor had to be run continuously to hold position while sampling.

The sample team donned a pair of new, clean, powder-free laboratory-grade nitrile gloves for each person before sampling activities. Volatile sample vials were filled first, with no headspace. Low level metals samples were collected next using the "clean hands – dirty hands" procedure. The sample tubing was firmly clamped to the boat railing to provide a constant stream of water flowing with no need to turn a pump off/on and no need to hold the tubing discharge end. Both team members donned two pair of new, clean, powder-free laboratory-grade nitrile gloves. Dirty hands only touched and opened the zip-lock bags. Clean hands only touched the sample containers, filled them and closed the lids. All remaining sample jars were filled by both samplers wearing new, clean, powder-free laboratory-grade nitrile gloves.

Sample labels were completed and samples were immediately placed in coolers on ice. Chain of Custody forms were filled out and secure custody of the samples was maintained thru receipt of the samples at the analytical laboratory. Samples for chemical analysis were shipped via overnight courier to ALS Labs in Houston, Texas and Holland, Michigan.

Results

BATHYMETRY AND CURRENT VELOCITY

Figure 4 illustrates the measured bathymetric survey. Results were generally consistent with and within 0.5 feet of previous surveys.

Figure 5 illustrates the results of the fixed horizontal ADCP and the tide gage. Note that this ADCP measures both horizontal (upstream/downstream) velocities and vertical (up/down) velocities. The horizontal velocities are much larger than the vertical and ranged between +1.25 m/s and – 1.2 m/s. The horizontal velocities are of primary interest. These velocities represent the average channel velocity over the roughly 200-meter portion of the channel measured by this ADCP. For comparison purposes, the figure also displays the point-in-time average velocity measurements from transects

by the boat-mounted ADCP. It indicates excellent agreement between fixed and boat-mounted ADCP velocity measurements.

Figure 6 offers a comparison of ADCP velocity measurements (both boat-mounted and fixed) from this study with nearby ADCP measurements retrieved from the National Oceanic and Atmospheric Administration website (https://tidesandcurrents.noaa.gov). One ADCP (station cc0601) is mounted on a pier at the University of Texas Marine Science Institute Fisheries and Marine Lab, west of the Texas Department of Transportation ferries, and its beam extends a reported 130 meters from the south shore at a depth of 4.5 meters. The second ADCP (station cc0301) is located downstream, in the Aransas Pass main channel (closer to the Gulf of Mexico) and its beam extends about 90 meters from the west shore and at a depth of 3.9 meters. The velocities measured in this project agreed very well with those measured upstream of the ferries. Agreement with the downstream ADCP in Aransas Pass was also strong, though higher peak velocities were noted there, probably due to channel dimensions and additional sources of flow such as Aransas Bay.

Table 2 provides a summary of ADCP current profile measurements for each transect. Depictions of the currents measured in each individual transect are included in Appendix A. Bad ensembles and bins were typically caused by loss of bottom tracking due to vessel pitch and roll; they show as white space for missing data in the profiles. Transects with less than 20% data loss were deemed acceptable.

Table 2. Summary of Boat-Mounted ADCP Velocity Measurements Transects

End Date/Time	Transect	Velocity (m/s)	Bad Ensembles (%)	Bad Bins (%)	Total Flow (m^3/s)	Cross-Section Area (m^2)
6/7/21 13:34	1	0.194	0.00%	0.56%	1,077	5,798
6/7/21 13:40	1	0.199	0.00%	0.67%	1,067	5,761
6/7/21 13:48	2	0.194	0.20%	0.20%	1,253	6,277
6/7/21 13:55	2	0.223	0.00%	0.63%	1,340	6,380
6/7/21 14:03	3	0.223	1.26%	1.24%	1,432	6,339
6/7/21 14:08	3	0.245	2.98%	1.11%	1,442	6,370
6/7/21 14:19	4	0.303	1.19%	0.45%	1,617	5,691
6/7/21 14:23	4	0.312	2.61%	1.52%	1,652	5,670
6/7/21 14:31	5	0.329	0.00%	0.78%	1,708	5,368
6/7/21 14:37	5	0.345	0.60%	0.30%	1,766	5,419
6/7/21 16:41	5	0.632	5.65%	7.04%	3,382	5,330
6/7/21 16:46	5	0.659	7.96%	1.17%	3,426	5,490
6/7/21 16:52	4	0.669	7.40%	2.85%	3,469	5,641
6/7/21 16:55	4	0.680	3.49%	1.68%	3,507	5,594
6/7/21 17:03	1	0.651	5.12%	3.32%	3,567	5,715
6/7/21 17:07	1	0.674	4.24%	1.87%	3,578	5,934
6/7/21 17:14	2	0.628	3.06%	1.76%	3,591	6,193
6/7/21 17:18	2	0.674	2.21%	1.36%	3,619	6,220
6/7/21 17:24	3	0.585	4.39%	0.96%	3,609	6,073
6/7/21 17:27	3	0.702	1.19%	0.29%	3,772	6,032
6/8/21 8:13	5	-0.570	0.00%	0.08%	(2,842)	5,242
6/8/21 8:17	5	-0.569	0.00%	0.17%	(2,898)	5,492
6/8/21 8:23	4	-0.490	0.00%	0.33%	(2,666)	5,675
6/8/21 8:28	4	-0.514	0.00%	0.22%	(2,731)	5,601
6/8/21 8:34	1	-0.502	0.00%	0.70%	(2,604)	5,780
6/8/21 8:39	1	-0.423	0.00%	2.00%	(2,413)	5,676

End Date/Time	Transect	Velocity (m/s)	Bad Ensembles (%)	Bad Bins (%)	Total Flow (m^3/s)	Cross-Section Area (m^2)
6/8/21 8:47	2	-0.420	0.00%	0.00%	(2,312)	5,850
6/8/21 8:52	2	-0.425	0.00%	0.00%	(2,328)	5,857
6/8/21 9:18	3	-0.380	1.93%	0.00%	(1,903)	5,913
6/8/21 9:22	3	-0.367	0.00%	0.00%	(1,906)	5,827
6/8/21 13:16	5	0.187	0.00%	0.00%	938	5,162
6/8/21 13:20	5	0.190	1.58%	3.00%	938	5,212
6/8/21 14:48	2	0.299	9.38%	0.17%	2,002	6,276
6/8/21 14:56	2	0.381	4.61%	0.18%	2,199	6,277
6/8/21 15:03	3	0.401	1.23%	1.84%	2,169	6,108
6/8/21 15:09	3	0.393	3.74%	0.14%	2,182	5,826
6/8/21 15:17	4	0.464	2.43%	0.05%	2,411	5,584
6/8/21 15:25	4	0.482	1.35%	0.16%	2,492	5,591
6/8/21 15:31	1	0.477	6.49%	0.34%	2,525	5,852
6/8/21 15:49	1	0.480	2.80%	0.00%	2,671	5,532
6/9/21 11:00	5	-0.232	0.00%	0.14%	(1,210)	5,519
6/9/21 11:05	4	-0.241	0.24%	0.31%	(1,203)	5,592
6/9/21 11:11	1	-0.207	5.64%	0.41%	(1,200)	5,771
6/9/21 11:17	2	-0.174	0.64%	0.47%	(899)	6,178
6/9/21 11:22	2	-0.171	1.23%	0.27%	(824)	6,139
6/9/21 11:33	3	-0.160	1.55%	0.58%	(852)	5,962
6/9/21 13:57	3	0.101	0.57%	1.04%	595	6,156
6/9/21 14:03	2	0.139	0.26%	0.87%	836	6,203
6/9/21 14:07	1	0.155	5.57%	0.42%	852	5,714
6/9/21 14:15	4	0.189	0.83%	0.50%	983	5,602
6/9/21 14:20	5	0.178	1.23%	0.25%	933	5,356
6/9/21 15:23	5	0.342	5.12%	1.08%	1,751	5,437
6/9/21 15:30	4	0.350	3.85%	1.20%	2,010	6,055
6/9/21 15:47	1	0.386	14.14%	15.72%	2,270	5,339
6/9/21 15:52	2	0.347	9.62%	17.03%	1,980	6,305
6/9/21 15:58	3	0.409	7.25%	6.02%	2,369	6,038
6/10/21 12:15	3	-0.252	0.48%	1.20%	(1,316)	6,116
6/10/21 12:19	2	-0.262	14.84%	0.74%	(1,483)	6,353
6/10/21 12:27	1	-0.264	0.49%	0.90%	(1,216)	6,041
6/10/21 12:32	4	-0.261	0.28%	0.31%	(1,117)	5,632
6/10/21 12:37	5	-0.238	1.10%	0.52%	(1,237)	5,451
6/10/21 14:34	5	0.080	2.26%	0.23%	416	5,453
6/10/21 14:38	4	0.090	0.36%	0.39%	465	5,666
6/10/21 14:43	1	0.109	0.29%	0.14%	578	5,784
6/10/21 14:50	3	0.115	0.00%	0.45%	653	6,196
6/10/21 14:55	2	0.144	0.00%	0.34%	827	6,291

FIELD PARAMETERS

Tables 3 and 4 present water quality field parameters measured from June 7 to 10 for the proposed discharge location and intake location, respectively.

Table 3. Field Water Quality Profile Measurements from Deep Hole near the Proposed Discharge Location

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
6/7/2021 15:15 - Flow toward GOM at ~ 0.4 m/s (5 hours since flow reversal)						
	5	8.08	27.10	5.27	44,080	28.52
	10	8.04	26.80	5.27	44,800	29.04
	15	8.04	26.80	5.20	45,400	29.47
	20	8.01	26.56	4.74	45,400	29.47
	25	8.00	26.30	4.42	45,450	29.51
	29	8.01	26.50	4.47	45,485	29.54
6/7/2021 17:36 - Flow toward GOM at ~ 0.9 m/s (7.3 hours since flow reversal)						
	5	8.23	27.70	5.77	44,175	28.59
	10	8.19	27.50	5.61	44,444	28.78
	15	8.18	27.50	5.45	44,570	28.88
	20	8.14	27.30	5.23	44,600	28.90
	25	8.14	27.20	5.23	44,400	28.75
	30	8.13	27.10	5.13	44,700	28.97
6/8/2021 10:48 - Flow toward CC Bay at ~ 0.26 m/s (9.7 hours since flow reversal)						
	5	7.86	25.80	3.65	47,350	30.88
	10	7.86	25.50	3.30	47,998	31.35
	15	7.84	25.30	2.76	49,353	32.33
	20	7.83	25.20	2.60	50,090	32.86
	25	7.83	25.10	2.49	50,020	32.81
	30	7.83	25.10	2.44	50,218	32.95
6/8/2021 15:35 - Flow toward GOM at 0.58 m/s (4 hours since flow reversal)						
	5	8.04	27.00	5.74	48,070	31.40
	10	8.03	27.10	5.37	48,200	31.50
	15	8.02	27.00	5.33	48,380	31.63
	20	7.99	26.80	4.82	48,729	31.88
	25	7.99	26.70	5.00	48,339	31.60
	30	7.96	26.60	4.63	48,651	31.82
6/9/2021 11:43 - Flow toward CC Bay at 0.25 m/s (11.3 hours since flow reversal)						
	5	8.02	27.21	3.38	44,033	28.49
	10	8.01	27.02	2.48	42,321	27.25
	15	8.00	26.93	2.79	42,425	27.33
	20	7.99	26.92	2.70	41,978	27.00
	25	7.99	26.72	2.68	43,661	28.22
	30	7.97	26.23	2.47	44,658	28.94

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
	35	7.94	26.23	2.93	41,972	27.00
	40	7.94	26.18	2.81	45,033	29.21
	45	7.94	26.16	2.42	42,606	27.46
	50	7.94	26.15	2.43	42,196	27.16
	55	7.93	26.14	2.47	43,600	28.17
	60	7.93	26.13	2.53	40,551	25.97
	65	7.93	26.13	2.50	41,818	26.89
	70	7.93	26.16	2.27	42,791	27.59
	75	7.92	26.09	2.82	44,628	28.92
6/9/2021 14:35 - Flow toward GOM at 0.18 m/s (1.8 hours since flow reversal)						
	5	8.13	27.91	5.61	43,682	28.23
	10	8.13	27.86	5.38	44,132	28.56
	15	8.12	27.57	5.68	43,211	27.89
	20	8.11	27.71	8.35	42,560	27.42
	25	8.11	27.42	6.75	43,961	28.44
	30	8.12	27.38	6.98	44,404	28.76
	35	8.11	27.30	6.56	44,663	28.94
	40	8.10	27.15	6.01	44,889	29.11
	45	8.09	26.73	4.77	44,252	28.65
	50	8.06	26.63	4.29	44,312	28.69
	55	8.07	26.61	6.65	45,111	29.27
	60	8.06	26.46	4.54	43,489	28.09
	65	8.06	26.40	5.30	44,976	29.17
	70	8.06	26.40	4.70	44,195	28.60
	75	8.06	26.45	5.79	40,287	25.78
	80	8.07	26.53	6.65	41,199	26.44
6/9/2021 16:04 - Flow toward GOM at 0.52 m/s (3.2 hours since flow reversal)						
	1	8.10	27.83	7.30	39,792	25.43
	5	8.07	27.85	4.30	41,555	26.70
	10	8.08	27.75	4.65	41,519	26.67
	15	8.08	27.77	4.70	41,416	26.60
	20	8.08	27.71	4.55	39,964	25.55
	25	8.07	27.60	4.59	41,423	26.60
	30	8.06	27.36	4.35	39,371	25.12
	35	8.04	27.32	4.39	39,892	25.50
	40	8.04	27.16	4.47	39,330	25.09
	45	8.03	27.07	4.63	39,962	25.55
	50	8.02	27.02	4.68	39,510	25.22
	55	8.01	26.96	4.29	40,568	25.99
	60	8.04	27.53	4.80	39,702	25.36

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
	65	8.01	26.92	4.54	39,973	25.56
	70	8.01	27.34	4.96	39,982	25.56
	75	8.01	26.76	5.12	39,044	24.89
	80	7.98	26.72	4.76	39,872	25.48
	85	7.98	26.90	6.83	38,927	24.80
6/10/2021 12:44 - Flow toward CC Bay at 0.42 m/s (>11 hours since flow reversal)						
	1	8.17	27.78	9.17	43,062	27.79
	5	8.17	27.76	9.19	43,034	27.77
	10	8.17	27.57	9.13	43,086	27.80
	15	8.16	27.50	8.99	42,046	27.05
	20	8.15	27.52	8.99	43,251	27.92
	25	8.15	27.50	8.94	43,162	27.86
	30	8.15	27.52	8.98	43,116	27.83
	35	8.15	27.51	8.91	43,110	27.82
	40	8.15	27.44	8.94	42,168	27.14
	45	8.15	27.40	8.87	42,684	27.51
	50	8.14	27.45	8.62	43,086	27.80
	55	8.15	27.43	8.89	43,187	27.88
	60	8.14	27.37	8.46	43,689	28.24
	65	8.14	27.40	8.28	43,089	27.81
	70	8.14	27.40	0.43	43,068	27.79
	75	8.14	27.37	0.07	43,106	27.82
	80	8.14	27.39	0.62	43,331	27.98
6/10/2021 14:58 - Flow toward GOM at 0.21 m/s (< 1 hour since flow reversal)						
	1	8.18	28.19	8.35	42,990	27.73
	5	8.18	28.18	9.32	42,906	27.67
	10	8.18	28.16	9.14	42,612	27.46
	15	8.18	28.12	9.09	43,091	27.81
	20	8.18	27.82	8.60	42,902	27.67
	25	8.17	28.09	8.45	42,170	27.14
	30	8.17	27.70	1.79	42,986	27.73
	35	8.14	27.38	0.00	43,658	28.22
	40	8.12	27.30	0.00	43,726	28.27
	45	8.11	27.26	0.00	43,562	28.15
	50	8.11	27.41	0.34	43,631	28.20
	55	8.12	27.30	0.08	43,503	28.10
	60	8.11	27.28	0.51	43,619	28.19
	65	8.11	27.22	0.95	43,163	27.86
	70	8.11	27.36	1.51	42,796	27.59
	75	8.12	27.39	2.24	43,712	28.26

Table 4. Field Water Quality Profile Measurements from the Proposed Intake Location

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
6/9/2021 08:24						
	5	8.09	27.37	8.33	36,297	22.90
	10	8.08	27.31	6.03	39,919	25.52
	15	8.02	27.21	5.64	39,214	25.01
6/10/2021 11:09						
	1	8.20	27.92	9.64	42,164	27.14
	5	8.20	27.86	9.38	42,396	27.31
	10	8.18	27.57	8.55	42,461	27.35
	15	8.13	27.66	8.92	42,626	27.47

Table 5. Analytical Laboratory Results

Port of Corpus Christi Desalination Industrial Wastewater Permit Application
Intake Samples - Gulf of Mexico
Validated Result Summary for Samples Collected June 2021

				SAMPLE ID:	POCC - INTAKE-1			POCC - INTAKE-2			POCC - INTAKE-2-DUP		
				DATE SAMPLED:	6/9/2021			6/10/2021			6/10/2021		
				LAB SAMPLE ID:	HS21060521-01			HS21060616-01			HS21060616-02		
Analytical Method	MAL (1)	Unit	CAS Number	Analyte									
Worksheet 2 Table 1													
SM5210 B	--	mg/L	NA	BOD (5-day)	<	2.00		<	2.00		<	2.00	
SM5210 B	--	mg/L	NA	CBOD (5-day)	<	2.00			**2.18**		<	2.00	
E410.4	--	mg/L	NA	Chemical oxygen demand		**60.0**			**55.0**			**53.0**	
E415.1	--	mg/L	NA	Total organic carbon		**2.09**			**2.08**			**2.02**	
SM4500 NH3-B-F	--	mg/L	7664-41-7	Ammonia nitrogen	<	0.050		<	0.050		<	0.050	
M2540D	--	mg/L	NA	Total suspended solids		**8.40**			**6.70**			**7.00**	
E300	--	mg/L	14797-55-8	Nitrate nitrogen	<	10.0		<	5.00		<	5.00	
M4500-N C	--	mg/L	NA	Total organic nitrogen	<	0.50		<	0.50		<	0.50	
E365.3	--	mg/L	7723-14-0	Total phosphorus	<	0.0500		<	0.0500		<	0.0500	
E1664A	--	mg/L	NA	Oil and grease		**3.00**			**2.58**		<	2.00	
M2540C	--	mg/L	NA	Total dissolved solids		**33,400**			**33,800**			**34,000**	
E300	--	mg/L	14808-79-8	Sulfate		**2,340**			**2,350**			**2,360**	
E300	--	mg/L	16887-00-6	Chloride		**16,400**			**16,200**			**17,000**	
E300	--	mg/L	16984-48-8	Fluoride	<	10.0		<	5.00		<	5.00	
SM2320B	--	mg/L	NA	Total alkalinity (mg/L as CaCO3)		**118**			**119**			**120**	
Worksheet 2 Table 2													
E200.8	2.5	µg/L	7429-90-5	Aluminum, total		**74.6**	J		**122**			**183**	
E200.8	5.0	µg/L	7440-36-0	Antimony, total	<	5.30		<	5.30		<	5.30	
E200.8	0.50	µg/L	7440-38-2	Arsenic, total		**3.01**	J	<	2.50			**3.28**	J

				SAMPLE ID:	POCC - INTAKE-1			POCC - INTAKE-2			POCC - INTAKE-2-DUP		
				DATE SAMPLED:	6/9/2021			6/10/2021			6/10/2021		
				LAB SAMPLE ID:	HS21060521-01			HS21060616-01			HS21060616-02		
Analytical Method	MAL (1)	Unit	CAS Number	Analyte									
Worksheet 2 Table 1													
E200.8	3.0	µg/L	7440-39-3	Barium, total		**19.9**	J		**20.8**	J		**21.0**	J
E200.8	0.50	µg/L	7440-41-7	Beryllium, total	<	0.910		<	0.910		<	0.910	
E200.8	1.0	µg/L	7440-43-9	Cadmium, total	<	0.770		<	0.770		<	0.770	
E200.8	3.0	µg/L	7440-47-3	Chromium, total	<	2.51		<	2.51		<	2.51	
M3500-Cr B	3.0	µg/L	18540-29-9	Chromium, hexavalent	<	20.0		<	20.0		<	20.0	
Calculation	--	µg/L	16065-83-1	Chromium, trivalent	<	10.0		<	10.0		<	10.0	
E200.8	2.0	µg/L	7440-50-8	Copper, total		**1.82**	J		**1.80**	J		**2.34**	J
OIA 1677-09	2.0/10	µg/L	NA	Cyanide, available	<	2.0		<	2.0		<	2.0	
E200.8	0.50	µg/L	7439-92-1	Lead, total	<	1.20		<	1.20		<	1.20	
E1631E	0.0050/0.00050	µg/L	7439-97-6	Mercury, total		**0.00058**			**0.00066**			**0.00065**	
E200.8	2.0	µg/L	7440-02-0	Nickel, total		**1.63**	J		**1.69**	J		**2.37**	J
E200.8	5.0	µg/L	7782-49-2	Selenium, total	<	8.60		<	8.60		<	8.60	
E200.8	0.50	µg/L	7440-22-4	Silver, total	<	0.440		<	0.440		<	0.440	
E200.8	0.50	µg/L	7440-28-0	Thallium, total	<	2.50		<	2.50		<	2.50	
E200.8	5.0	µg/L	7440-66-6	Zinc, total	<	10.0		<	10.0		<	10.0	
Worksheet 2 Table 3													
E624	50	µg/L	107-13-1	Acrylonitrile	<	10.0		<	10.0		<	10.0	
E625	10	µg/L	120-12-7	Anthracene	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	71-43-2	Benzene	<	5.00		<	5.00		<	5.00	
E625	50	µg/L	92-87-5	Benzidine	<	5.00		<	5.00		<	5.00	
E625	5.0	µg/L	56-55-3	Benzo(a)anthracene	<	5.00		<	5.00		<	5.00	
E625	5.0	µg/L	50-32-8	Benzo(a)pyrene	<	5.00		<	5.00		<	5.00	
E625	10	µg/L	111-44-4	Bis(2-chloroethyl)ether	<	5.00		<	5.00		<	5.00	

				SAMPLE ID:	POCC - INTAKE-1			POCC - INTAKE-2			POCC - INTAKE-2-DUP		
				DATE SAMPLED:	6/9/2021			6/10/2021			6/10/2021		
				LAB SAMPLE ID:	HS21060521-01			HS21060616-01			HS21060616-02		
Analytical Method	MAL (1)	Unit	CAS Number	Analyte									
Worksheet 2 Table 1													
E625	10	µg/L	117-81-7	Bis(2-ethylhexyl)phthalate	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	75-27-4	Bromodichloromethane [Dichlorobromomethane]	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	75-25-2	Bromoform	<	5.00		<	5.00		<	5.00	
E624	2.0	µg/L	56-23-5	Carbon tetrachloride	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	108-90-7	Chlorobenzene	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	124-48-1	Chlorodibromomethane [Dibromochloromethane]	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	67-66-3	Chloroform	<	5.00		<	5.00		<	5.00	
E625	5.0	µg/L	218-01-9	Chrysene	<	5.00		<	5.00		<	5.00	
E625	10	µg/L	106-44-5	m-Cresol [3-Methylphenol]	<	5.00		<	5.00		<	5.00	
E625	10	µg/L	95-48-7	o-Cresol [2-Methylphenol]	<	5.00		<	5.00		<	5.00	
E625	10	µg/L	106-44-5	p-Cresol [4-Methylphenol]	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	106-93-4	1,2-Dibromoethane	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	541-73-1	m-Dichlorobenzene [1,3-Dichlorobenzene]	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	95-50-1	o-Dichlorobenzene [1,2-Dichlorobenzene]	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	106-46-7	p-Dichlorobenzene [1,4-Dichlorobenzene]	<	5.00		<	5.00		<	5.00	
E625	5.0	µg/L	91-94-1	3,3'-Dichlorobenzidine	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	107-06-2	1,2-Dichloroethane	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	75-35-4	1,1-Dichloroethene [1,1-Dichloroethylene]	<	5.00		<	5.00		<	5.00	
E624	20	µg/L	75-09-2	Dichloromethane [Methylene chloride]	<	10.0		<	10.0		<	10.0	
E624	10	µg/L	78-87-5	1,2-Dichloropropane	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	542-75-6	1,3-Dichloropropene [1,3-Dichloropropylene]	<	5.00		<	5.00		<	5.00	
E625	10	µg/L	105-67-9	2,4-Dimethylphenol	<	5.00		<	5.00		<	5.00	
E625	10	µg/L	84-74-2	Di-n-Butyl phthalate	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	100-41-4	Ethylbenzene	<	5.00		<	5.00		<	5.00	

				SAMPLE ID:	POCC - INTAKE-1			POCC - INTAKE-2			POCC - INTAKE-2-DUP		
				DATE SAMPLED:	6/9/2021			6/10/2021			6/10/2021		
				LAB SAMPLE ID:	HS21060521-01			HS21060616-01			HS21060616-02		
Analytical Method	MAL (1)	Unit	CAS Number	Analyte									
Worksheet 2 Table 1													
E300	500	µg/L	16984-48-8	Fluoride	<	10,000		<	5,000		<	5,000	
E625	5.0	µg/L	118-74-1	Hexachlorobenzene	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	87-68-3	Hexachlorobutadiene	<	5.00		<	5.00		<	5.00	
E625	10	µg/L	77-47-4	Hexachlorocyclopentadiene	<	5.00		<	5.00		<	5.00	
E625	20	µg/L	67-72-1	Hexachloroethane	<	5.00		<	5.00		<	5.00	
E624	50	µg/L	78-93-3	Methyl ethyl ketone	<	10.0		<	10.0		<	10.0	
E625	10	µg/L	98-95-3	Nitrobenzene	<	5.00		<	5.00		<	5.00	
E625	20	µg/L	55-18-5	N-Nitrosodiethylamine	<	5.00		<	5.00		<	5.00	
E625	20	µg/L	924-16-3	N-Nitroso-di-n-butylamine	<	5.00		<	5.00		<	5.00	
E625	333	µg/L	84852-15-3	Nonylphenol	<	5.00		<	5.00		<	5.00	
E625	20	µg/L	608-93-5	Pentachlorobenzene	<	5.00		<	5.00		<	5.00	
E625	5.0	µg/L	87-86-5	Pentachlorophenol	<	5.00		<	5.00		<	5.00	
E625	10	µg/L	85-01-8	Phenanthrene	<	5.00		<	5.00		<	5.00	
E608	0.20	µg/L	12674-11-2	Polychlorinated biphenyls (PCBs)	<	0.0125		<	0.0125		<	0.0125	
E625	20	µg/L	110-86-1	Pyridine	<	5.00		<	5.00		<	5.00	
E625	20	µg/L	95-94-3	1,2,4,5-Tetrachlorobenzene	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	79-34-5	1,1,2,2-Tetrachloroethane	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	127-18-4	Tetrachloroethene [Tetrachloroethylene]	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	108-88-3	Toluene	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	71-55-6	1,1,1-Trichloroethane	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	79-00-5	1,1,2-Trichloroethane	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	79-01-6	Trichloroethene [Trichloroethylene]	<	5.00		<	5.00		<	5.00	
E625	50	µg/L	95-95-4	2,4,5-Trichlorophenol	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	NA	TTHM (Total trihalomethanes)	<	5.00		<	5.00		<	5.00	

				SAMPLE ID:	POCC - INTAKE-1			POCC - INTAKE-2			POCC - INTAKE-2-DUP		
				DATE SAMPLED:	6/9/2021			6/10/2021			6/10/2021		
				LAB SAMPLE ID:	HS21060521-01			HS21060616-01			HS21060616-02		
Analytical Method	MAL (1)	Unit	CAS Number	Analyte									
Worksheet 2 Table 1													
E624	10	µg/L	75-01-4	Vinyl chloride	<	2.00		<	2.00		<	2.00	
Worksheet 2 Table 6													
E300	400 (ug/L)	mg/L	24959-67-9	Bromide		**48.3**			**49.8**			**51.2**	
SM2120B	--	PCU	NA	Color (PCU)		**15.0**			**15.0**			**15.0**	
E300	--	mg/L	NA	Nitrate-Nitrite (as N)	<	20.0		<	10.0		<	10.0	
SM4500 S2-D	--	mg/L	18496-25-8	Sulfide (as S)	<	0.050		<	0.050		<	0.050	
SM5540C	--	mg/L	NA	Surfactants	<	0.050		<	0.050		<	0.050	
E200.8	20 (ug/L)	mg/L	7440-42-8	Boron, total		**3.57**			**3.71**			**3.95**	
E200.8	0.30 (ug/L)	mg/L	7440-48-4	Cobalt, total	<	0.00040		<	0.00040		<	0.00040	
E200.8	7.0 (ug/L)	mg/L	7439-89-6	Iron, total	<	0.500		<	0.500		<	0.500	
E200.8	20 (ug/L)	mg/L	7439-95-4	Magnesium, total		**1,060**			**1,060**			**1,160**	
E200.8	0.50 (ug/L)	mg/L	7439-96-5	Manganese, total		**0.00478**	J		**0.00829**	J		**0.00705**	J
E200.8	1.0 (ug/L)	mg/L	7439-98-7	Molybdenum, total		**0.00886**	J		**0.00927**	J		**0.00982**	J
E200.8	5.0 (ug/L)	mg/L	7440-31-5	Tin, total	<	0.00058		<	0.00058		<	0.00058	
E200.8	30 (ug/L)	mg/L	7440-32-6	Titanium, total	<	0.00390			**0.00666**	J	<	0.00390	
Other Reported Analytes													
E200.8	--	µg/L	7440-70-2	Calcium		**345,000**			**352,000**			**382,000**	
E200.8	--	µg/L	7440-09-7	Potassium		**318,000**			**320,000**			**347,000**	
E200.8	--	µg/L	7440-23-5	Sodium		**9,490,000**			**9,780,000**			**9,520,000**	
E300	--	mg/L	14797-65-0	Nitrogen, Nitrite (As N)	<	10.0		<	5.00		<	5.00	
M4500 NH3 D	--	mg/L	7727-37-9	Nitrogen, Total Kjeldahl	<	0.50		<	0.50		<	0.50	
SM2320B	--	mg/L	NA	Alkalinity, Bicarbonate (As CaCO3)		**118**			**119**			**120**	

				SAMPLE ID:	POCC - INTAKE-1			POCC - INTAKE-2			POCC - INTAKE-2-DUP		
				DATE SAMPLED:	6/9/2021			6/10/2021			6/10/2021		
				LAB SAMPLE ID:	HS21060521-01			HS21060616-01			HS21060616-02		
Analytical Method	MAL [1]	Unit	CAS Number	Analyte									
Worksheet 2 Table 1													
SM2320B	--	mg/L	NA	Alkalinity, Carbonate (As CaCO3)	<	5.00		<	5.00		<	5.00	
SM2320B	--	mg/L	NA	Alkalinity, Hydroxide (As CaCO3)	<	5.00		<	5.00		<	5.00	

QA NOTES AND DATA QUALIFIERS:

" (NO CODE) - Confirmed identification
J - Analyte detected, estimated concentration
Detections are bolded."

NOTES:

[1] Minimum Analytical Level
mg/L - milligrams per liter
µg/L - micrograms per liter
PCU - platinum-cobalt units
su - standard pH units

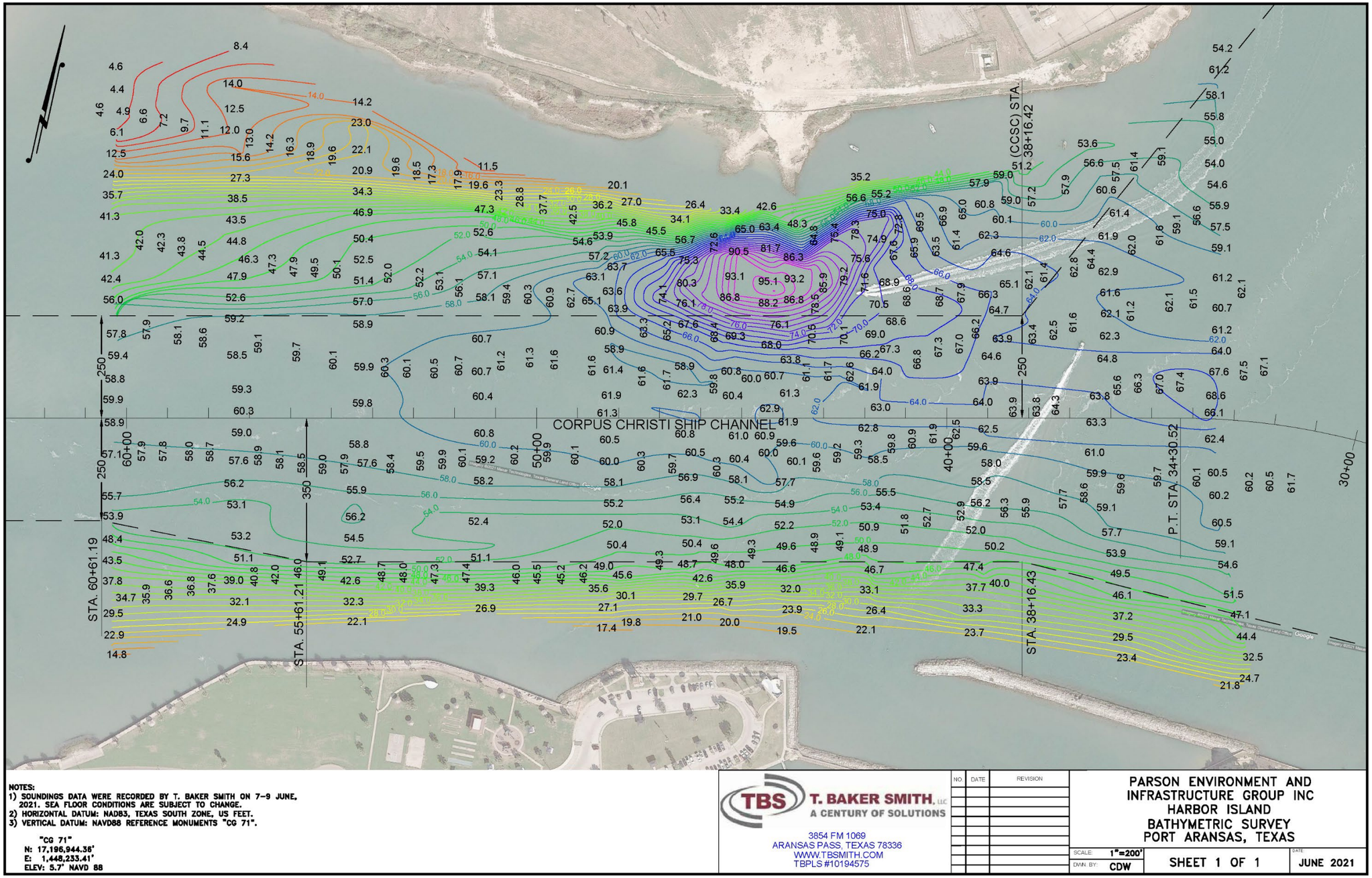


FIGURE 4. MEASURED BATHYMETRY

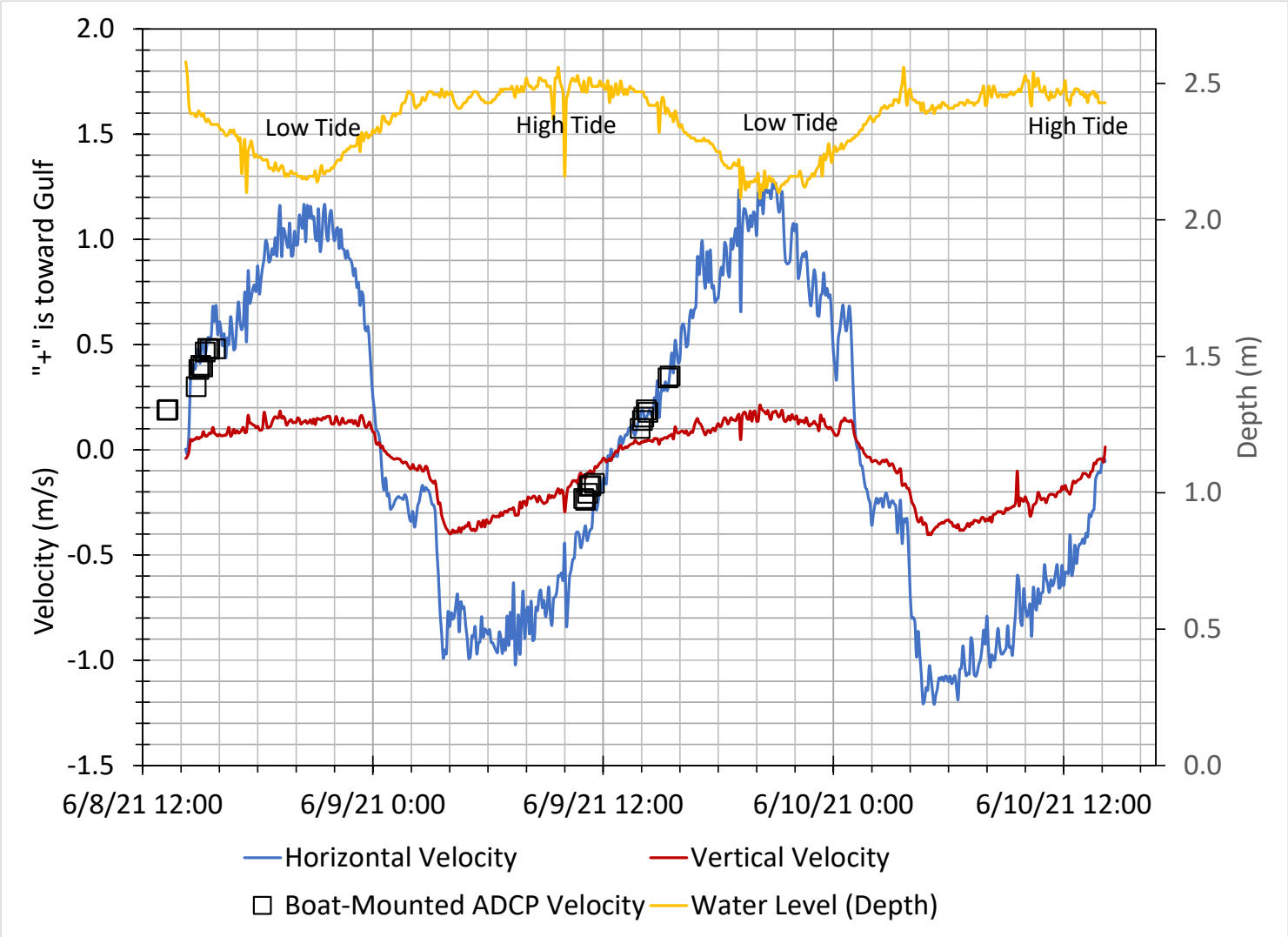


FIGURE 5. ACOUSTIC DOPPLER CURRENT PROFILER MEASUREMENTS

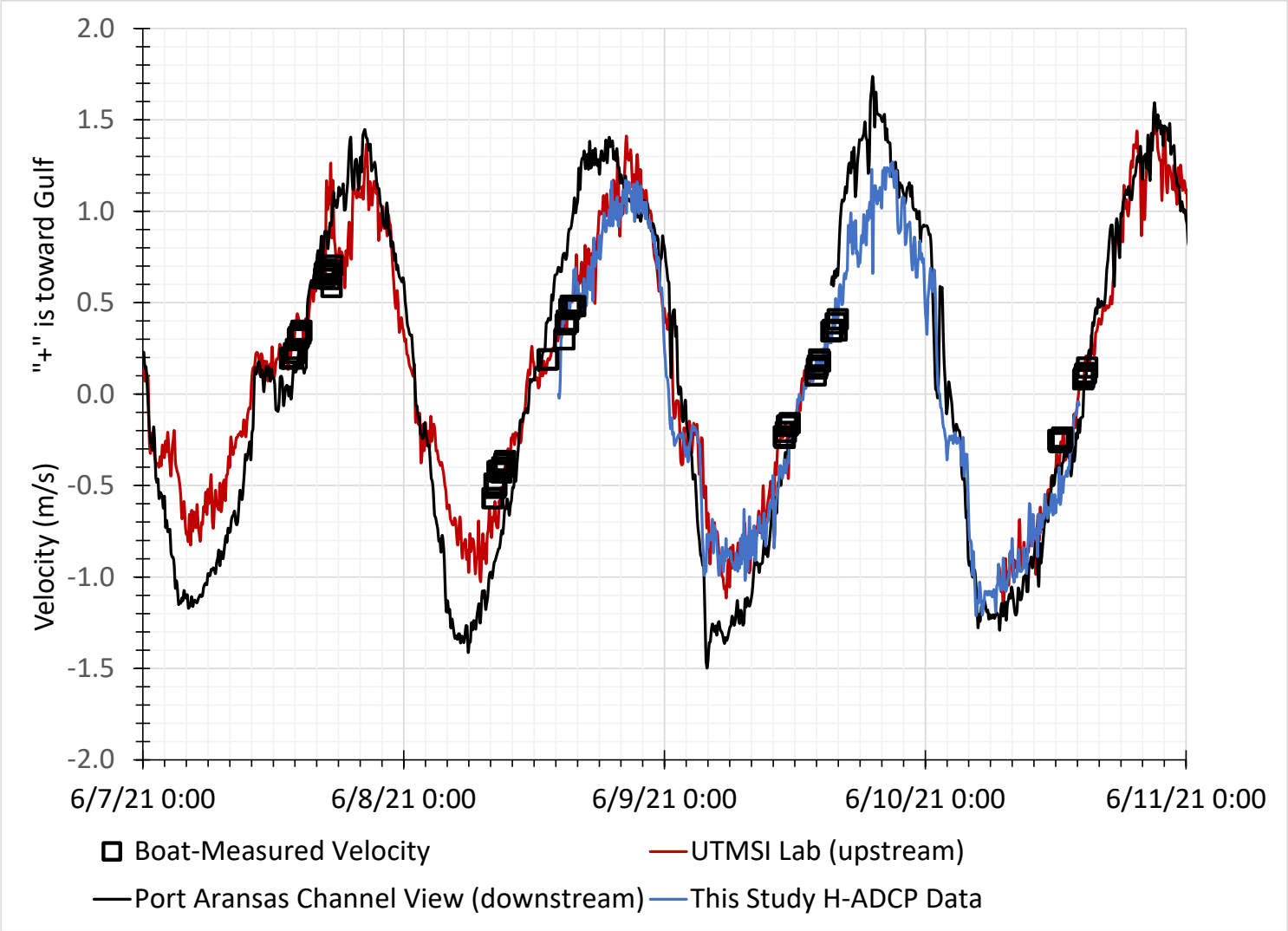
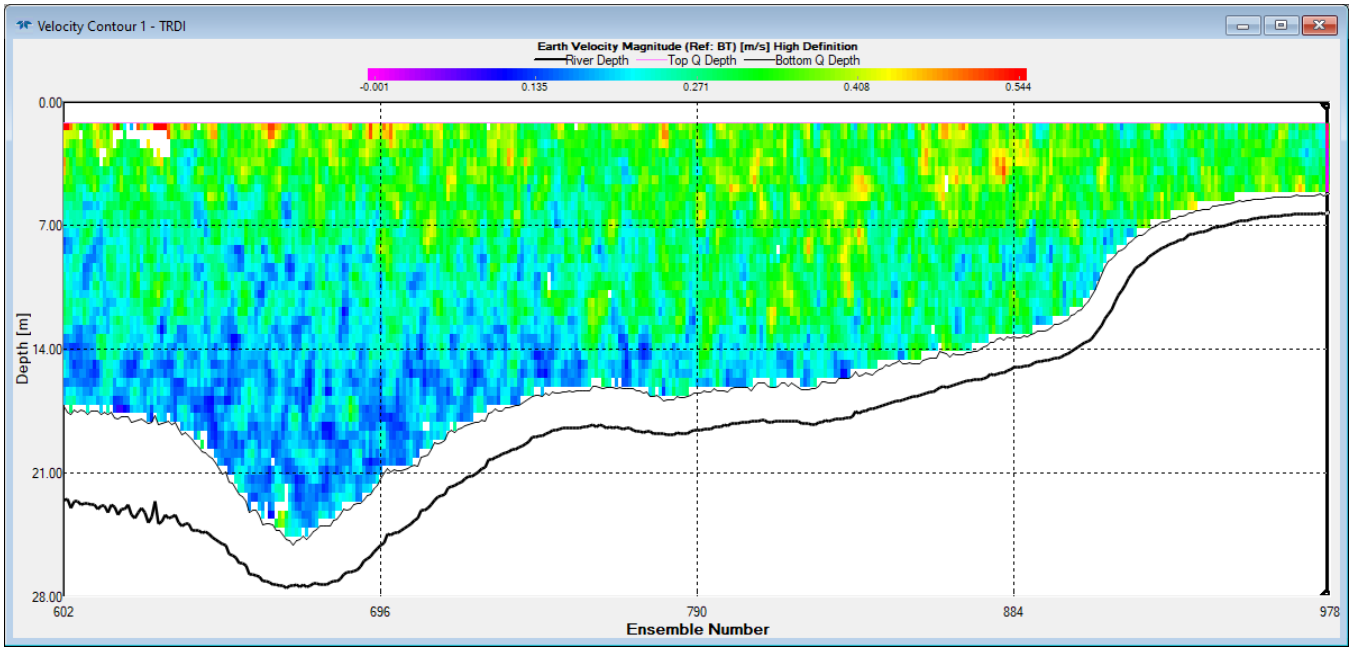


FIGURE 6. COMPARISON OF ADCP CURRENT PROFILE MEASUREMENTS WITH NEARBY SITES

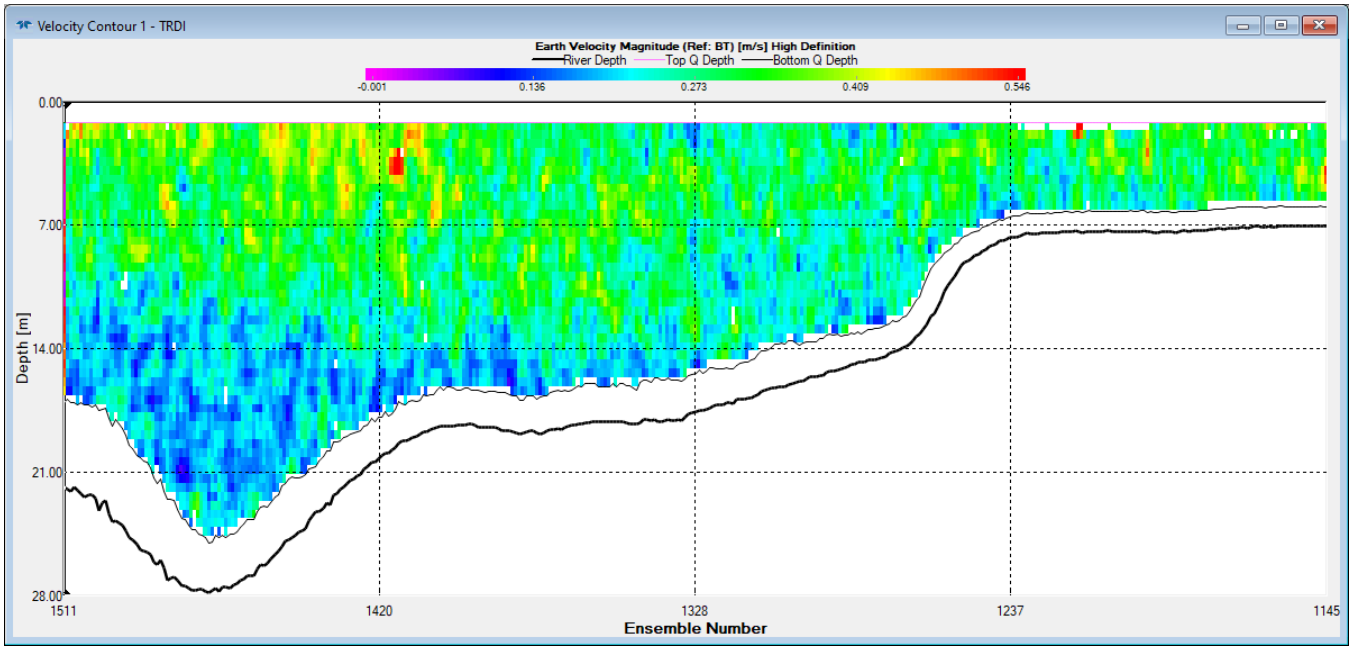
APPENDIX A
ADCP Velocity Transects

The north bank (Harbor Island) is always on left. The colors depict absolute velocity without respect to direction. The calculated channel average velocity includes areas at bottom, top, and sides of channel. A power curve is applied to estimate the un-measured velocities at the top and bottom of the cross-section, and a triangular cross-sectional area is assumed for unmeasured portions of the cross-section on either bank. Also note that the x-axis is not distance but ensemble number. Although we tried to maintain boat speed at a slow and constant pace, at times channel traffic forced us to stop the boat during a transect and extra ensembles were recorded in a limited area. This should not affect the velocity or flow calculations. Finally, although an effort was made to exactly reproduce each transect, in any transect there were small deviations in boat course, start, and end points. We attempted to correct for these using the software.

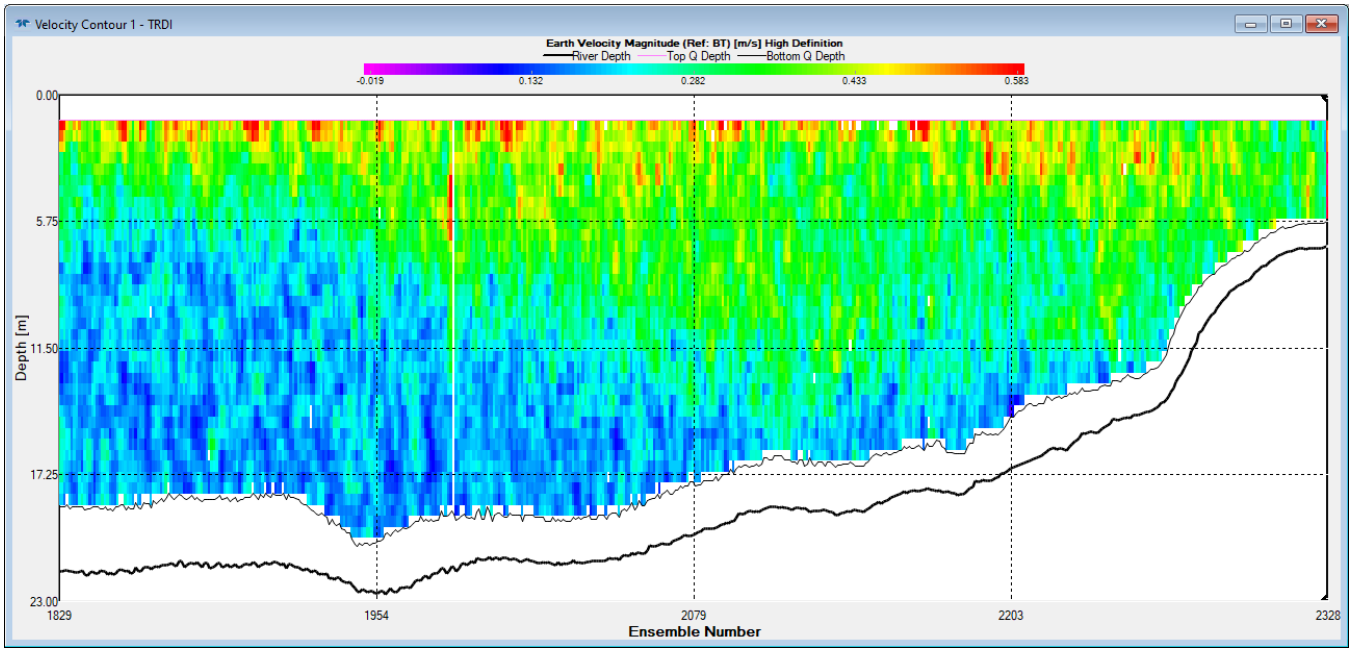
Transect 1, June 7 13:30 – 13:34, Channel Average Velocity = 0.194 m/s



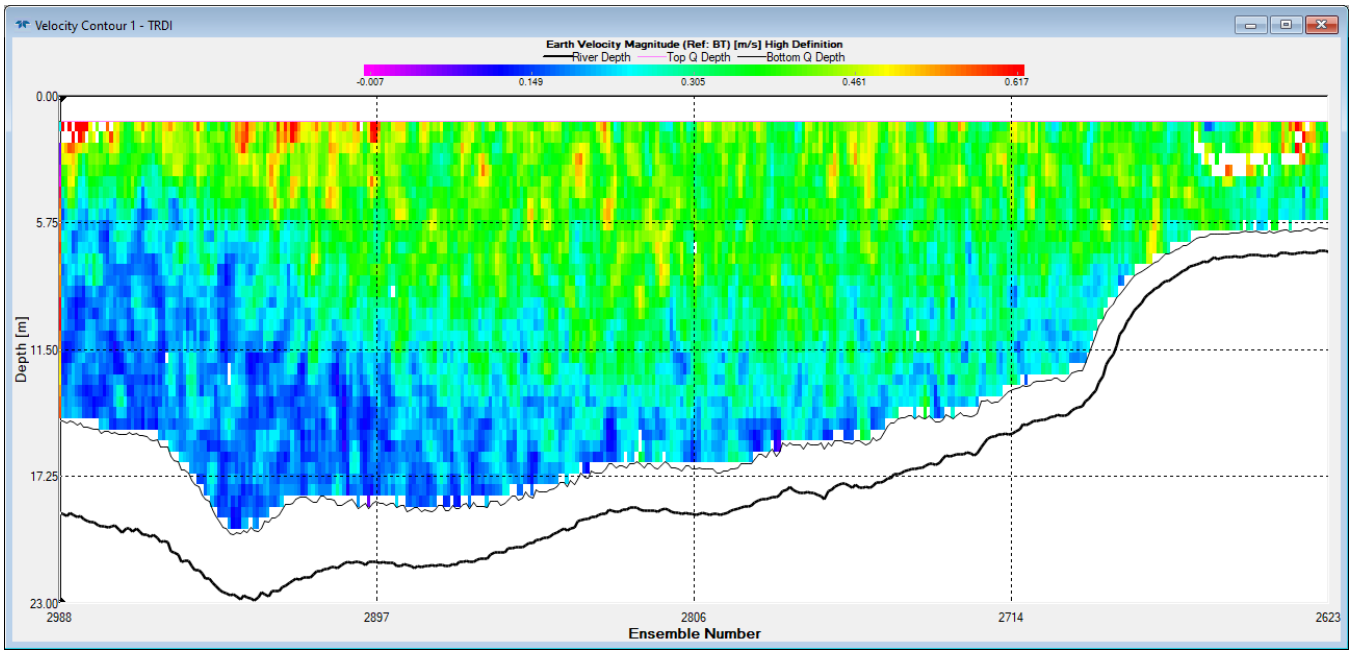
Transect 1, June 7 13:36 – 13:40, Channel Average Velocity = 0.199 m/s



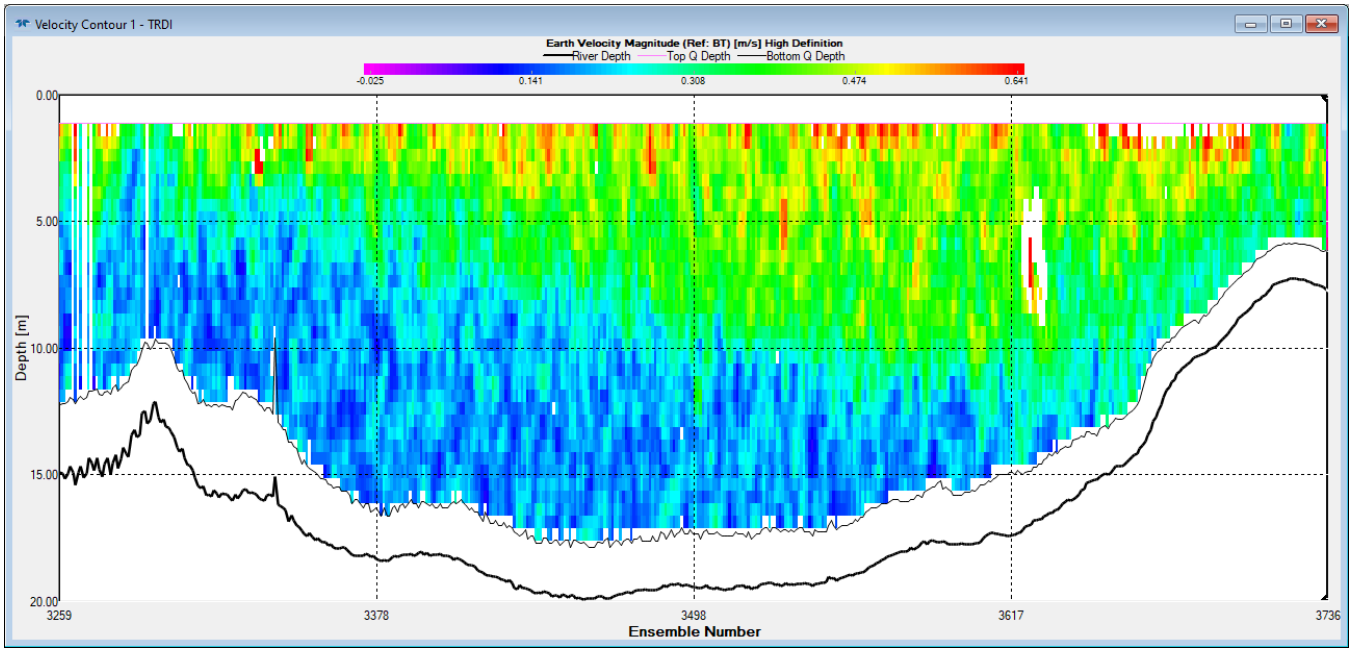
Transect 2, June 7 13:43 – 13:48, Channel Average Velocity = 0.194 m/s



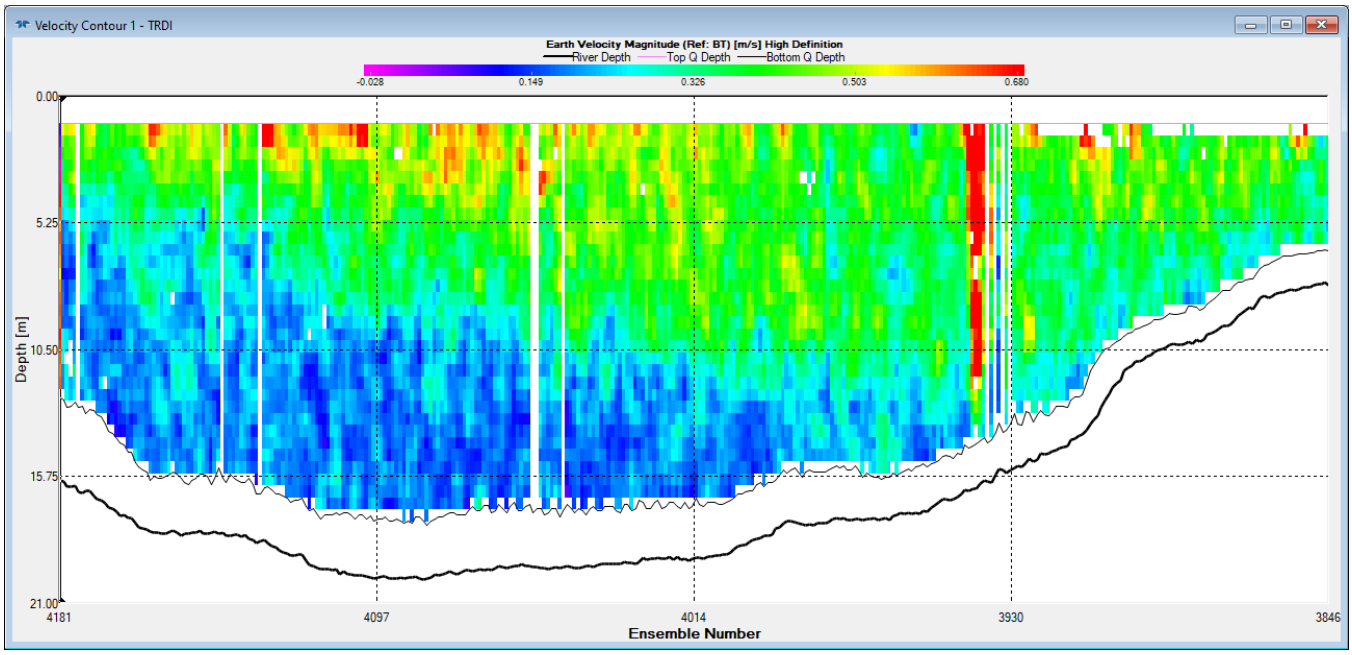
Transect 2, June 7 13:51 – 13:55, Channel Average Velocity = 0.223 m/s



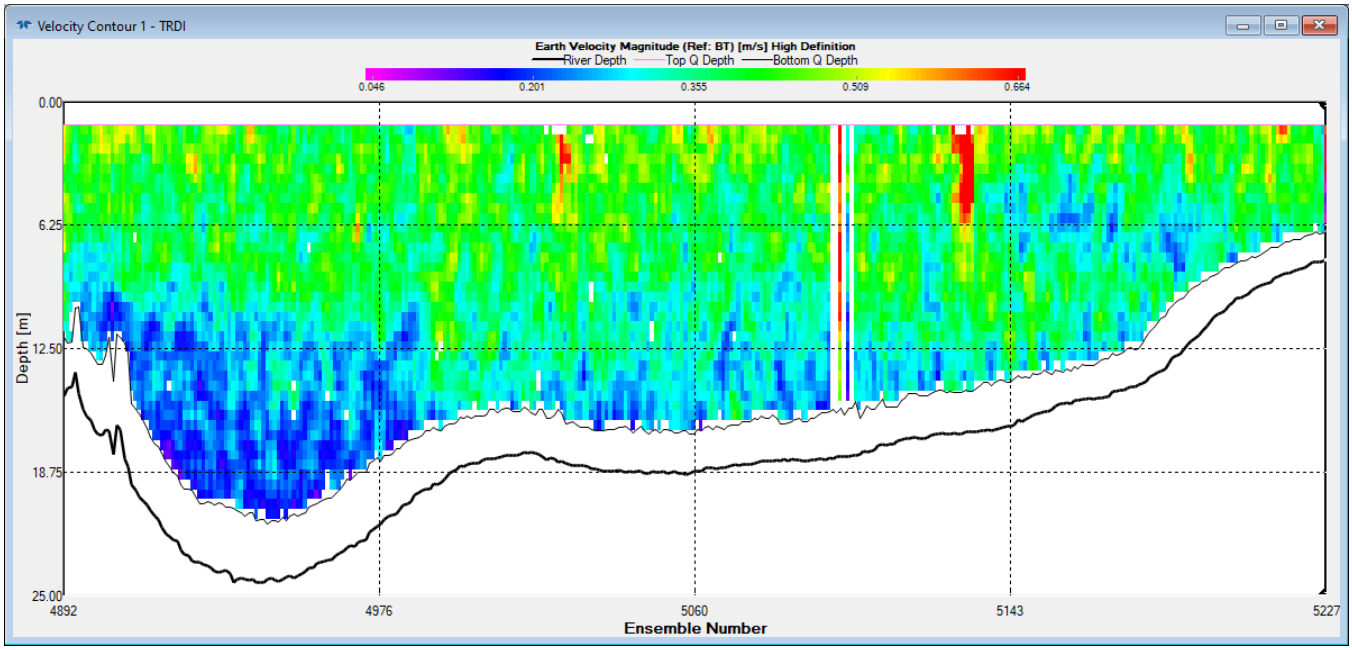
Transect 3, June 7 13:58 – 14:03, Channel Average Velocity = 0.223 m/s



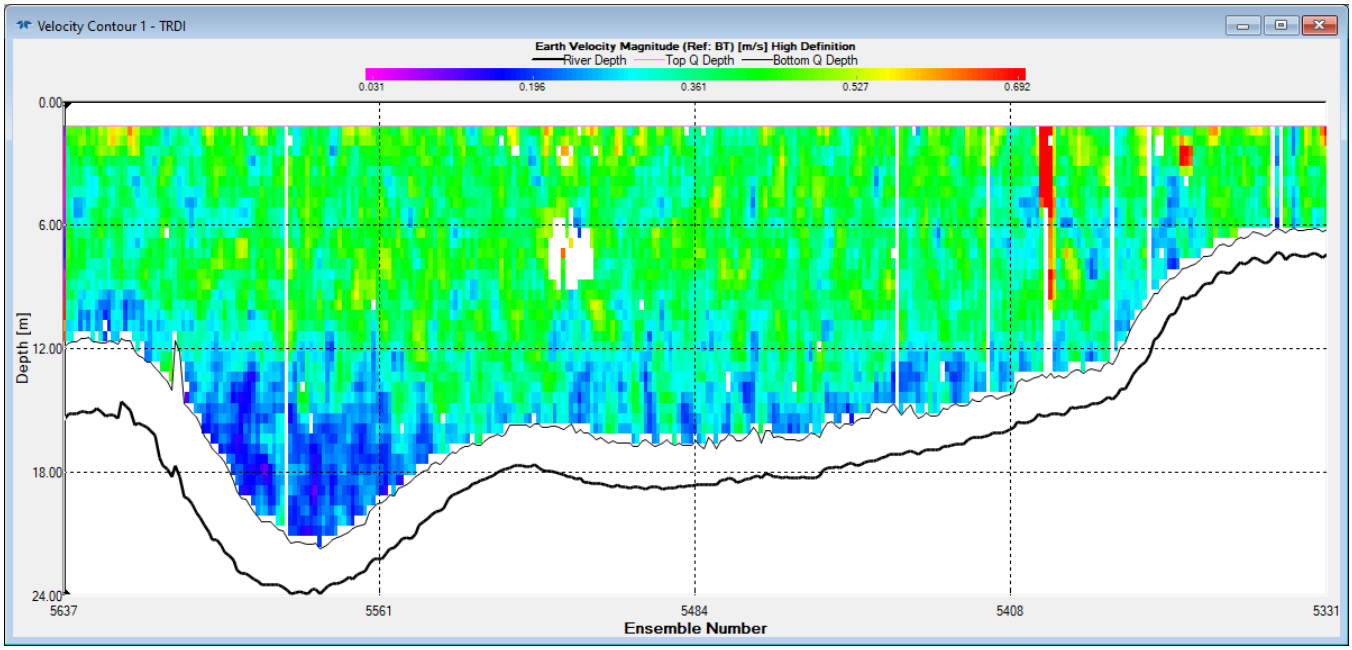
Transect 3, June 7 14:04 – 14:08, Channel Average Velocity = 0.245 m/s



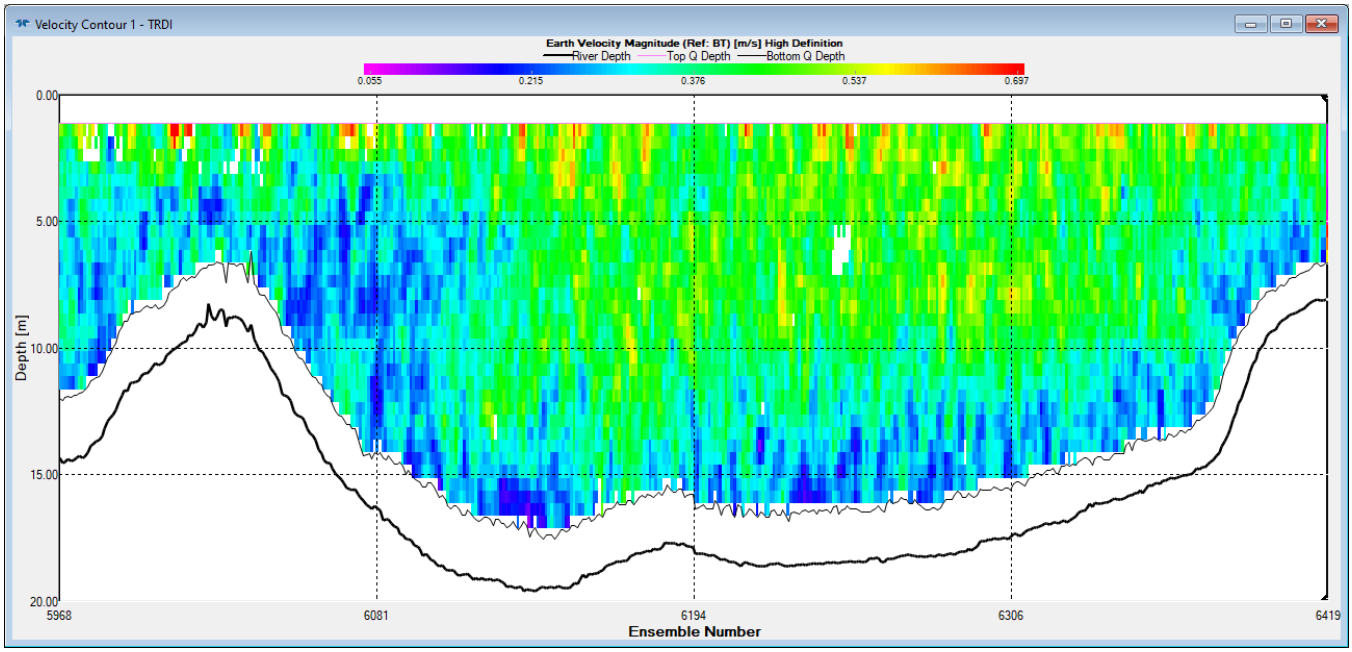
Transect 4, June 7 14:15 – 14:19, Channel Average Velocity = 0.303 m/s



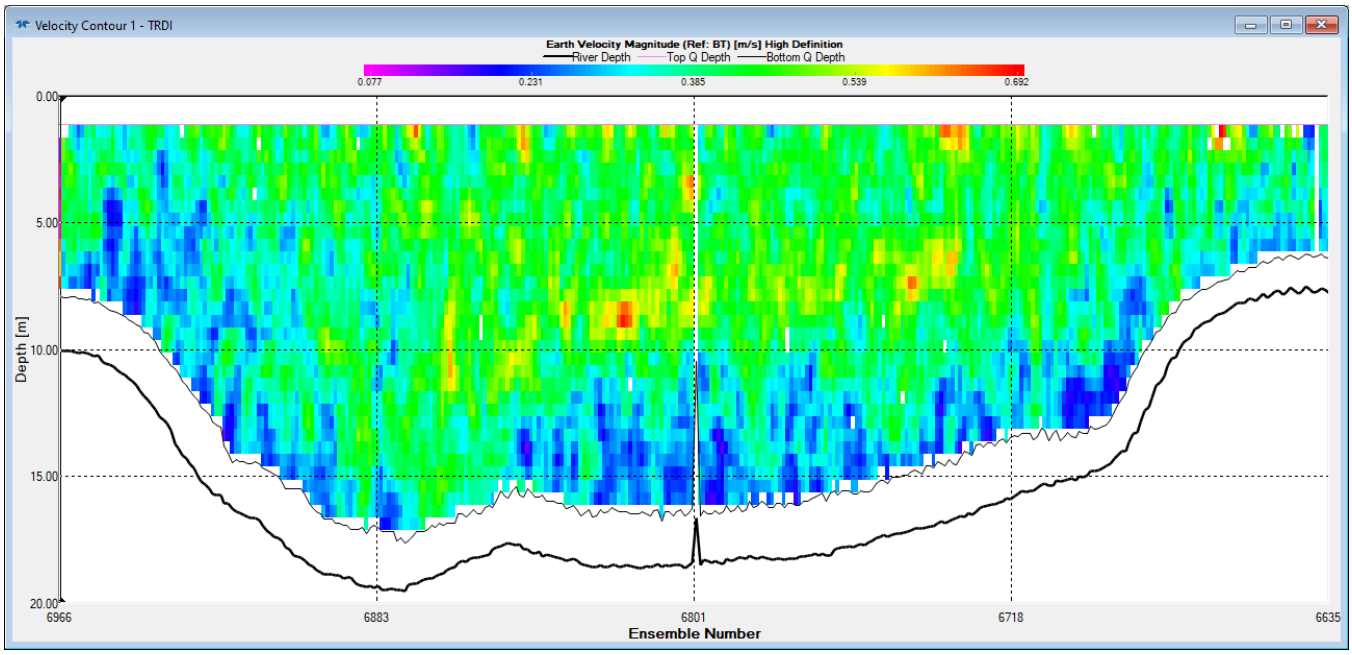
Transect 4, June 7 14:19 – 14:23, Channel Average Velocity = 0.312 m/s



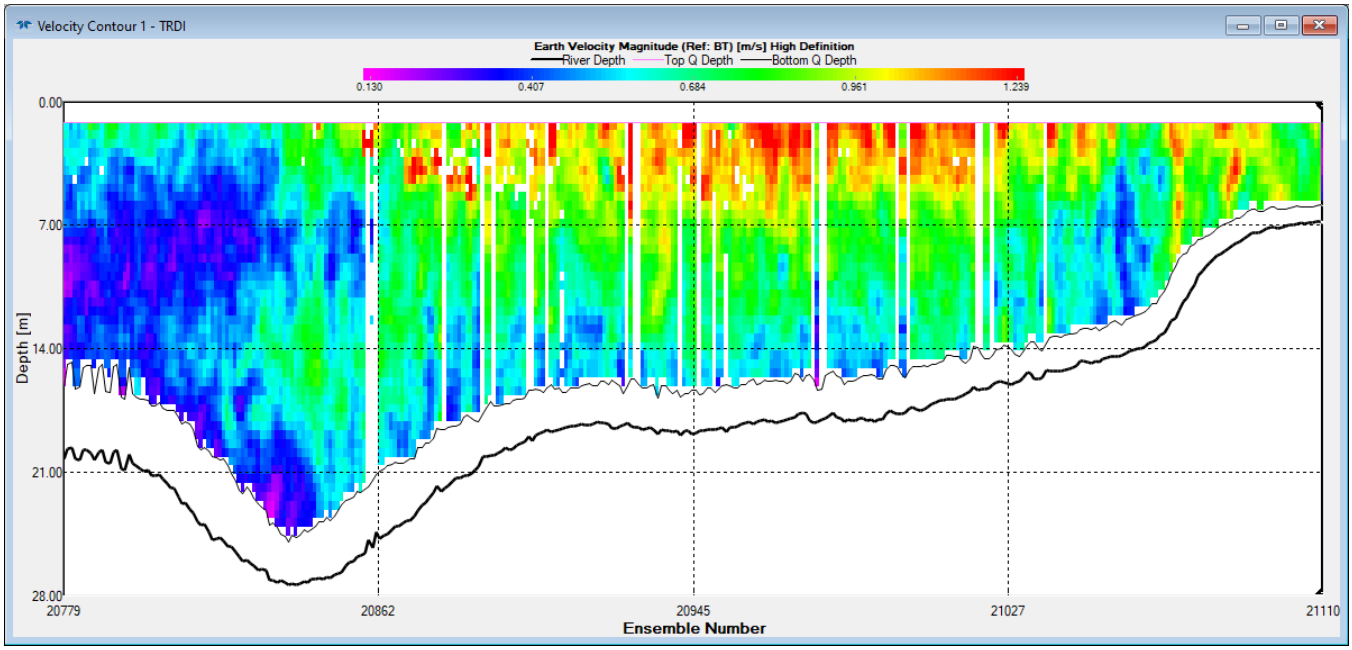
Transect 5, June 7 14:26 – 14:31, Channel Average Velocity = 0.329 m/s



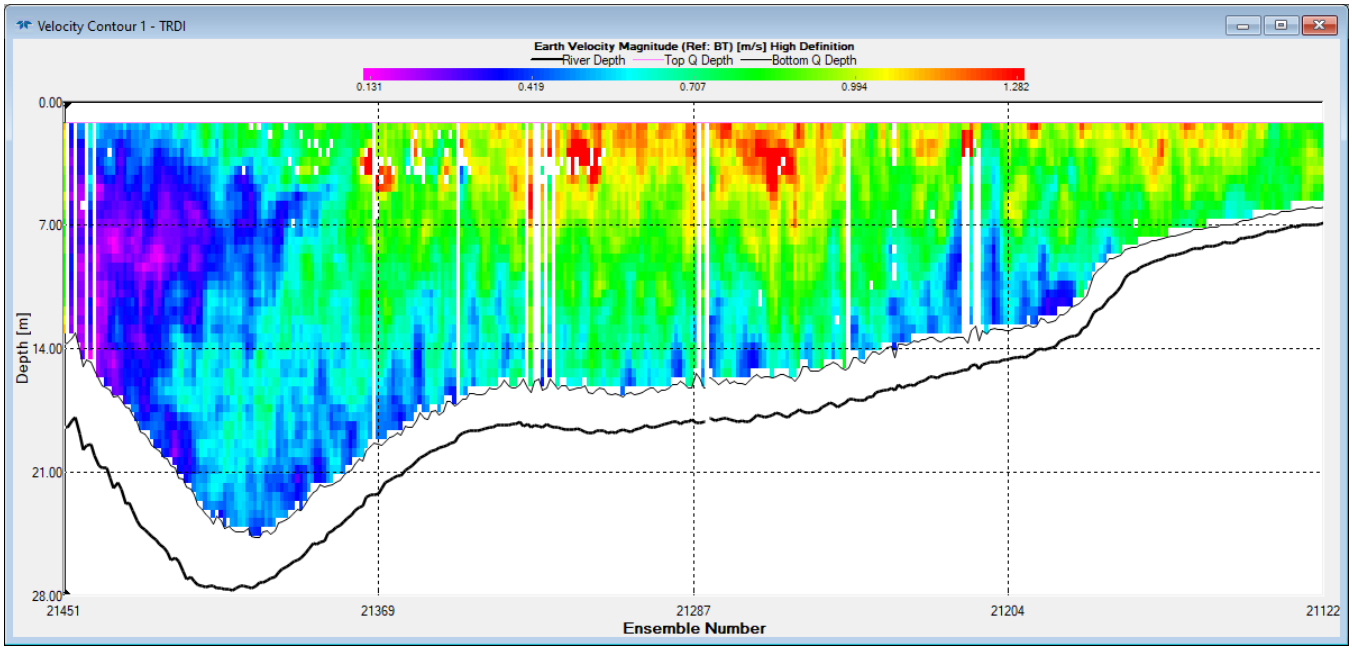
Transect 5, June 7 14:33 – 14:37, Channel Average Velocity = 0.345 m/s



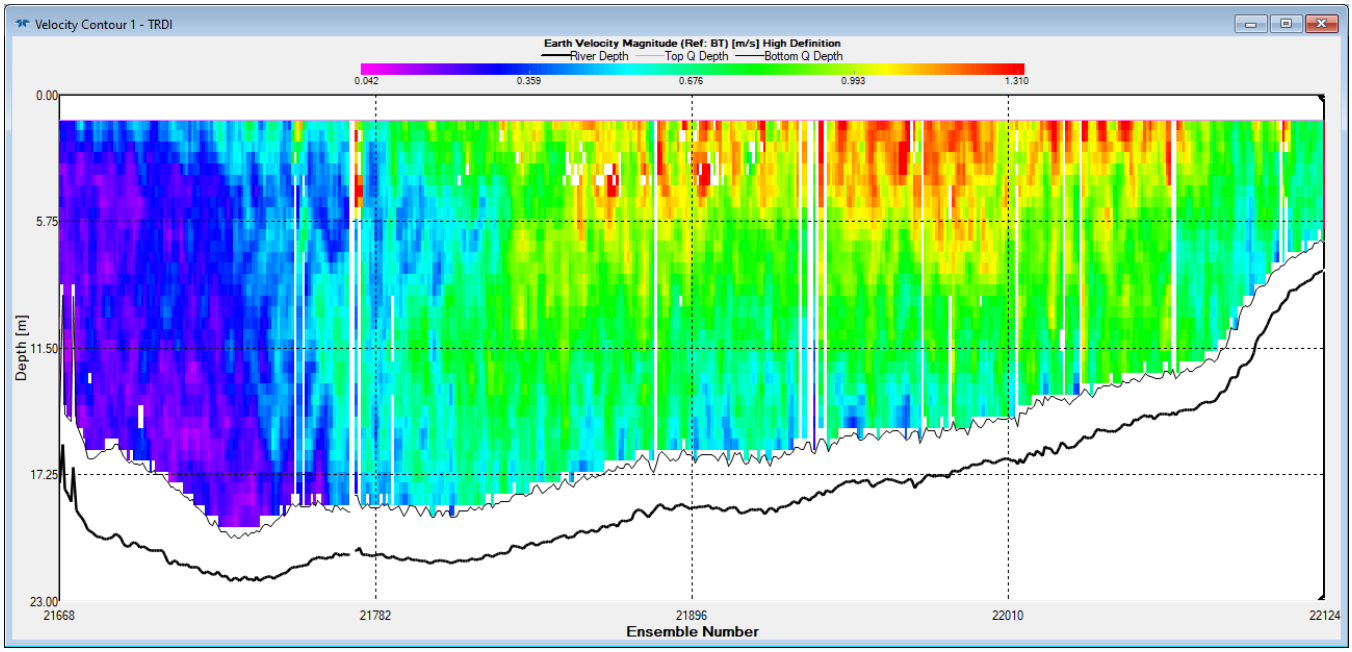
Transect 1, June 7 16:59 – 17:03, Channel Average Velocity = 0.651 m/s



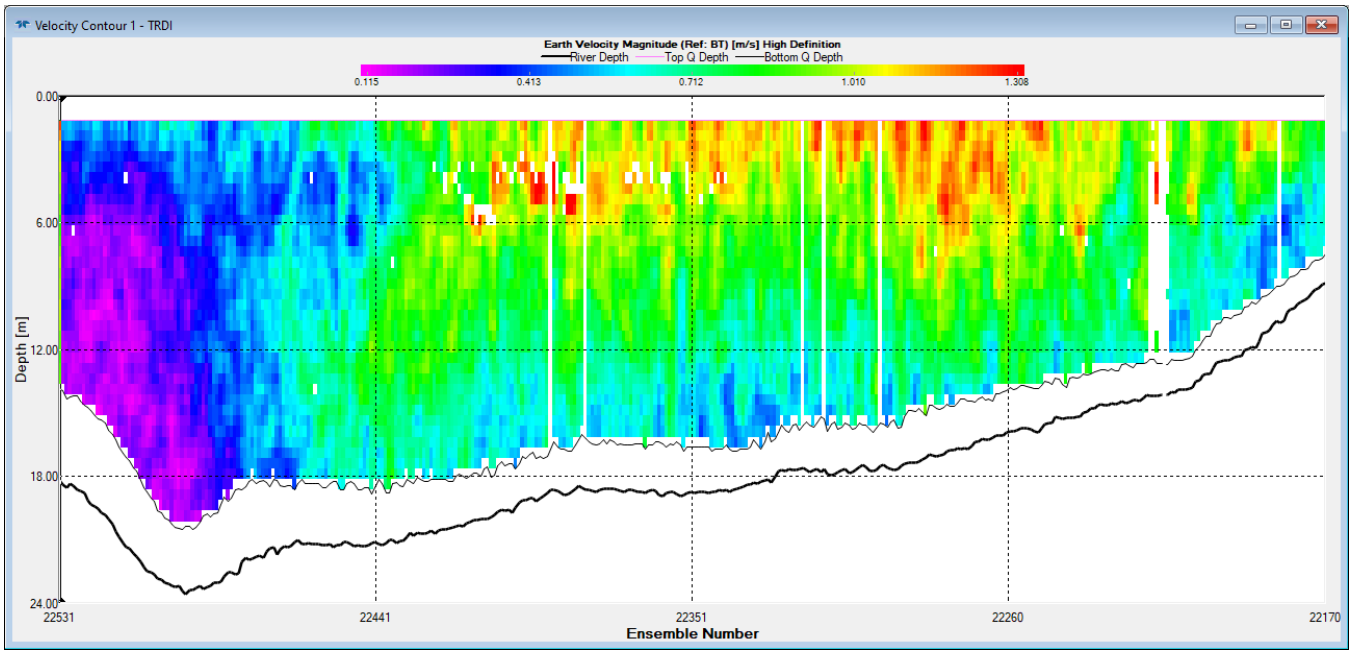
Transect 1, June 7 17:03 – 17:07, Channel Average Velocity = 0.674 m/s



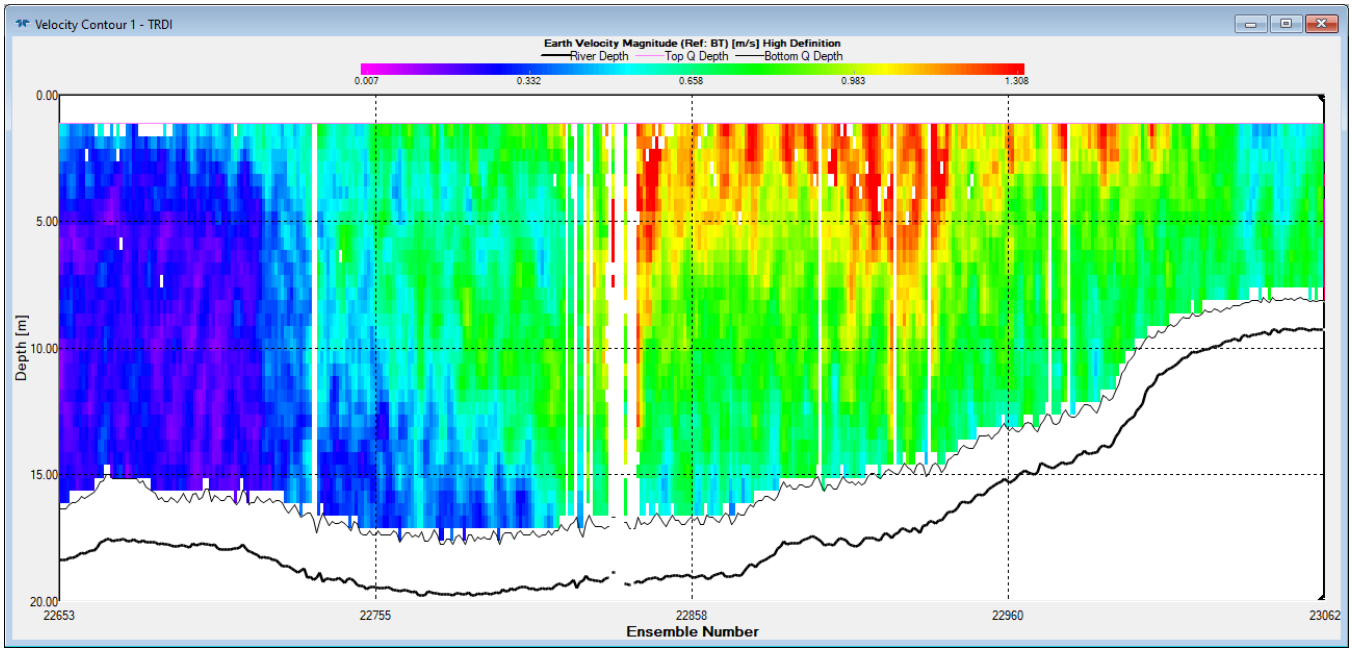
Transect 2, June 7 17:09 – 17:14, Channel Average Velocity = 0.628 m/s



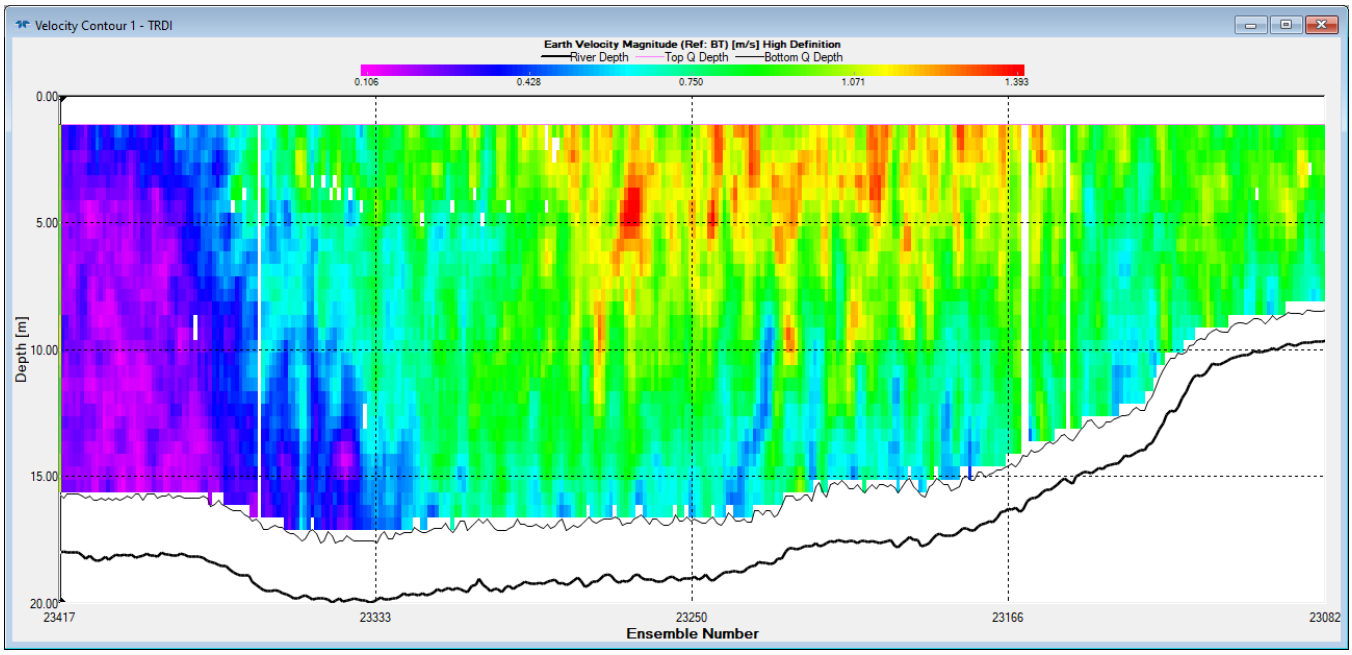
Transect 2, June 7 17:14 – 17:18, Channel Average Velocity = 0.674 m/s



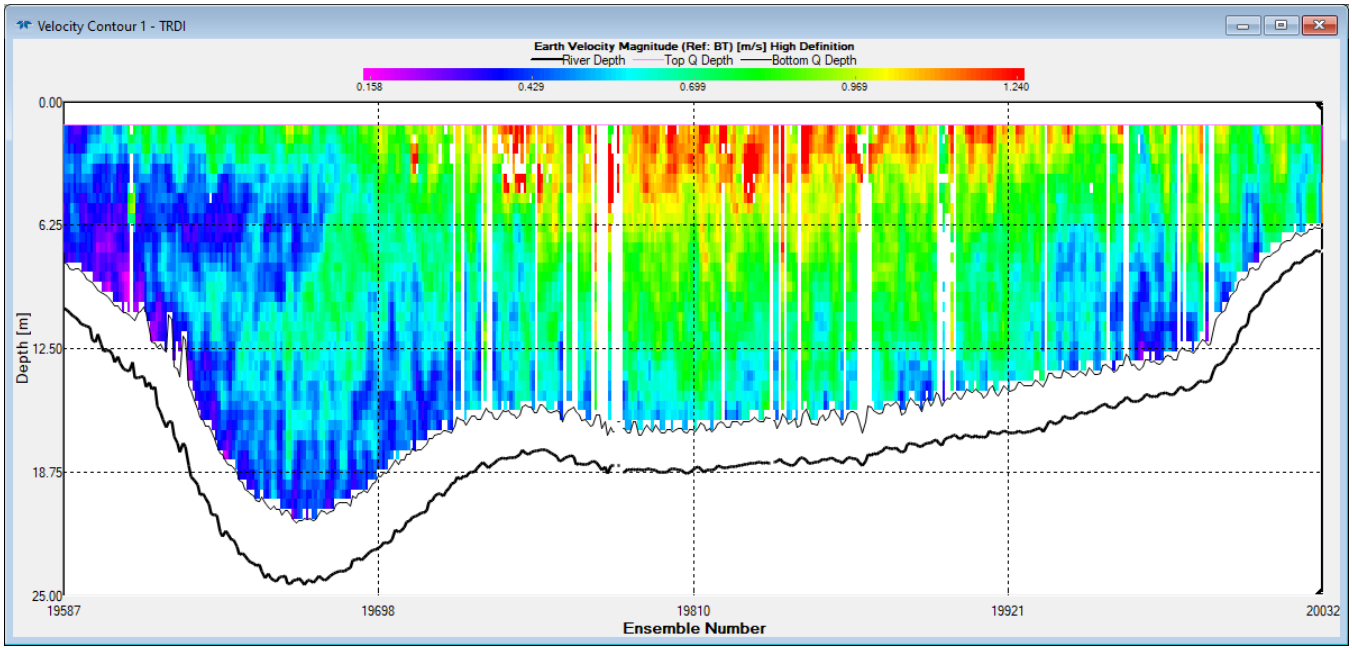
Transect 3, June 7 17:19 – 17:24, Channel Average Velocity = 0.585 m/s



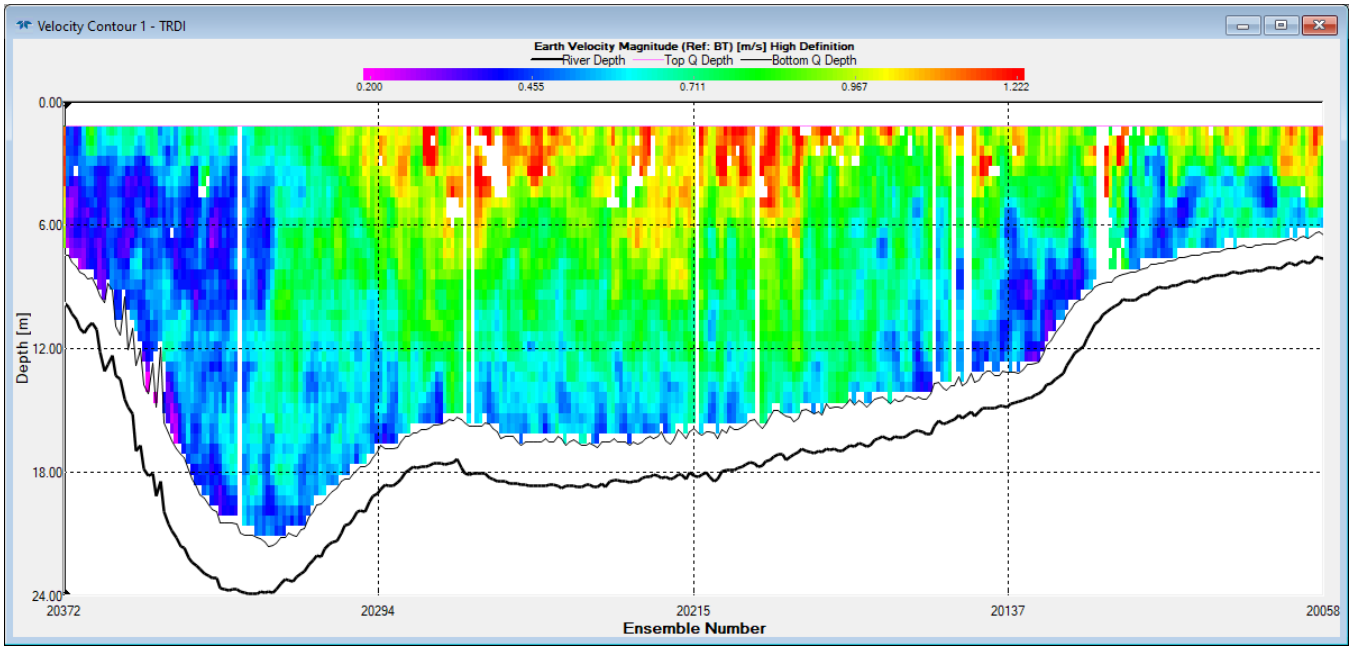
Transect 3, June 7 17:24 – 17:27, Channel Average Velocity = 0.702 m/s



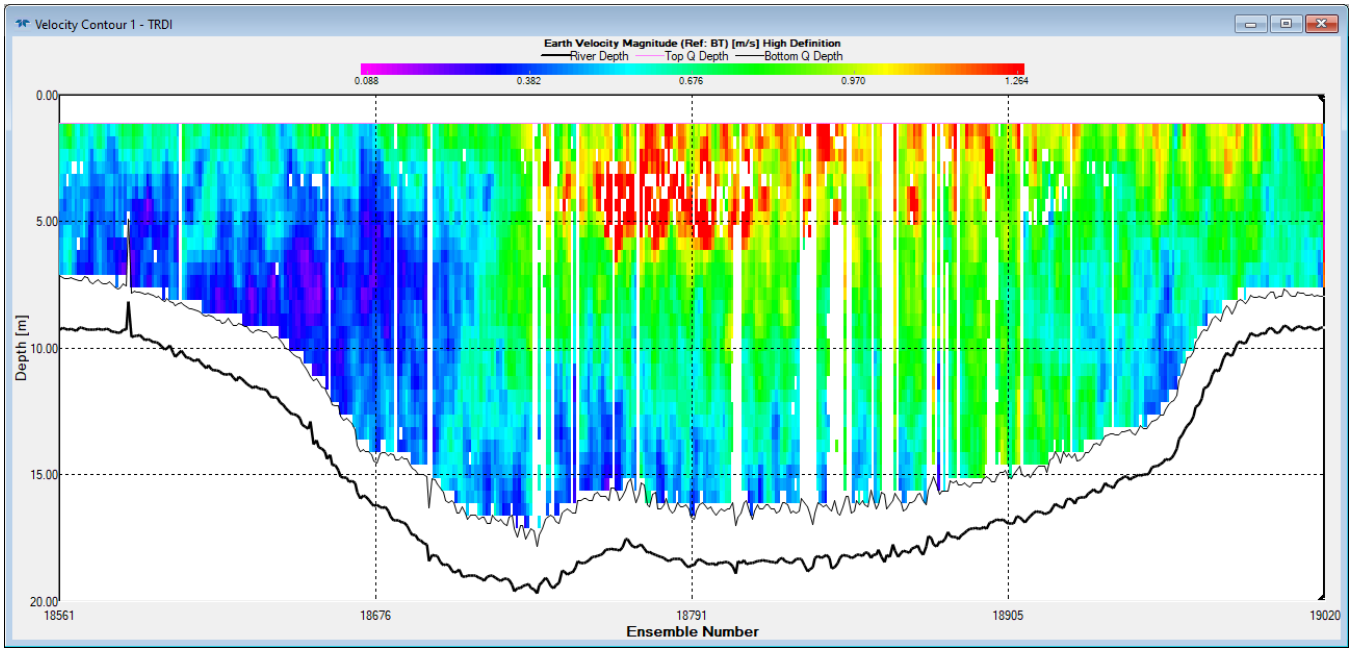
Transect 4, June 7 16:47 – 16:52, Channel Average Velocity = 0.669 m/s



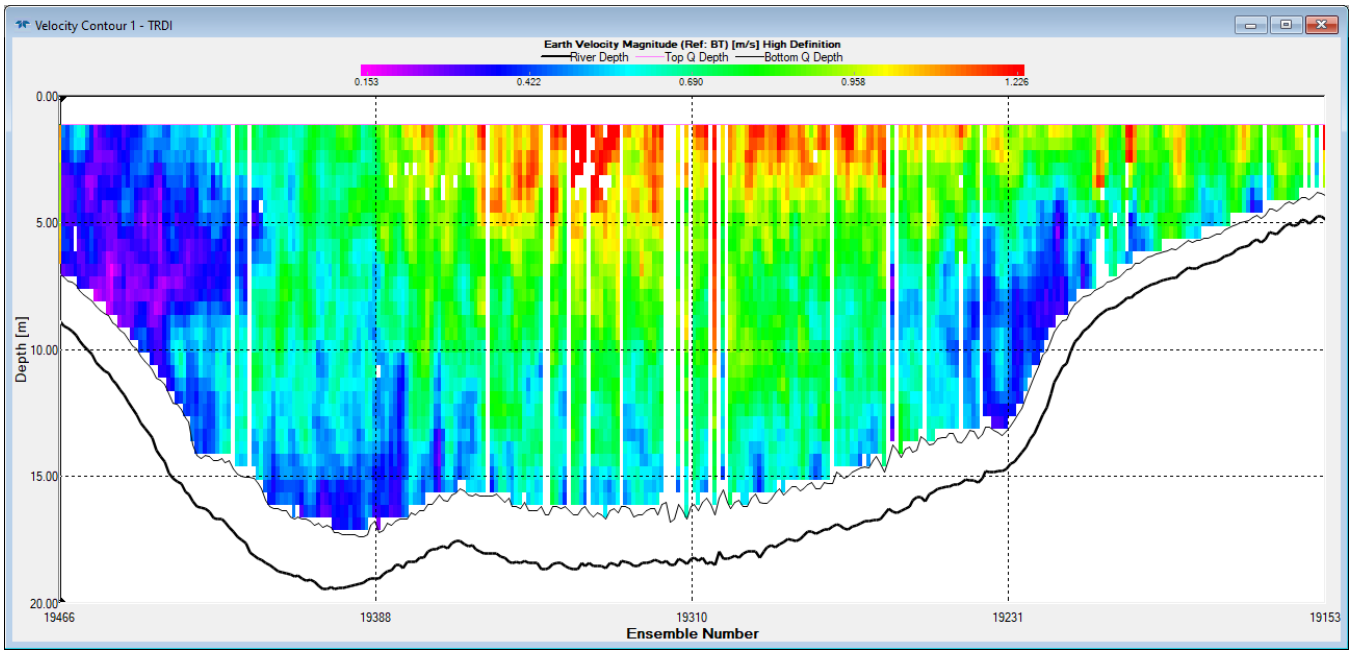
Transect 4, June 7 16:52 – 16:55, Channel Average Velocity = 0.680 m/s



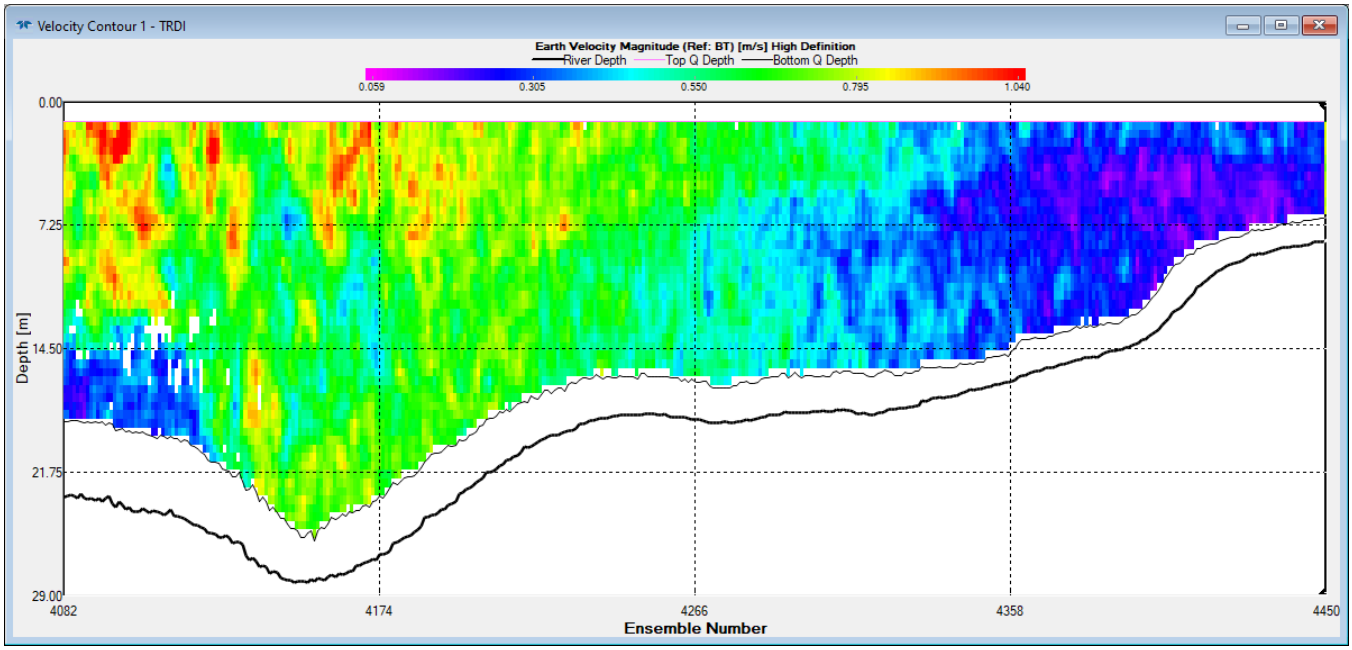
Transect 5, June 7 16:36 – 16:41, Channel Average Velocity = 0.632 m/s



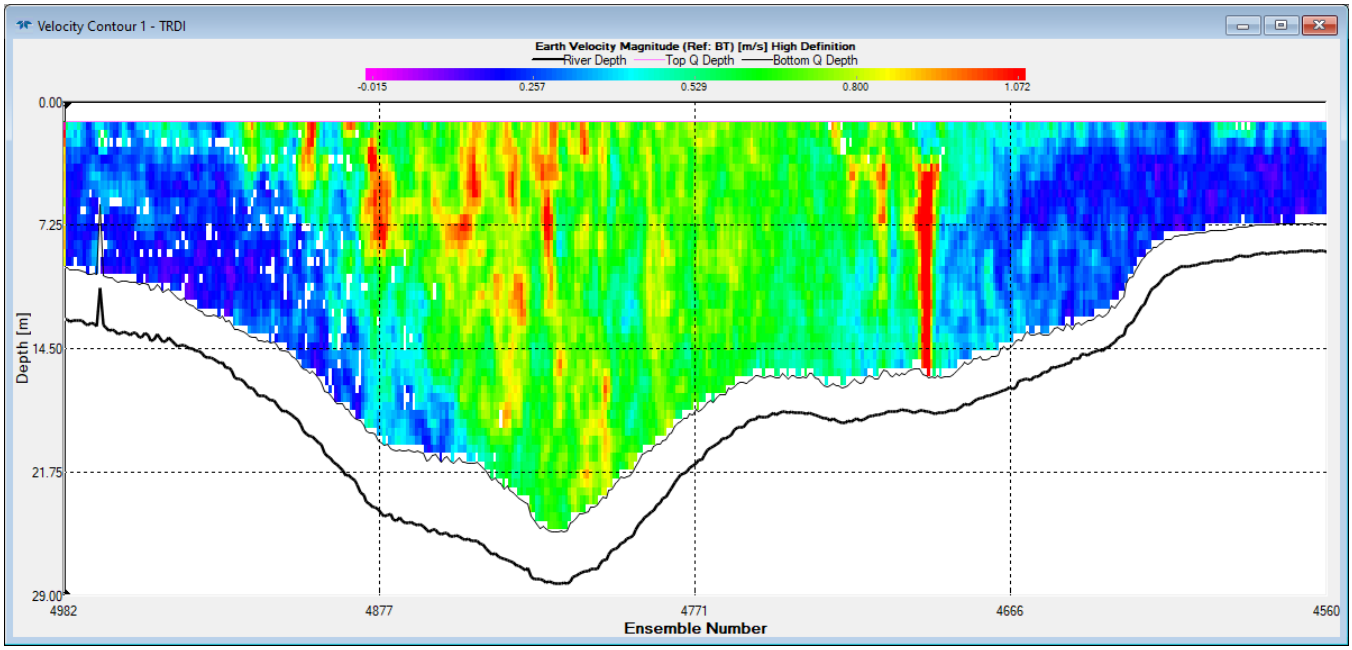
Transect 5, June 7 16:42 – 16:46, Channel Average Velocity = 0.659 m/s



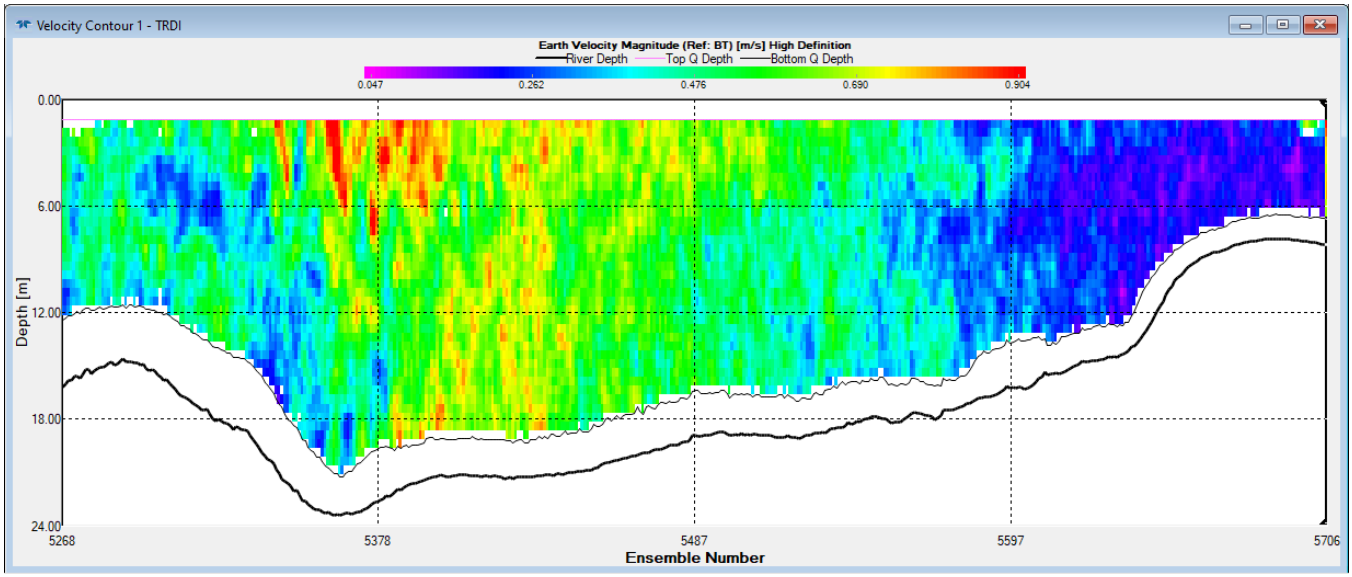
Transect 1, June 8 8:29 – 8:34, Channel Average Velocity = -0.502 m/s



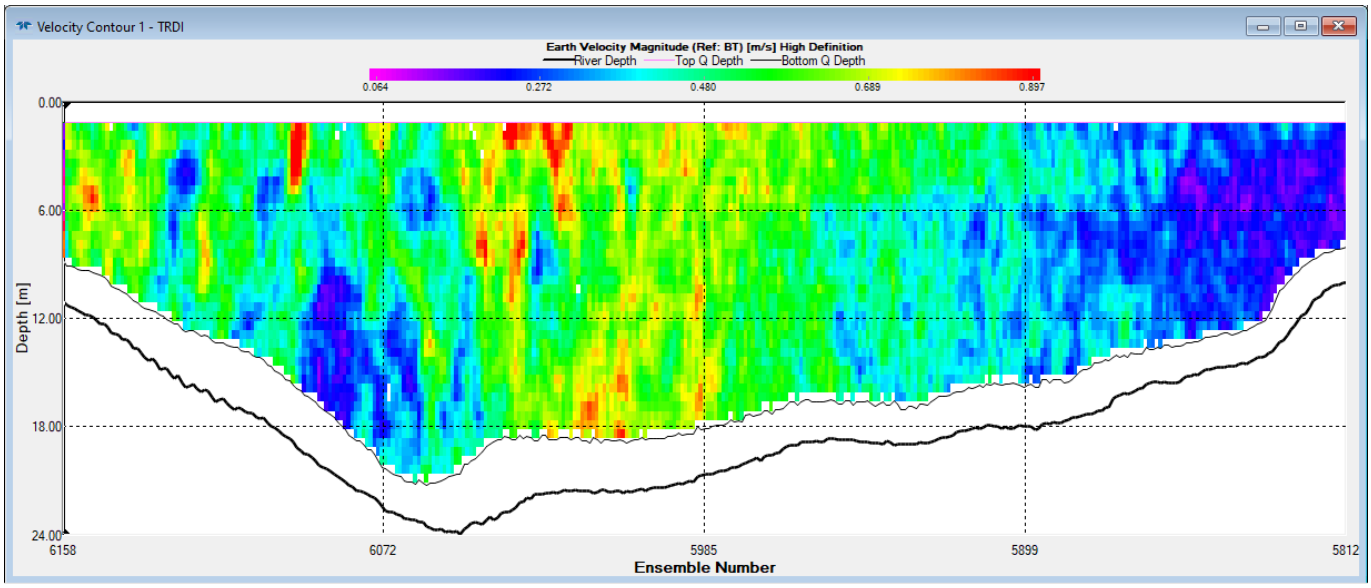
Transect 1, June 8 8:34 – 8:39, Channel Average Velocity = -0.423 m/s



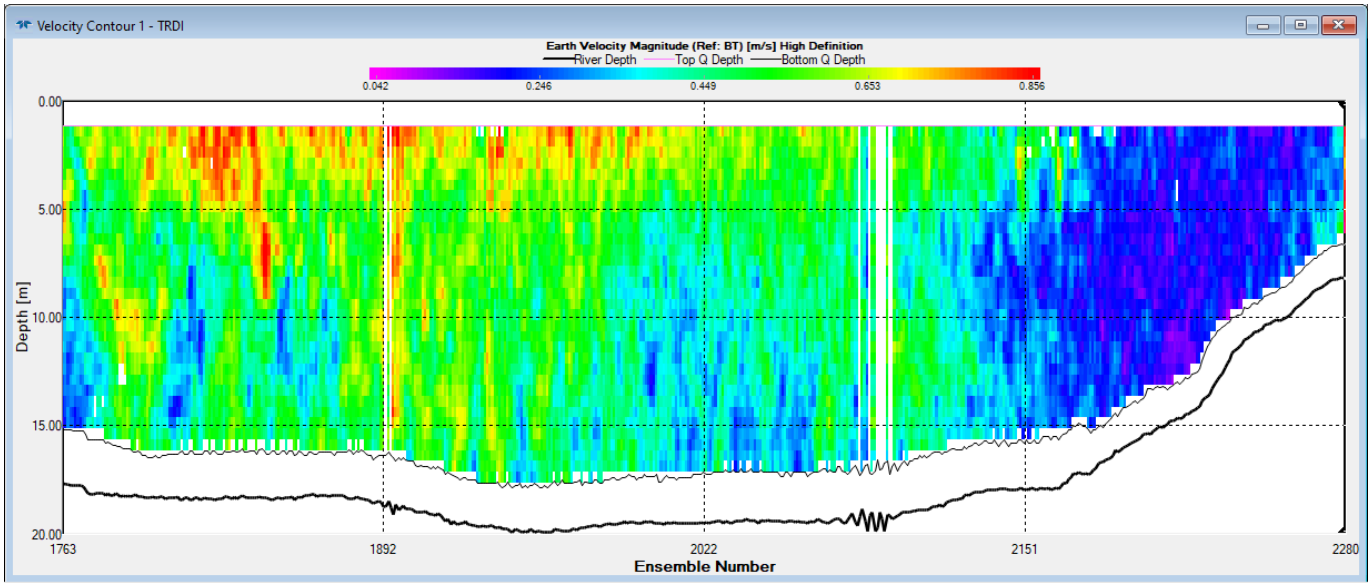
Transect 2, June 8 8:42 – 8:47, Channel Average Velocity = -0.420 m/s



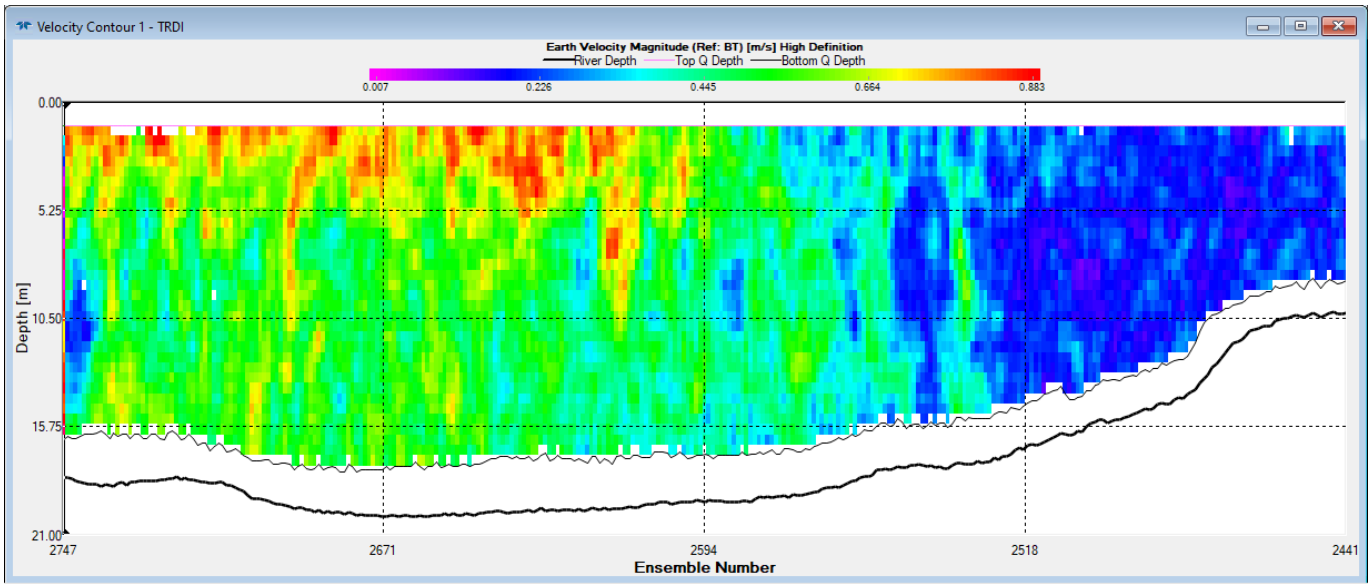
Transect 2, June 8 8:47 – 8:52, Channel Average Velocity = -0.425 m/s



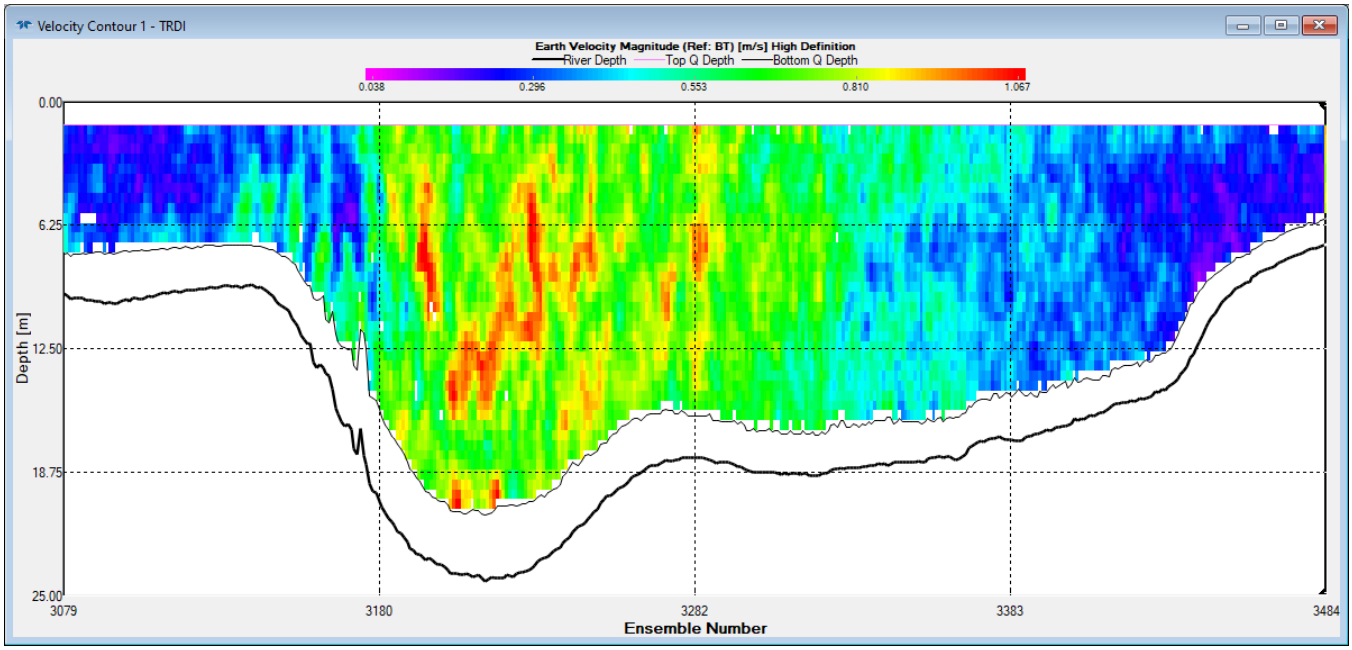
Transect 3, June 8 9:11 – 9:18, Channel Average Velocity = -0.380 m/s



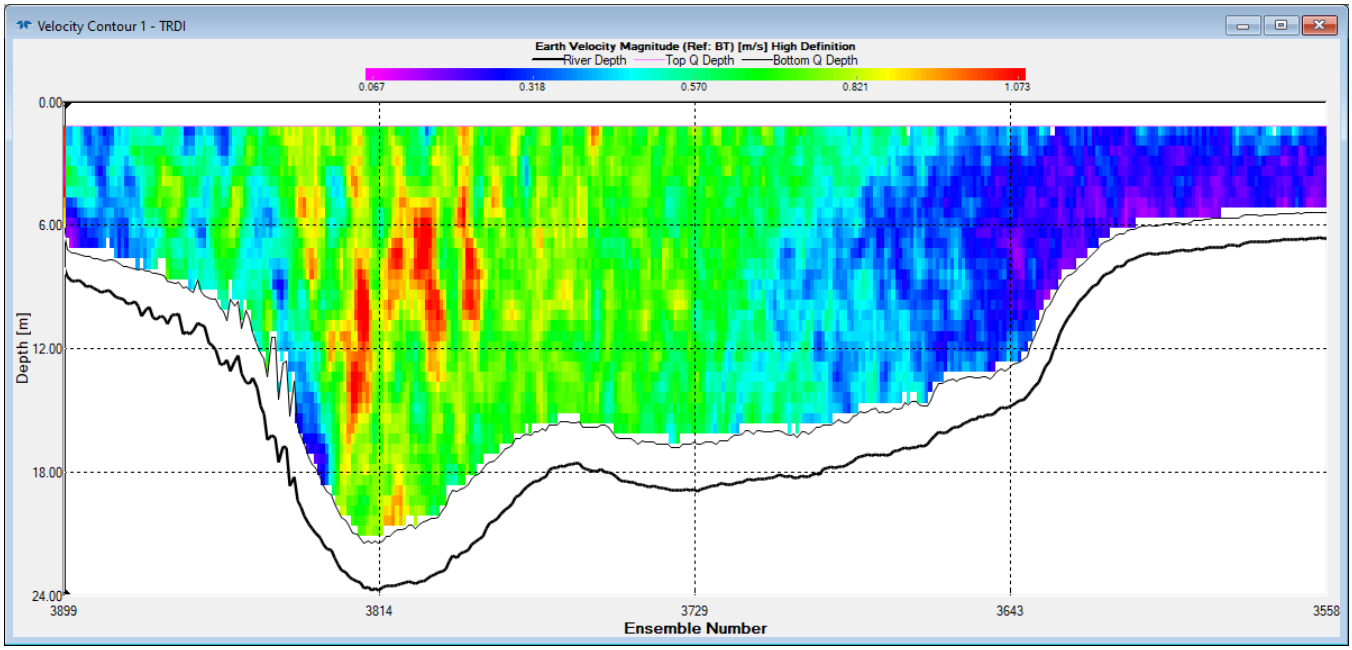
Transect 3, June 8 9:18 – 9:22, Channel Average Velocity = -0.367 m/s



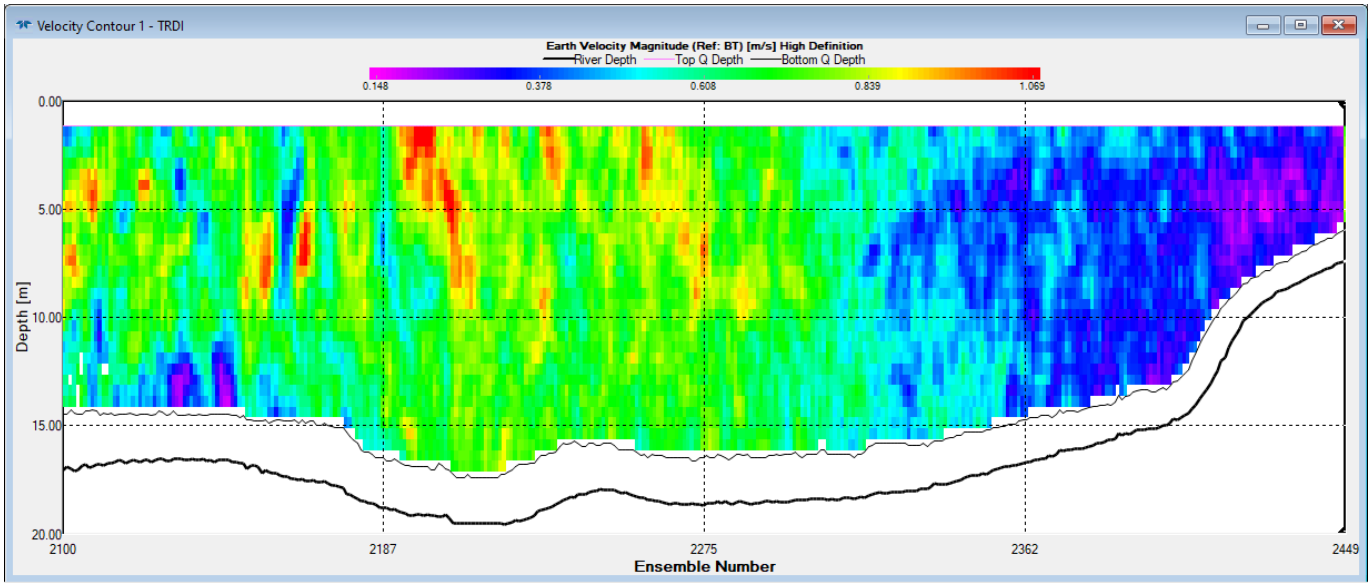
Transect 4, June 8 8:19 – 8:23, Channel Average Velocity = -0.490 m/s



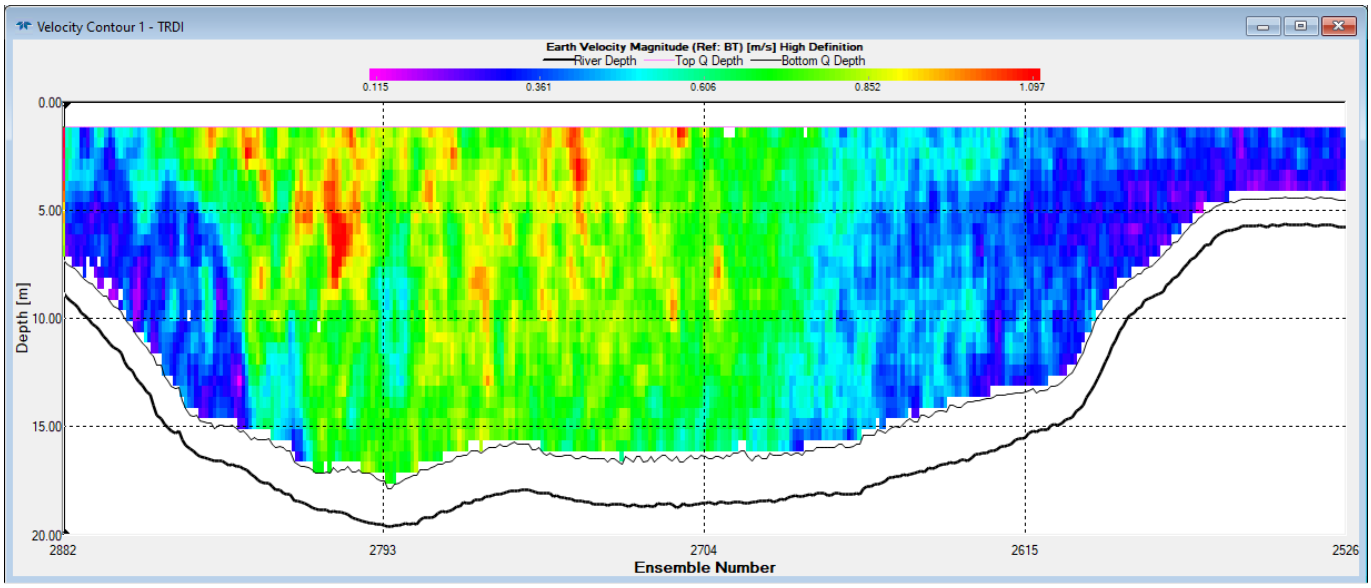
Transect 4, June 8 8:24 – 8:28, Channel Average Velocity = -0.514 m/s



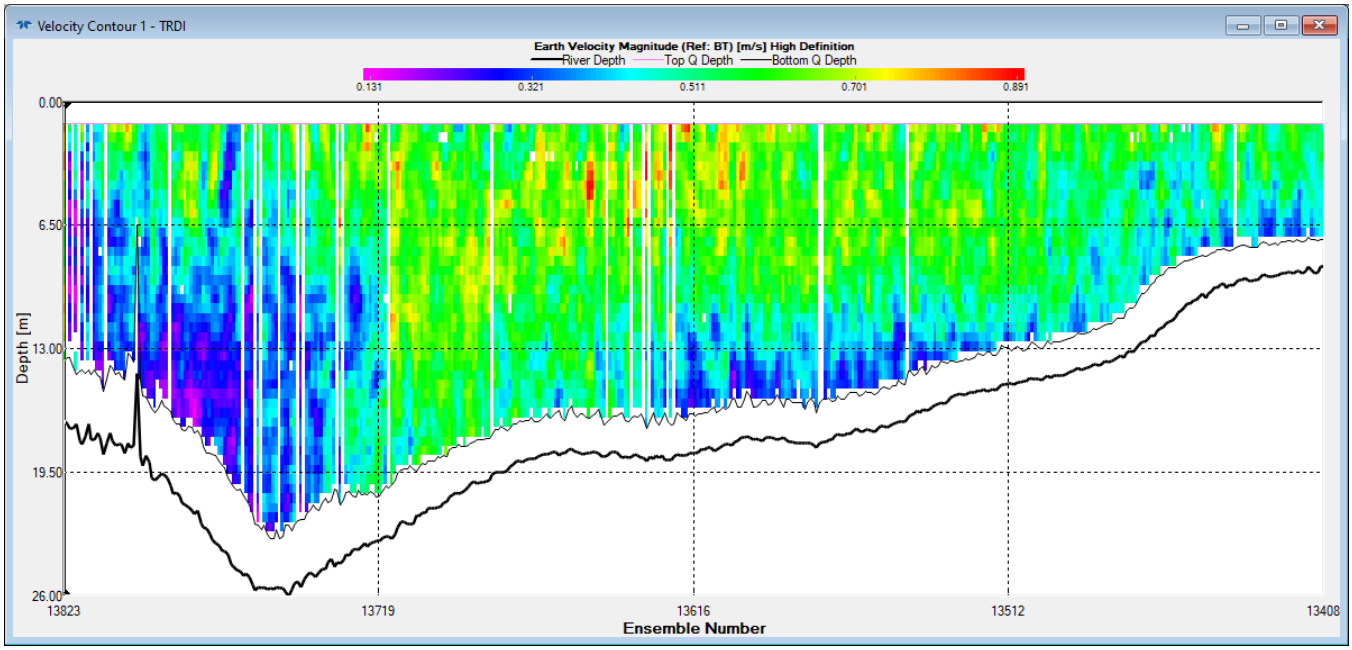
Transect 5, June 8 8:09 – 8:13, Channel Average Velocity = -0.570 m/s



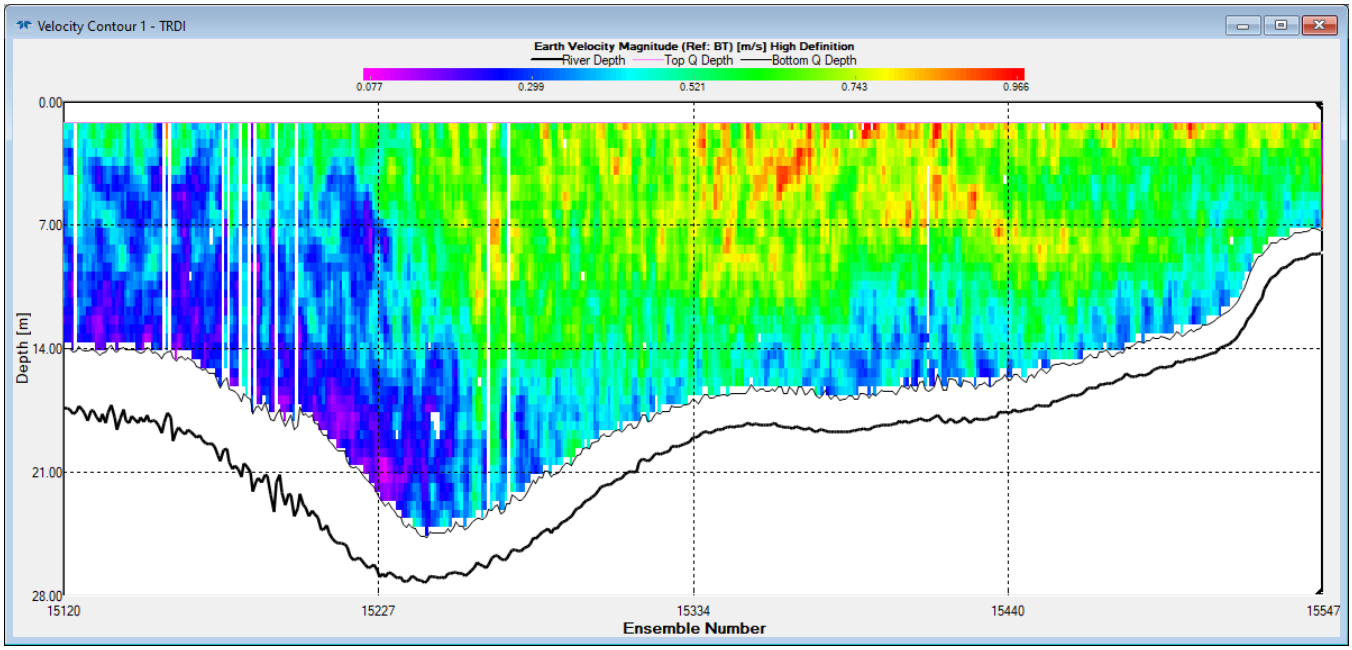
Transect 5, June 8 8:13 – 8:17, Channel Average Velocity = -0.570 m/s



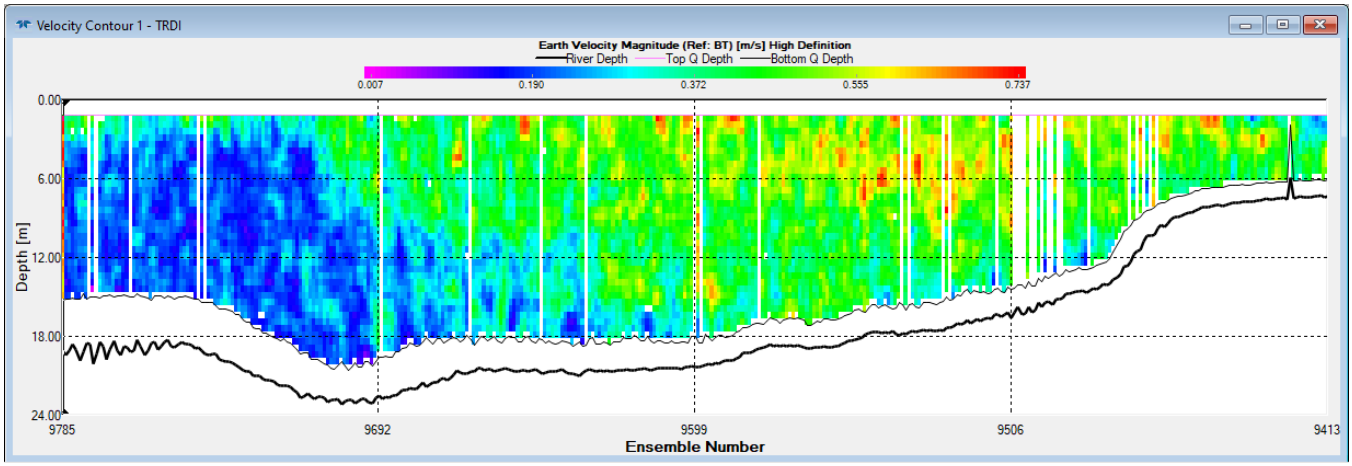
Transect 1, June 8 15:26 – 15:31, Channel Average Velocity = 0.477 m/s



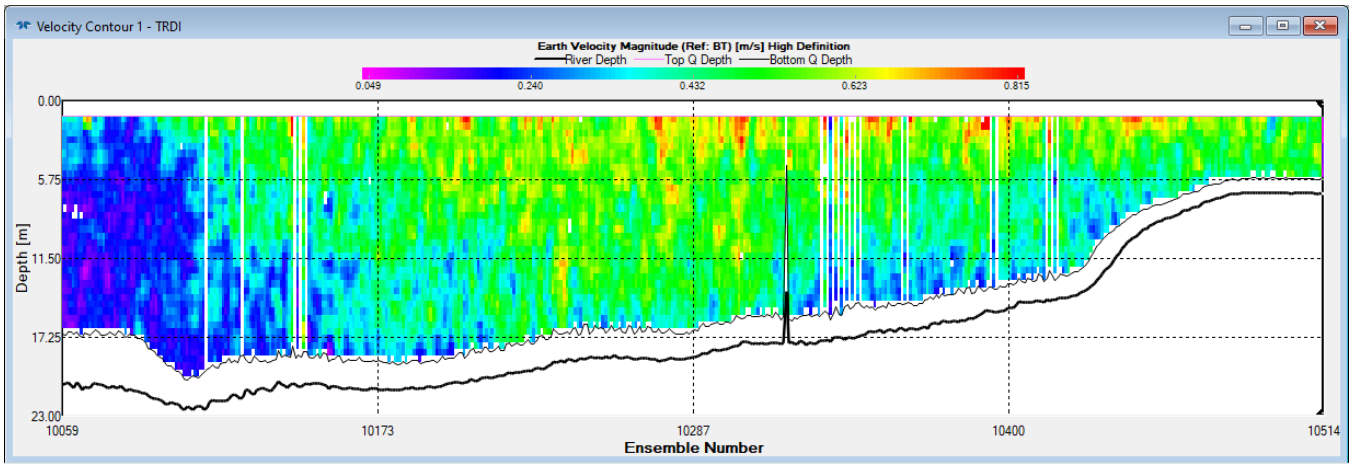
Transect 1, June 8 15:44 – 15:49, Channel Average Velocity = 0.480 m/s



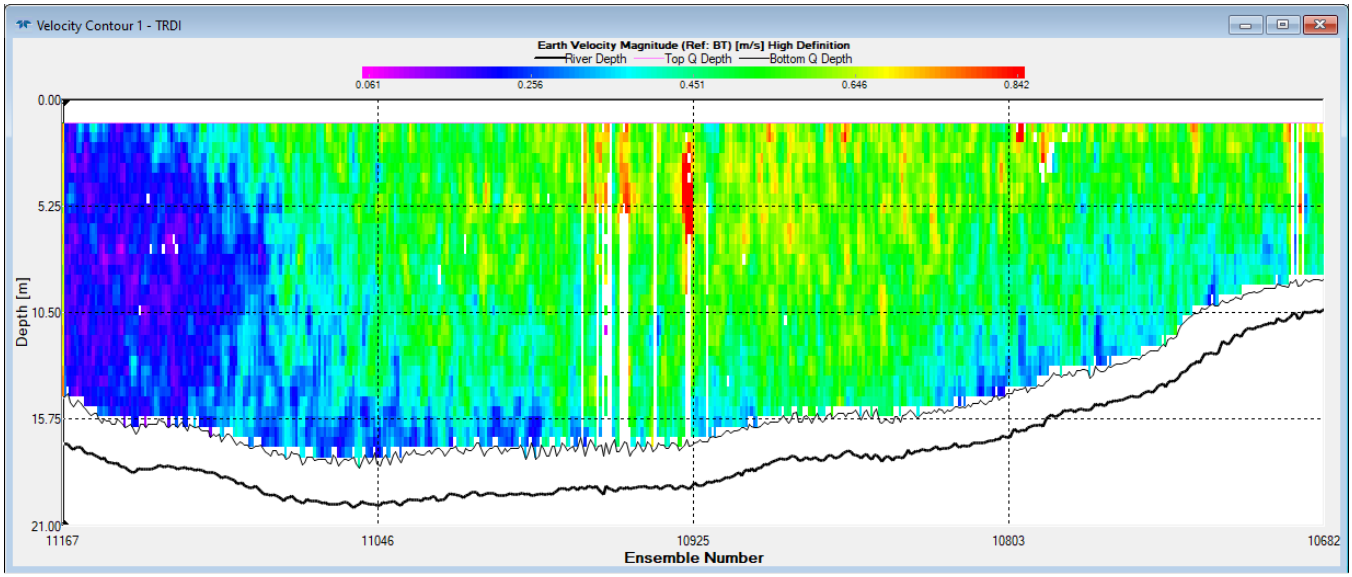
Transect 2, June 8 14:44 – 14:48, Channel Average Velocity = 0.299 m/s



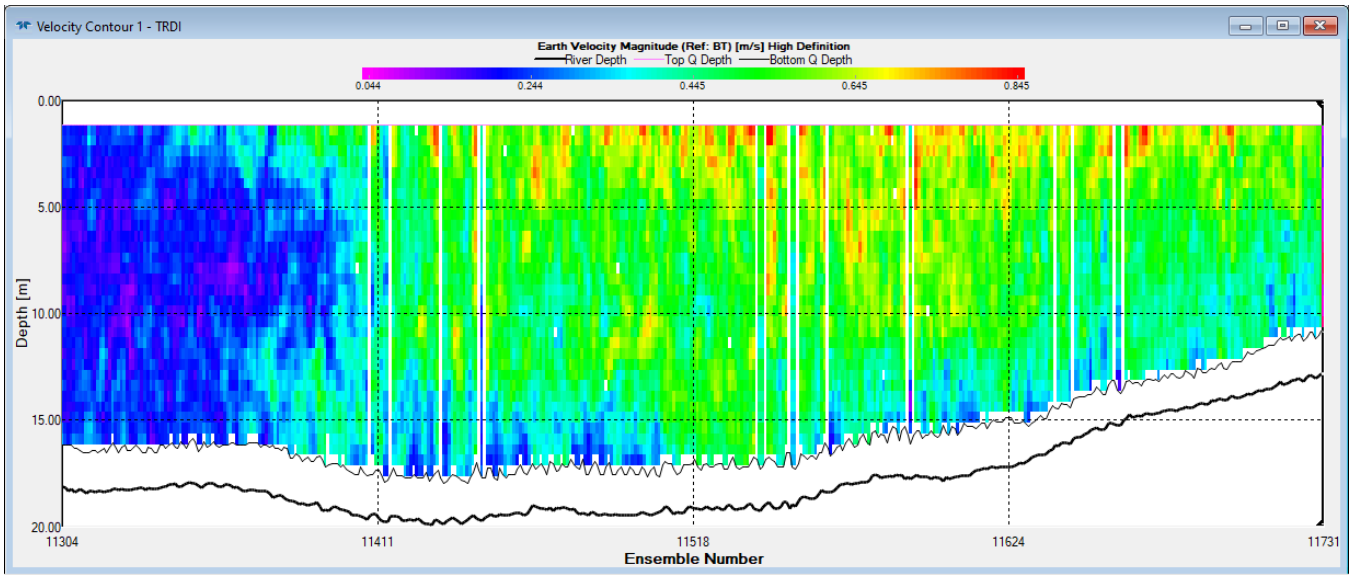
Transect 2, June 8 14:51 – 14:56, Channel Average Velocity = 0.381 m/s



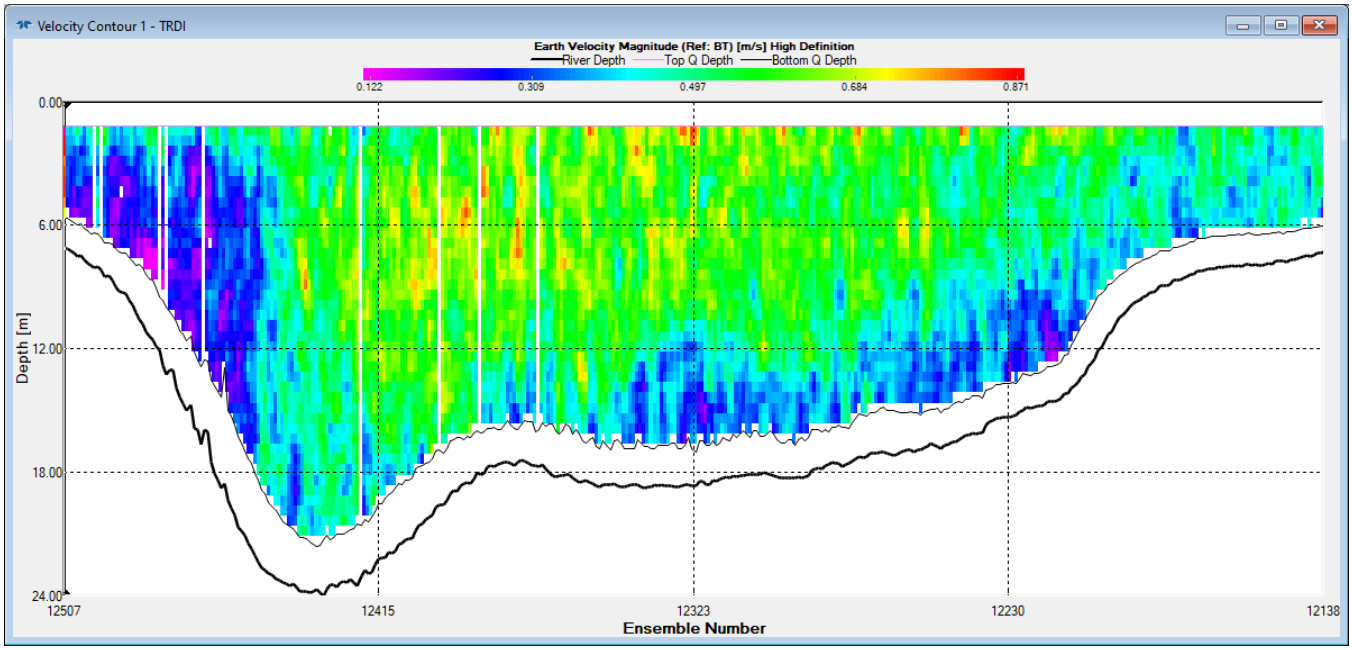
Transect 3, June 8 14:57 – 15:03, Channel Average Velocity = 0.401 m/s



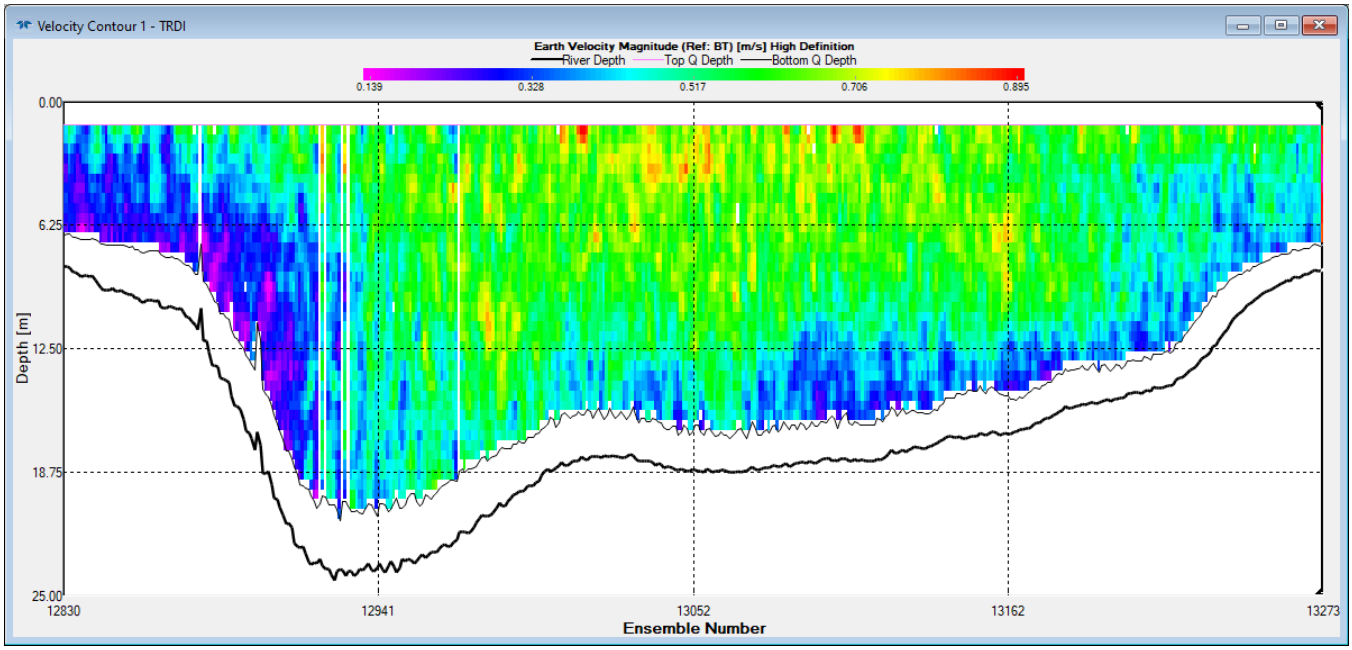
Transect 3, June 8 15:04 – 15:09, Channel Average Velocity = 0.393 m/s



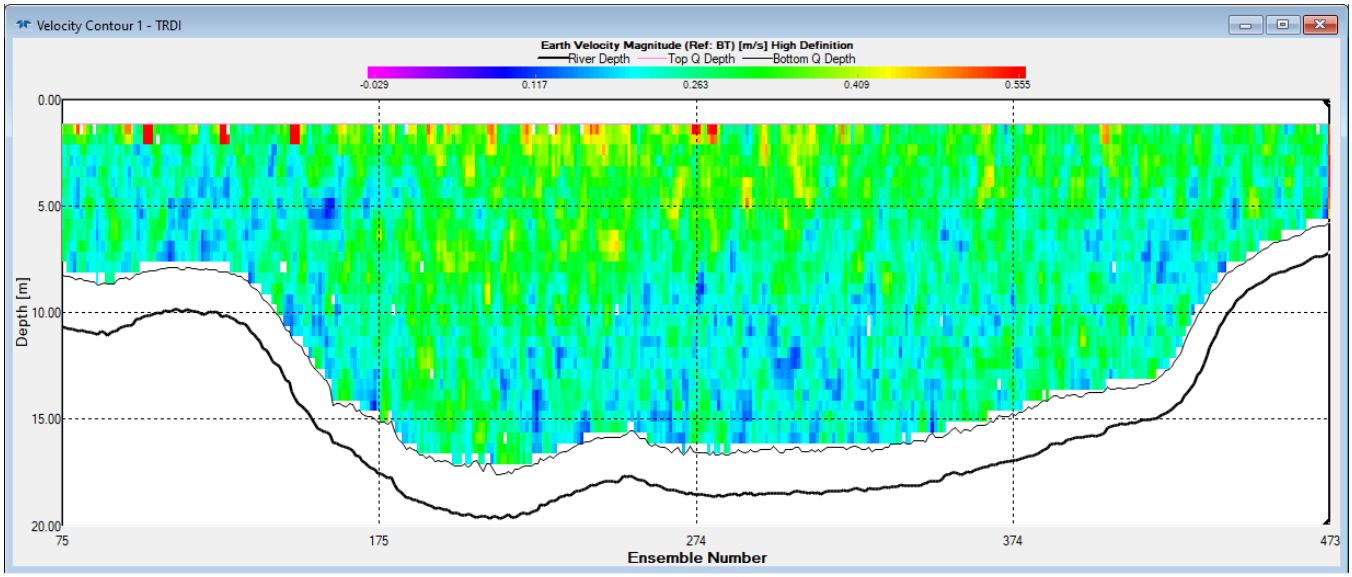
Transect 4, June 8 15:12 – 15:17, Channel Average Velocity = 0.464 m/s



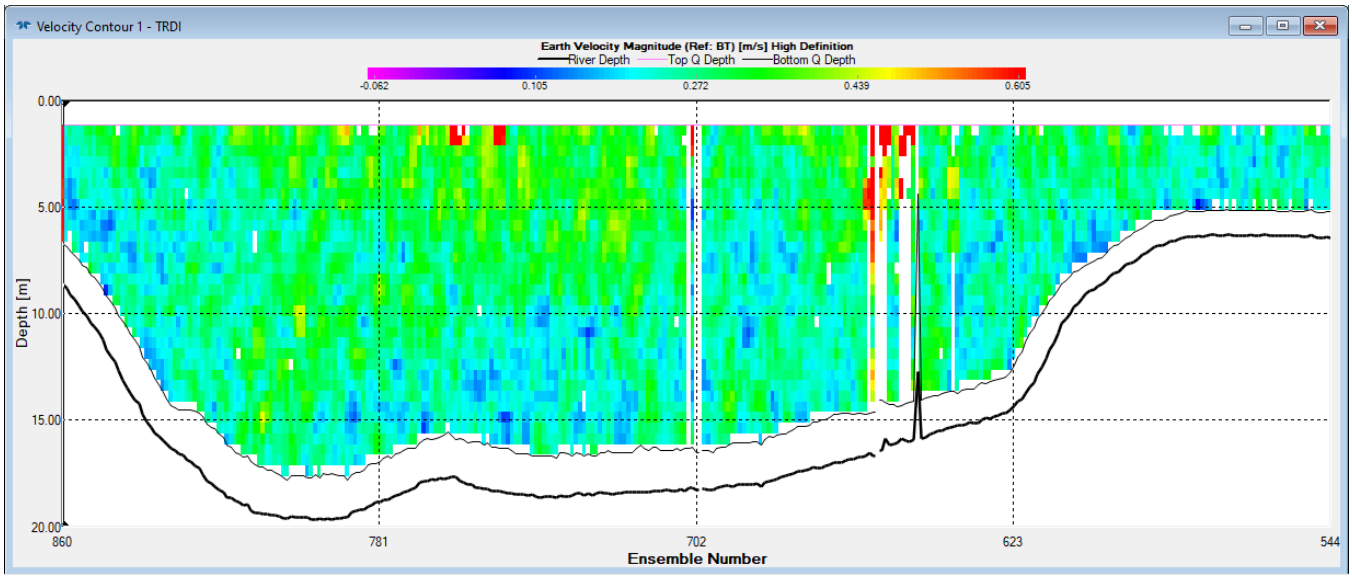
Transect 4, June 8 15:20 – 15:25, Channel Average Velocity = 0.482 m/s



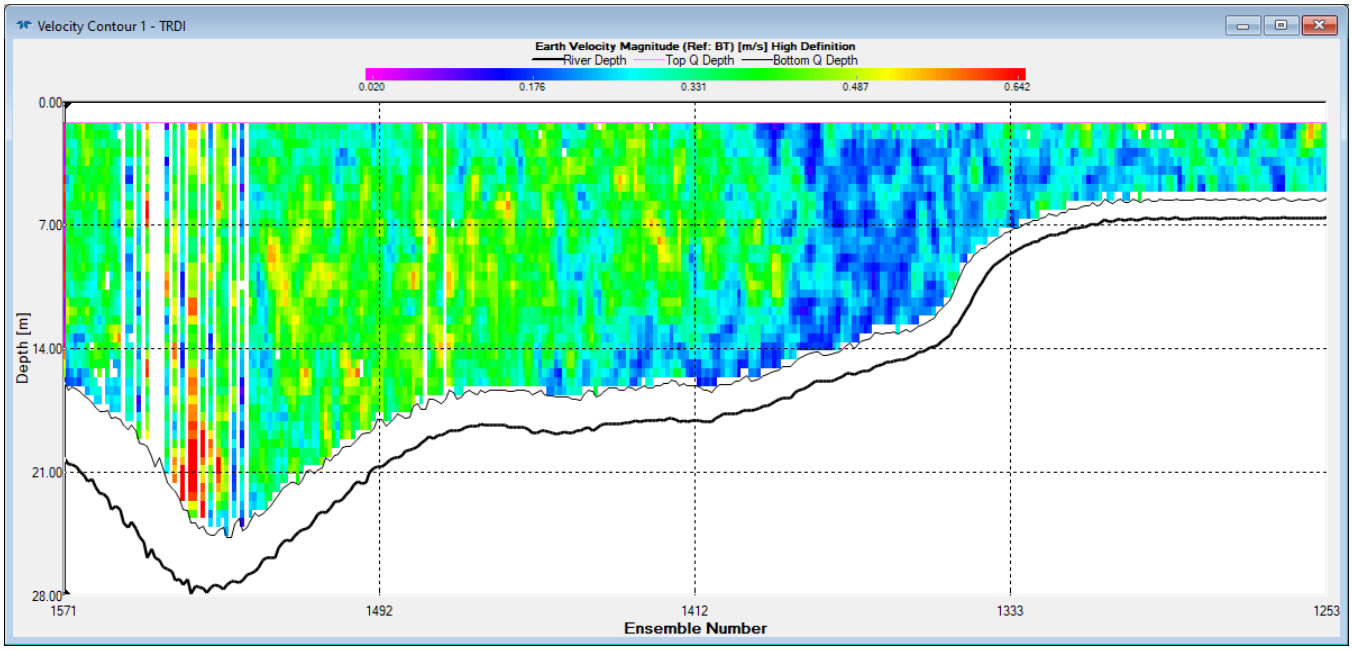
Transect 5, June 8 13:11 – 13:16, Channel Average Velocity = 0.187 m/s



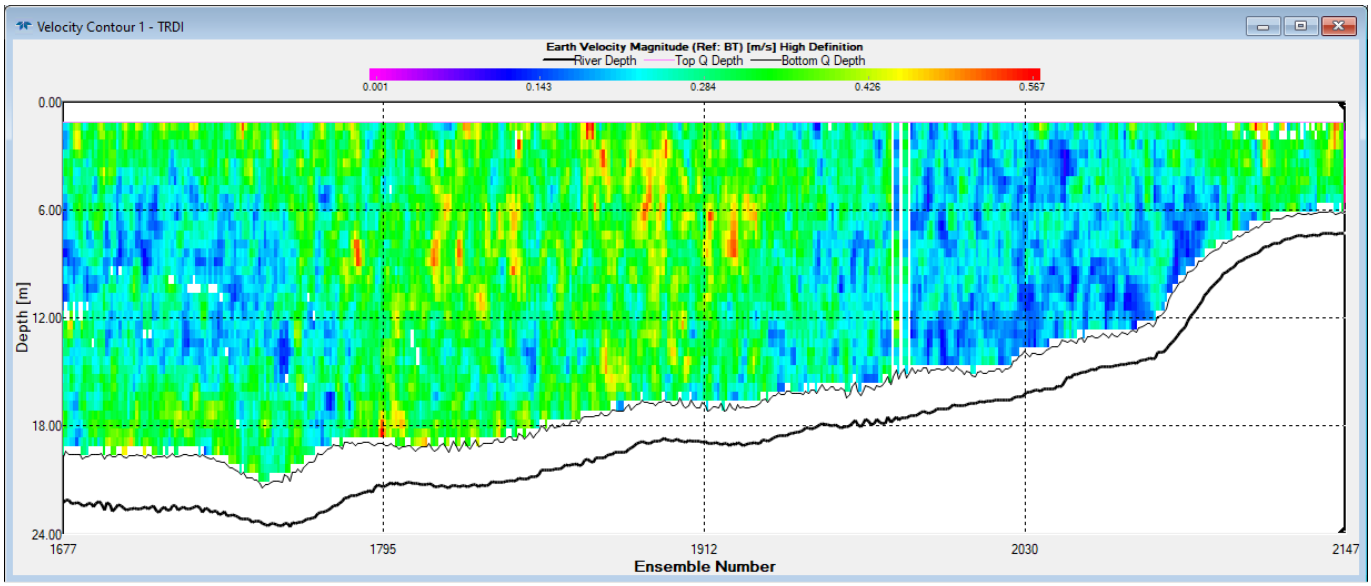
Transect 5, June 8 13:16 – 13:20, Channel Average Velocity = 0.190 m/s



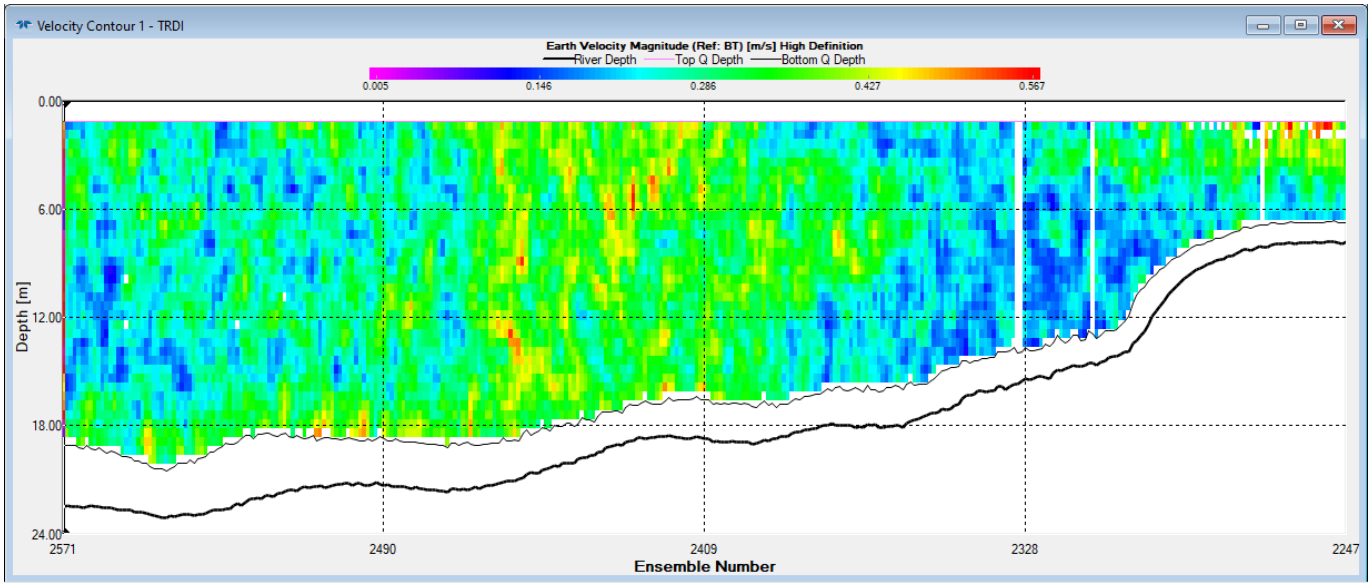
Transect 1, June 9 11:08 – 11:11, Channel Average Velocity = -0.207 m/s



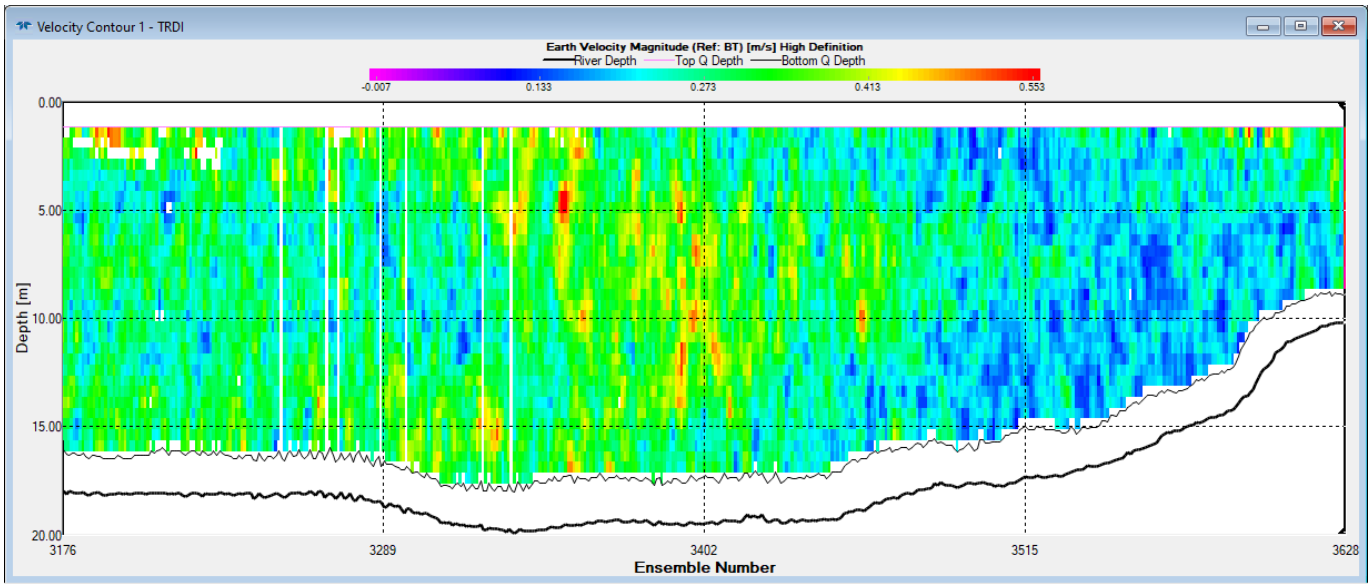
Transect 2, June 9 11:12 – 11:17, Channel Average Velocity = -0.174 m/s



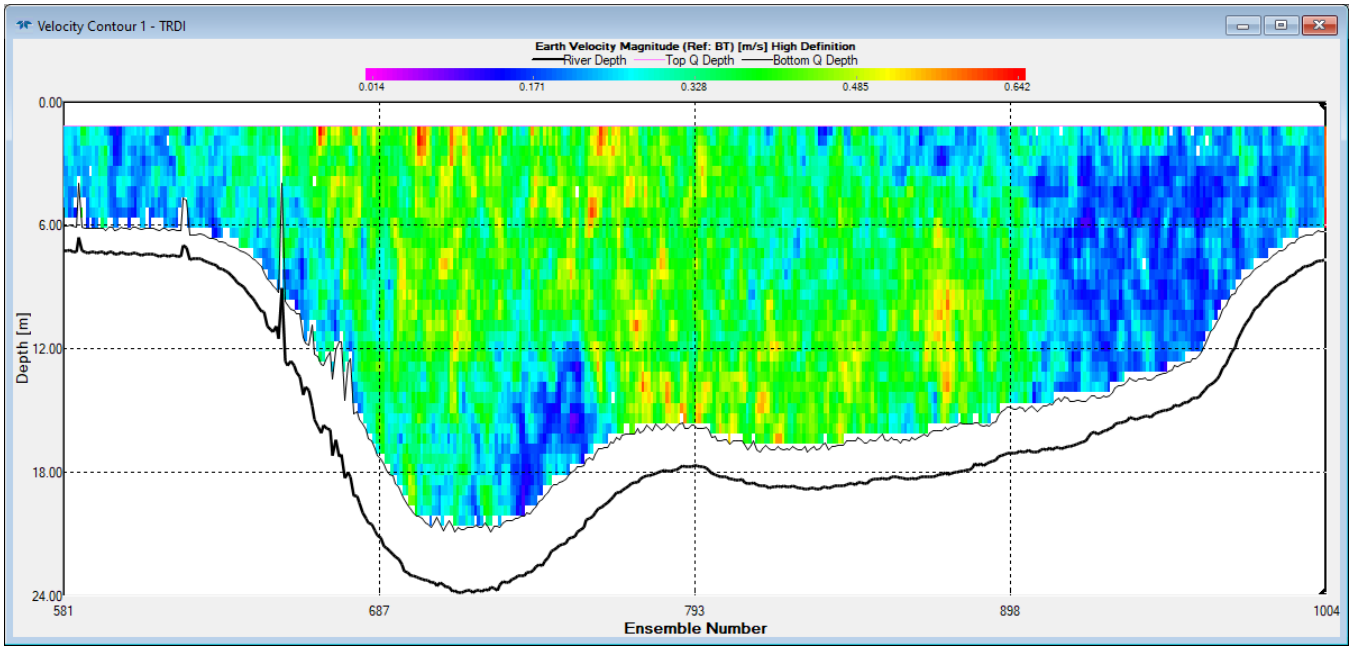
Transect 2, June 9 11:18 – 11:22, Channel Average Velocity = -0.171 m/s



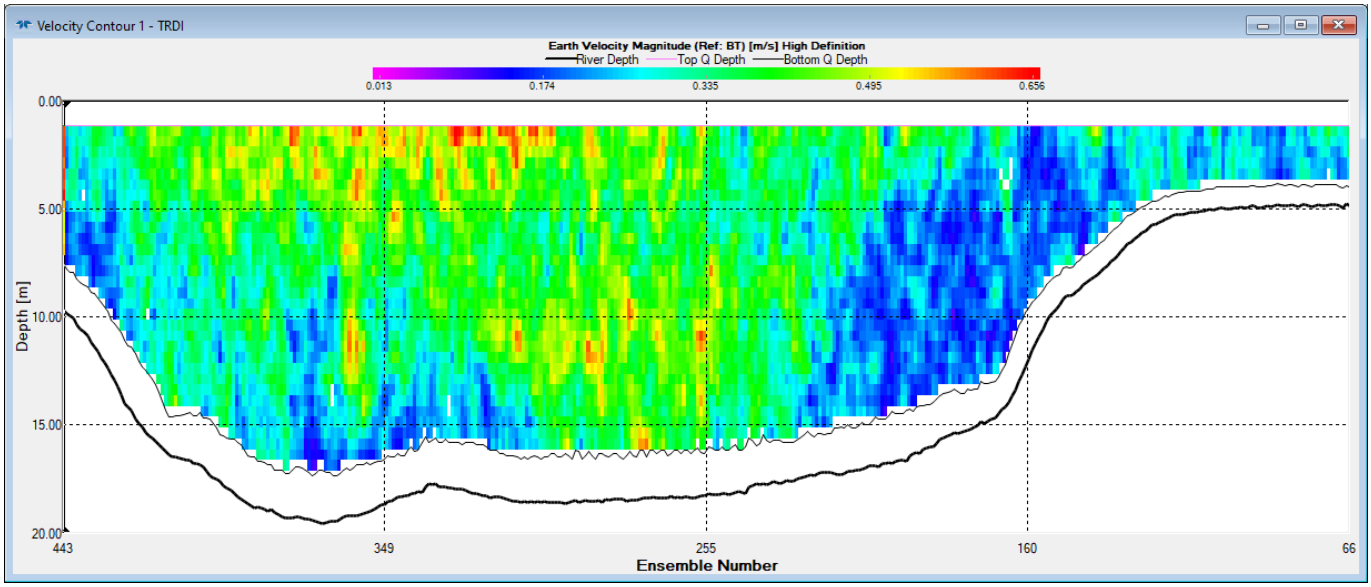
Transect 3, June 9 11:28 – 11:33, Channel Average Velocity = -0.160 m/s



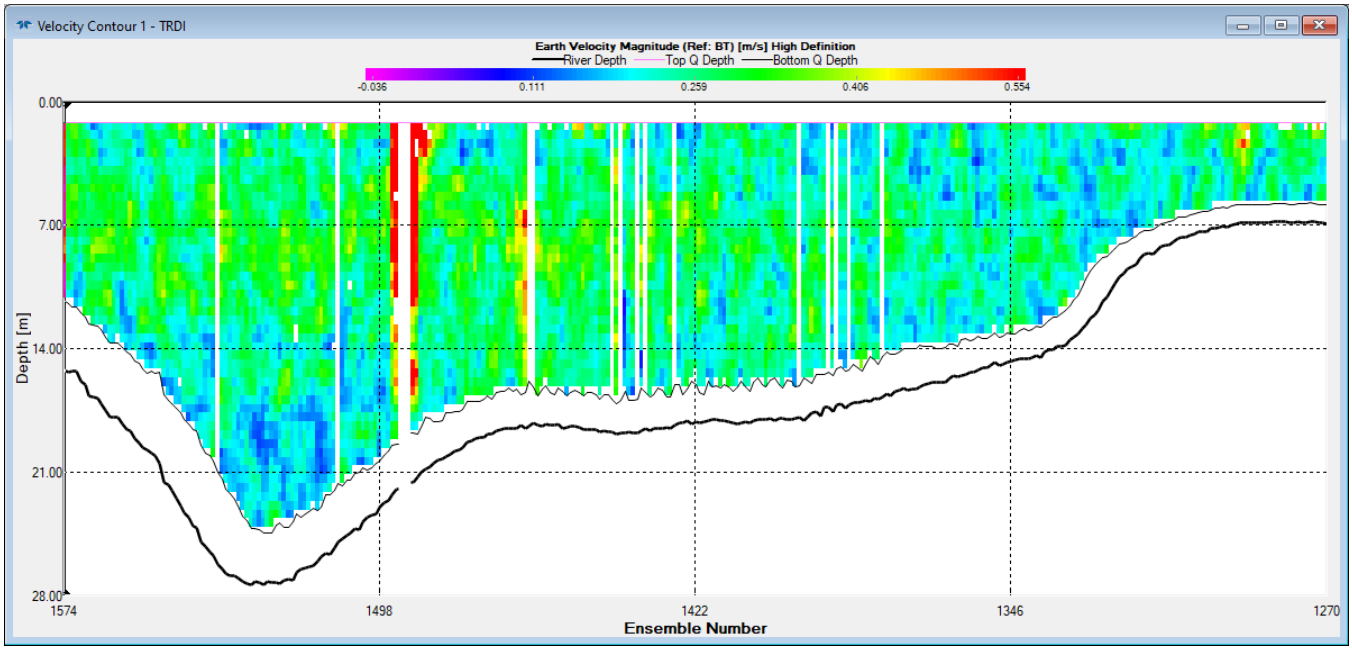
Transect 4, June 9 11:01 – 11:05, Channel Average Velocity = -0.241 m/s



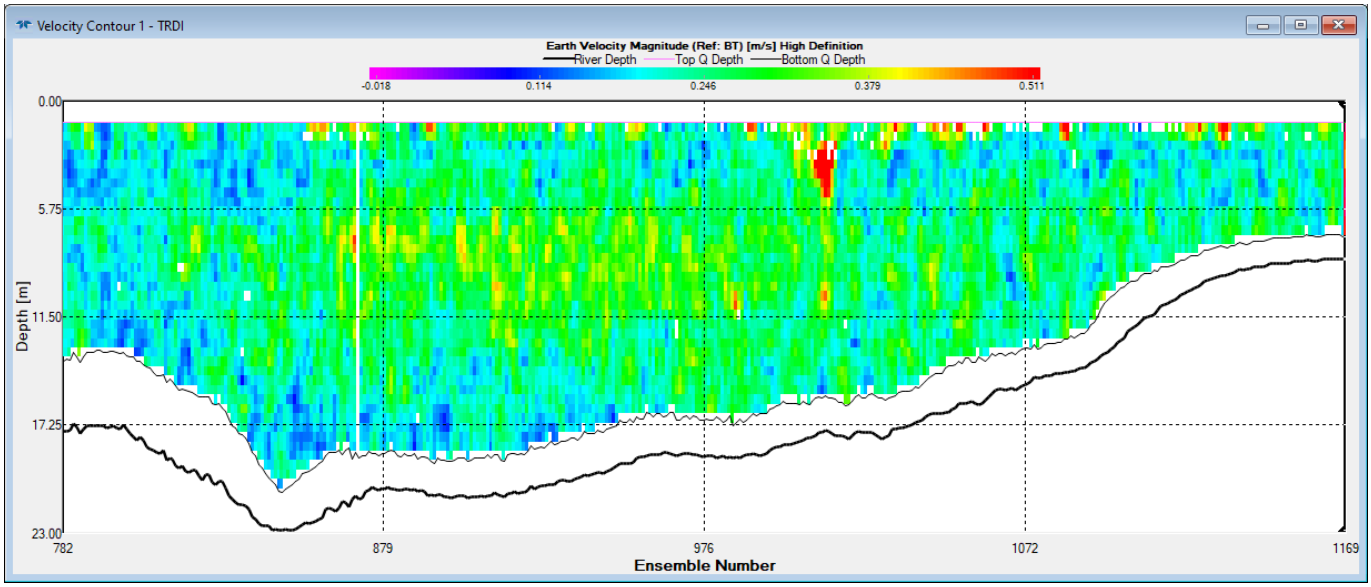
Transect 5, June 9 10:55 – 11:00, Channel Average Velocity = -0.232 m/s



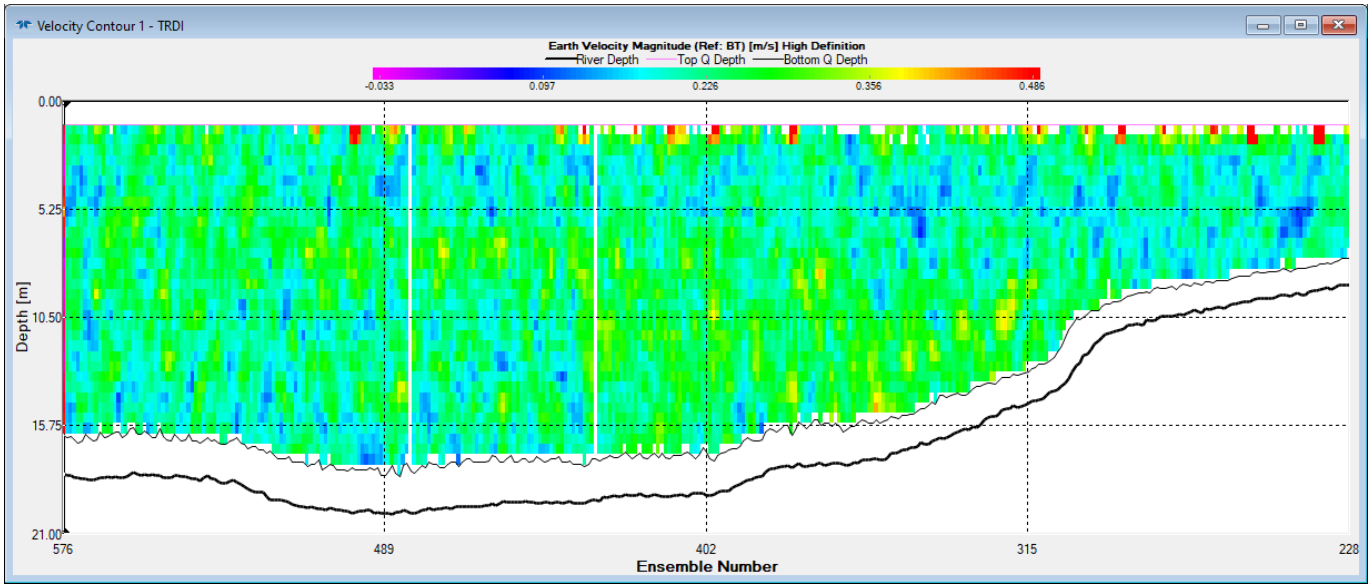
Transect 1, June 9 14:04 – 14:07, Channel Average Velocity = 0.156 m/s



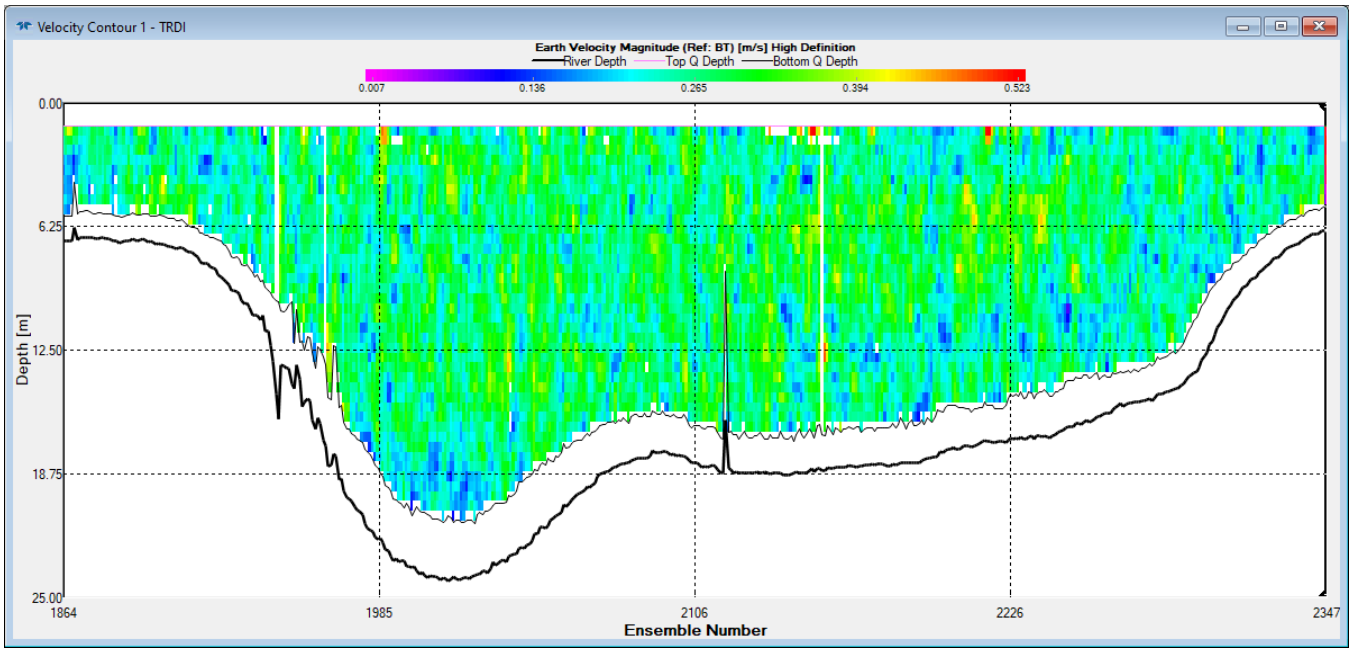
Transect 2, June 9 13:59 – 14:03, Channel Average Velocity = 0.139 m/s



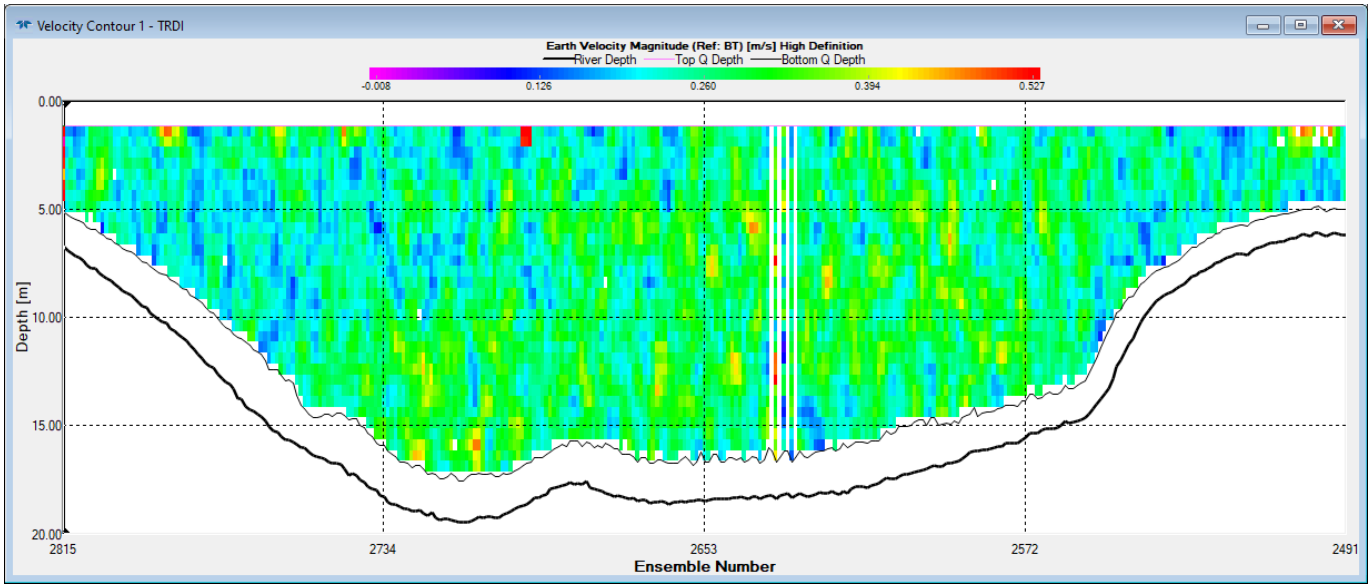
Transect 3, June 9 13:53 – 13:57, Channel Average Velocity = 0.101 m/s



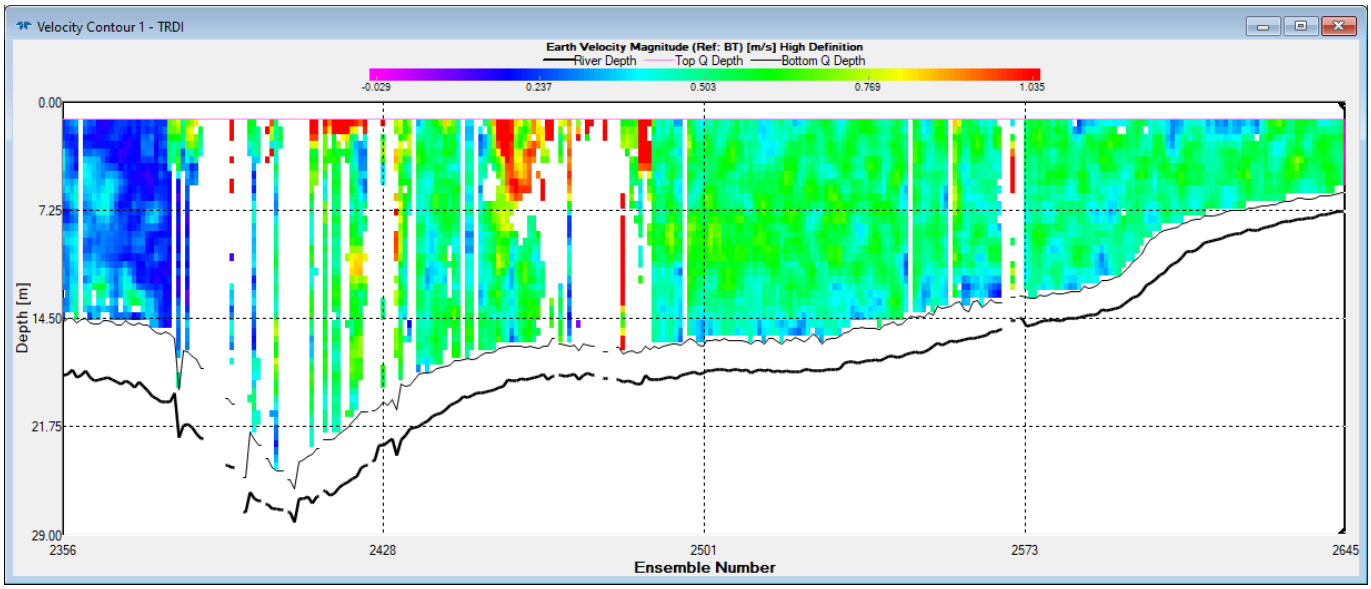
Transect 4, June 9 14:10 – 14:15, Channel Average Velocity = 0.189 m/s



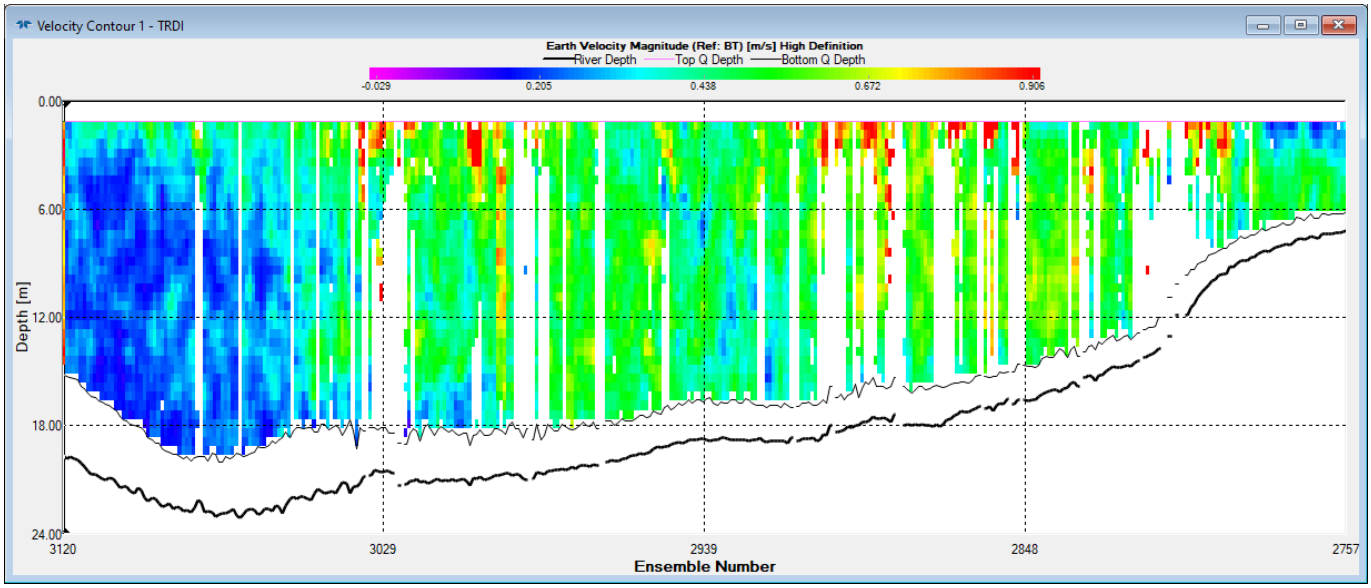
Transect 5, June 9 14:16 – 14:20, Channel Average Velocity = 0.178 m/s



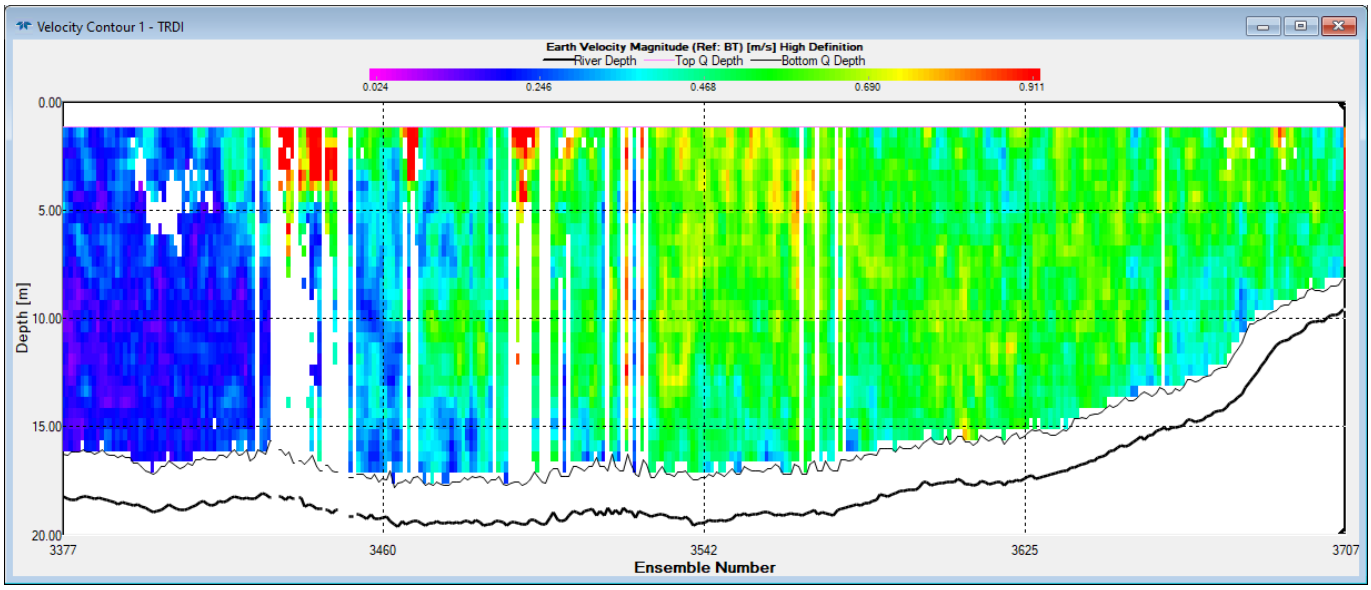
Transect 1, June 9 15:43 – 15:47, Channel Average Velocity = 0.386 m/s



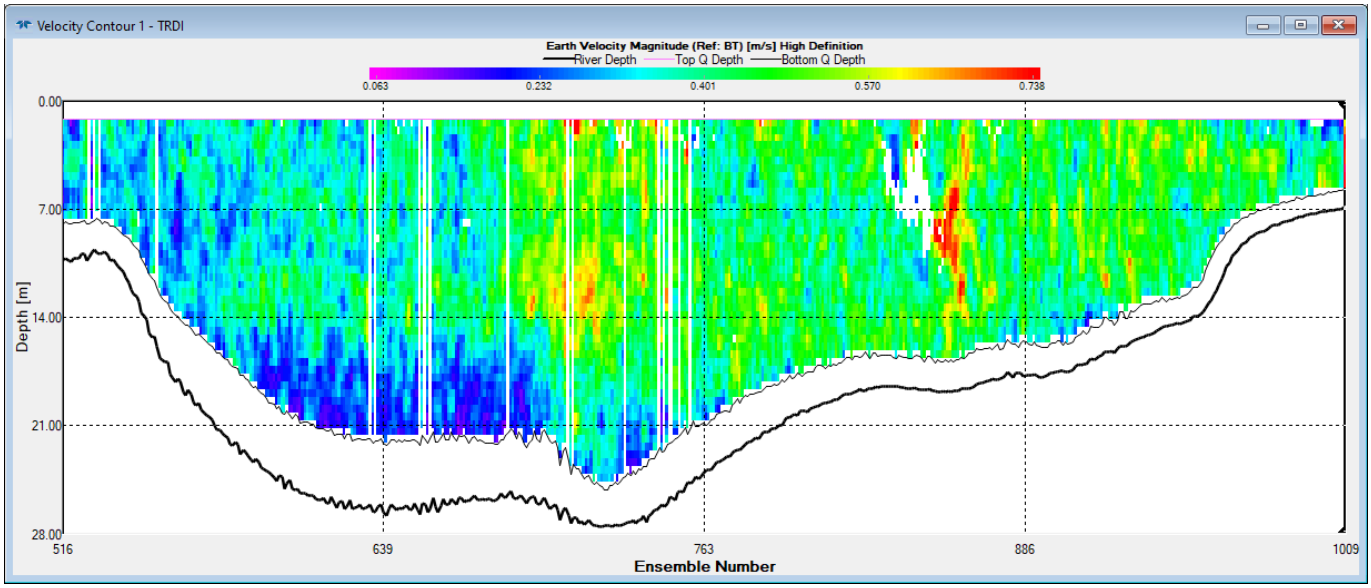
Transect 2, June 9 15:48 – 15:52, Channel Average Velocity = 0.347 m/s



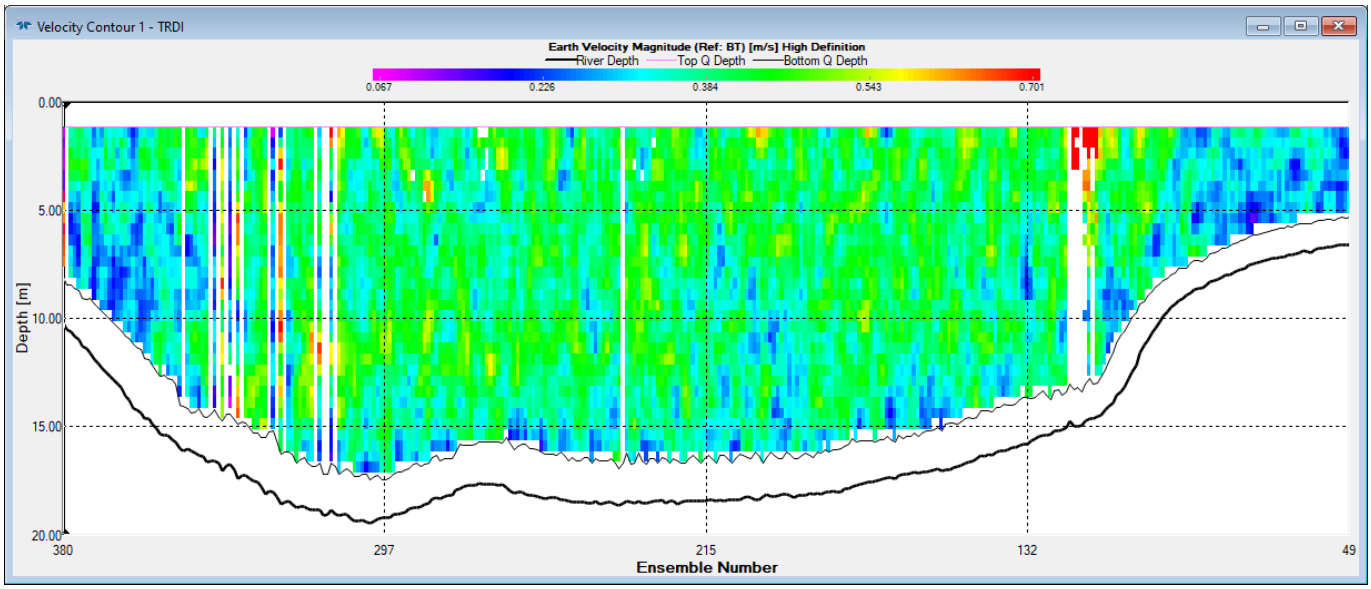
Transect 3, June 9 15:54 – 15:58, Channel Average Velocity = 0.409 m/s



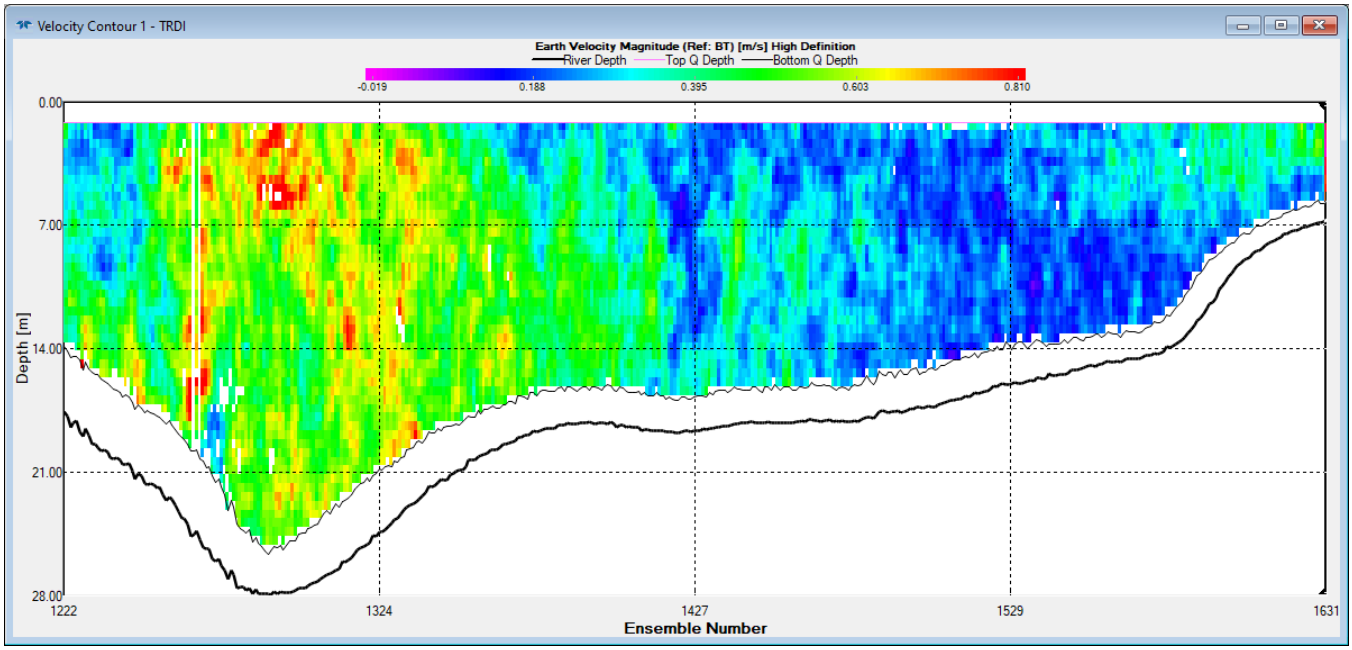
Transect 4, June 9 15:24 – 15:30, Channel Average Velocity = 0.350 m/s



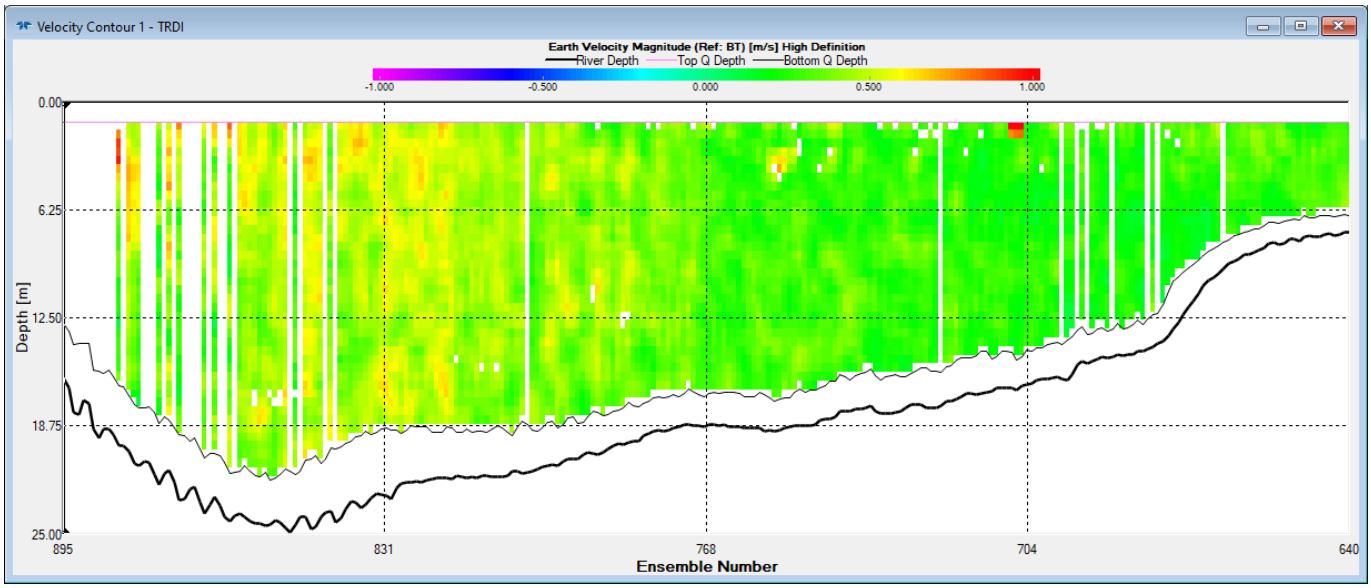
Transect 5, June 9 15:19 – 15:23, Channel Average Velocity = 0.342 m/s



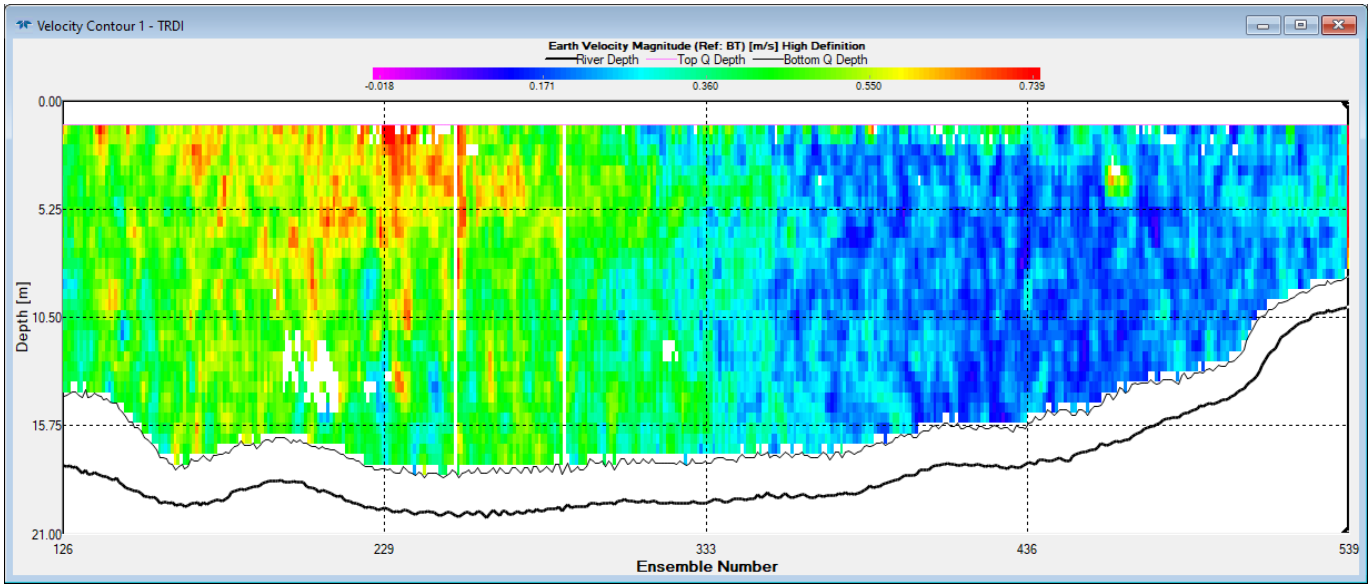
Transect 1, June 10 12:22 – 12:27, Channel Average Velocity = -0.264 m/s



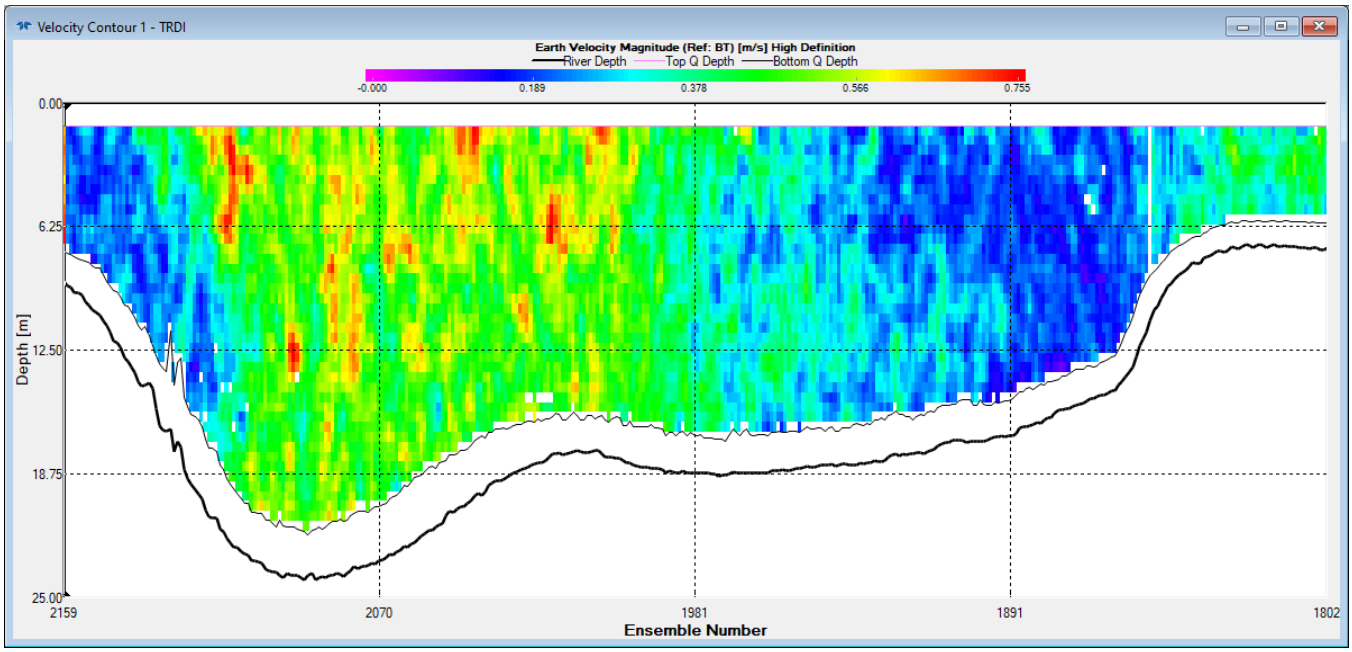
Transect 2, June 10 12:16 – 12:19, Channel Average Velocity = -0.262 m/s



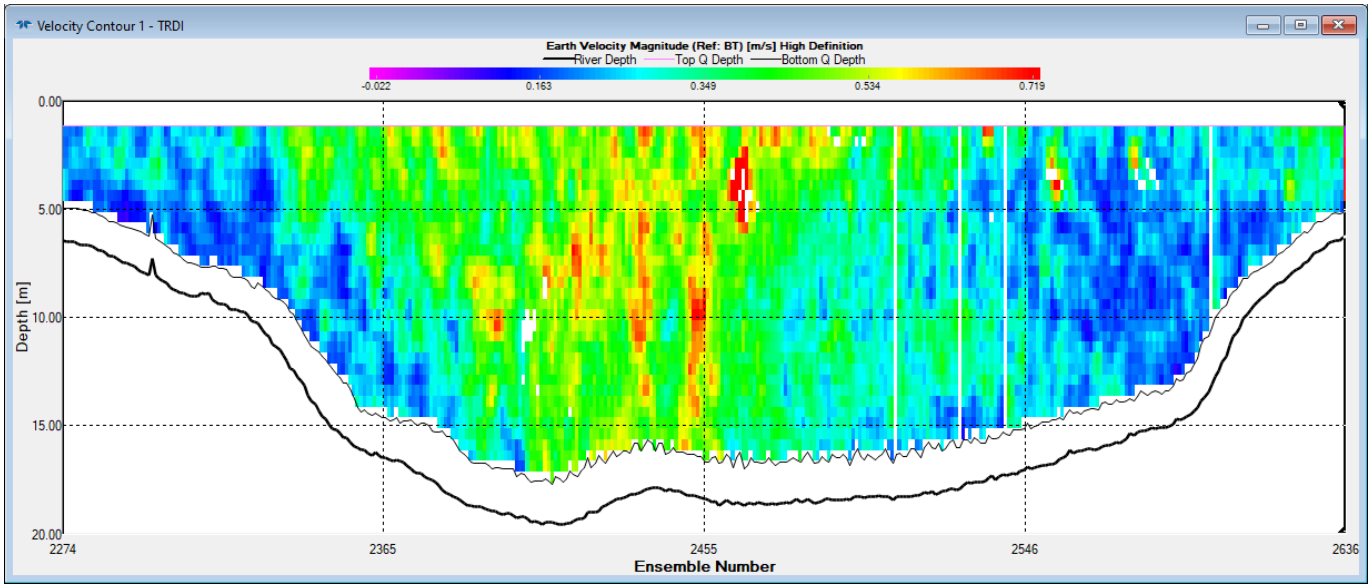
Transect 3, June 10 12:10 – 12:15, Channel Average Velocity = -0.252 m/s



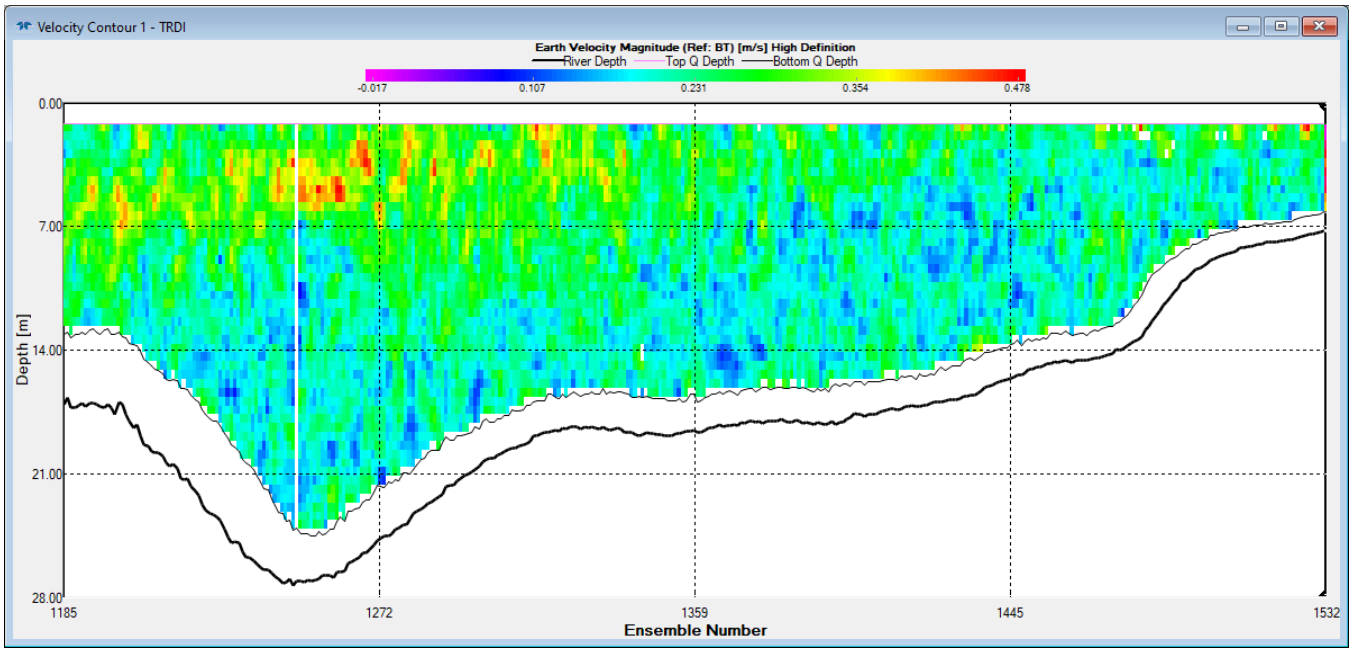
Transect 4, June 10 12:28 – 12:32, Channel Average Velocity = -0.261 m/s



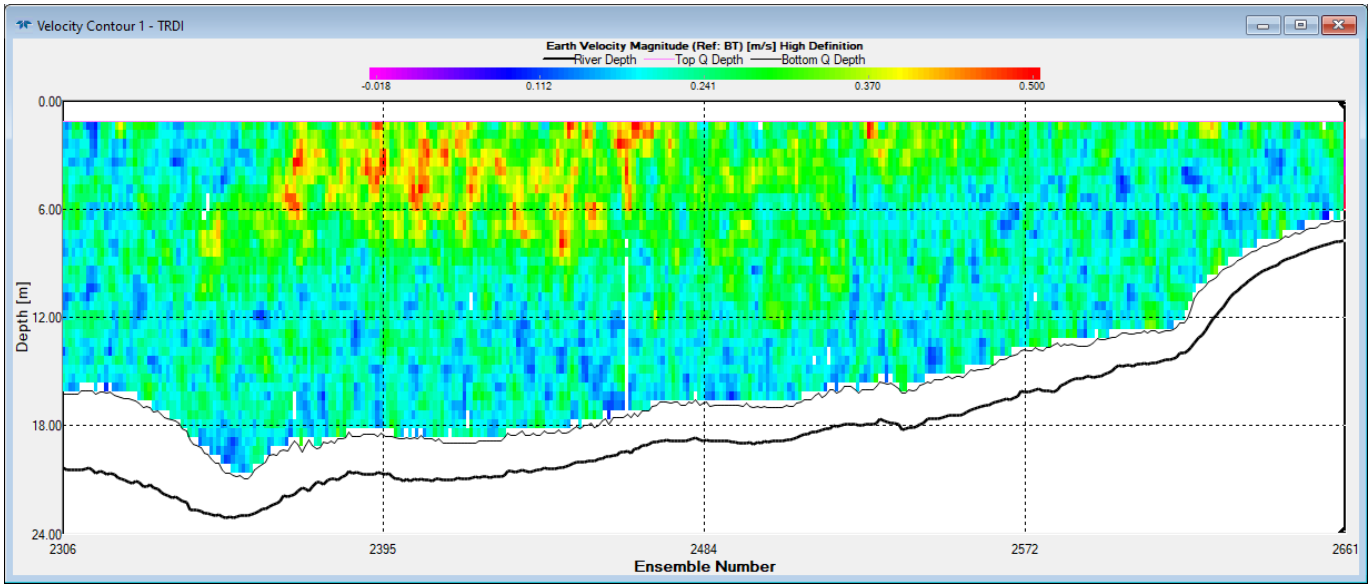
Transect 5, June 10 12:33 – 12:37, Channel Average Velocity = -0.238 m/s



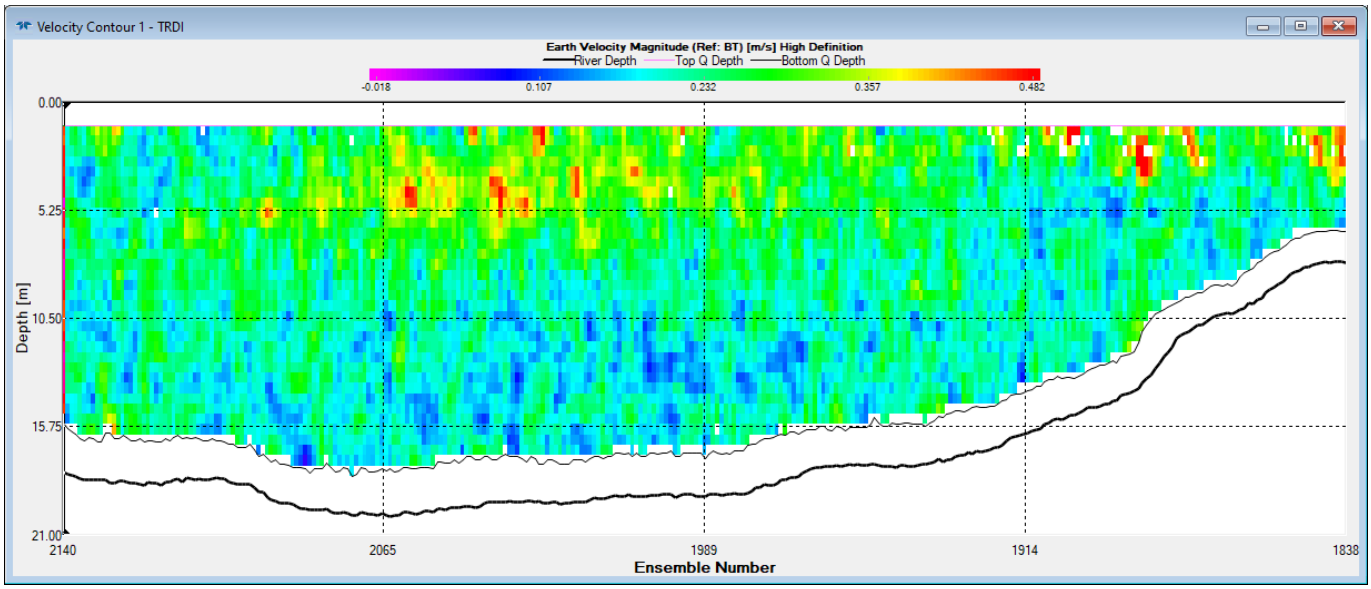
Transect 1, June 10 14:39 – 14:43, Channel Average Velocity = 0.109 m/s



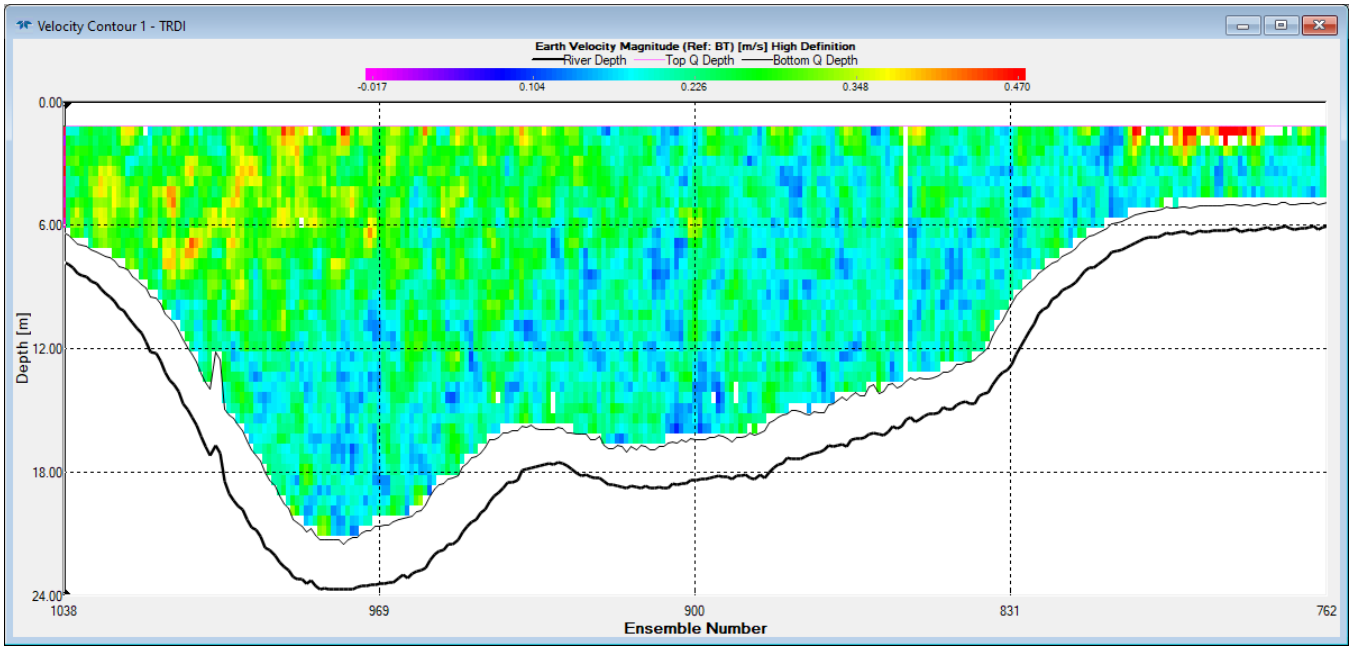
Transect 2, June 10 14:51 – 14:55, Channel Average Velocity = 0.144 m/s



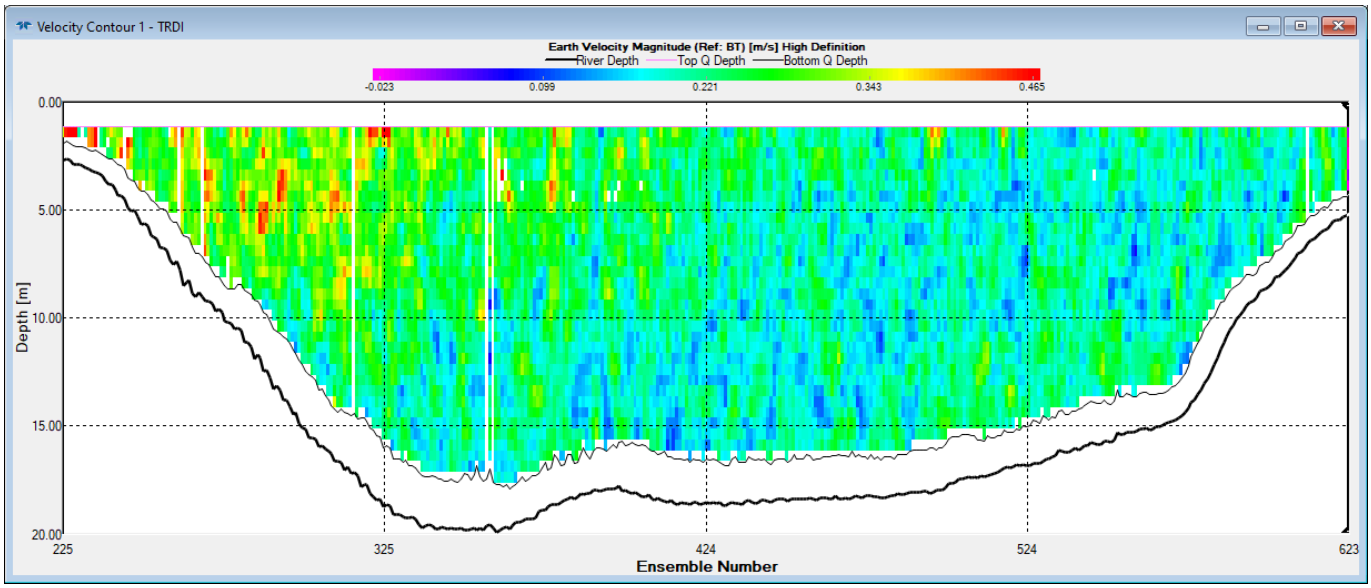
Transect 3, June 10 14:46 – 14:50, Channel Average Velocity = 0.115 m/s

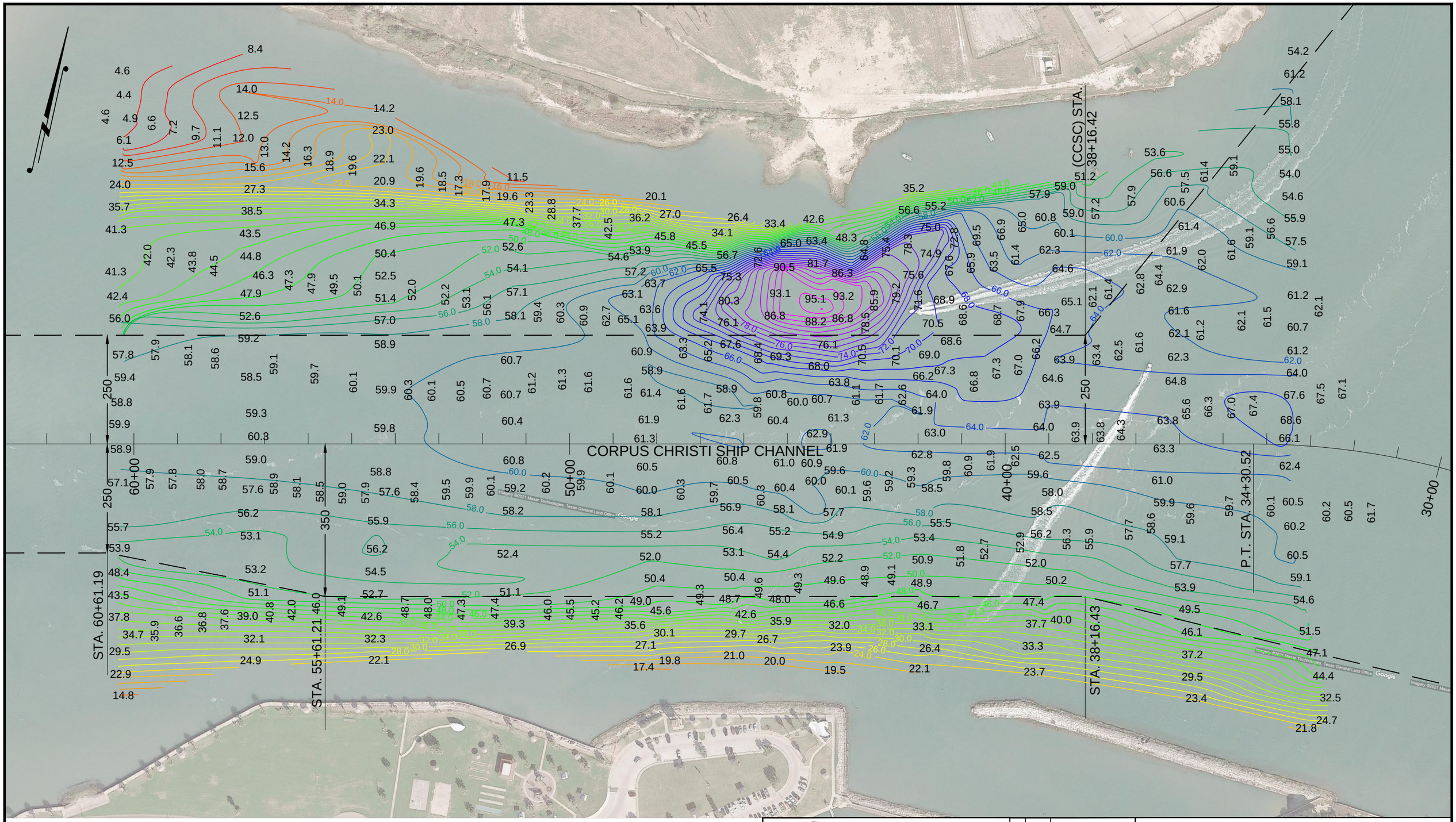


Transect 4, June 10 14:35 – 14:38, Channel Average Velocity = 0.090 m/s



Transect 5, June 10 14:29 – 14:34, Channel Average Velocity = 0.080 m/s





NOTES:
1) SOUNDINGS DATA WERE RECORDED BY T. BAKER SMITH ON 7-9 JUNE, 2021. SEA FLOOR CONDITIONS ARE SUBJECT TO CHANGE.
2) HORIZONTAL DATUM: NAD83, TEXAS SOUTH ZONE, US FEET.
3) VERTICAL DATUM: NAVD88 REFERENCE MONUMENTS "CG 71".

"CG 71"
N: 17,196,944.36'
E: 1,448,233.41'
ELEV: 5.7' NAVD 88

T. BAKER SMITH, LLC
A CENTURY OF SOLUTIONS
3854 FM 1069
ARANSAS PASS, TEXAS 78336
WWW.TBSMITH.COM
TBPLS #10194575

NO.	DATE	REVISION

PARSON ENVIRONMENT AND INFRASTRUCTURE GROUP INC
HARBOR ISLAND
BATHYMETRIC SURVEY
PORT ARANSAS, TEXAS

SCALE: 1"=200'
DWN. BY: CDW
SHEET 1 OF 1
DATE: JUNE 2021

2. APPLICANT INFORMATION (Instructions, Pages 21-22)

a. Facility Owner

(Owner of the facility must apply for the permit.)

What is the Legal Name of the entity (applicant) applying for this permit?

Port of Corpus Christi Authority of Nueces County

(The legal name must be spelled exactly as filed with the Texas Secretary of State, County, or in the legal documents forming the entity.)

If the applicant is currently a customer with the TCEQ, what is the Customer Number (CN)? You may search for your CN on the TCEQ website at http://www15.tceq.texas.gov/crpub/index.cfm?fuseaction=cust.CustSearch

CN: 600885248

What is the name and title of the person signing the application? The person must be an executive official meeting signatory requirements in *30 TAC § 305.44*.

First/Last Name: Sean Strawbridge

Title: Chief Executive Officer Credential: N/A

b. Co-applicant Information

What is the Legal Name of the co-applicant applying for this permit?

N/A

(The legal name must be spelled exactly as filed with the TX SOS, with the County, or in the legal documents forming the entity.)

If the co-applicant is currently a customer with the TCEQ, what is the Customer Number (CN)? You may search for your CN on the TCEQ website at http://www15.tceq.texas.gov/crpub/index.cfm?fuseaction=cust.CustSearch:

CN: N/A

What is the name and title of the person signing the application? The person must be an executive official meeting signatory requirements in *30 TAC § 305.44*.

First/Last Name: N/A

Title: N/A Credential: N/A

Provide a brief description of the need for a co-permittee:

N/A

c. Core Data Form

Complete the Core Data Form for each customer and include as an attachment. If the customer type selected on the Core Data Form is **Individual**, complete **Attachment 1** of Administrative Report 1.0.

Attachment: 2

3. APPLICATION CONTACT INFORMATION (Instructions, Page 22)

If the TCEQ needs additional information regarding this application, who should be contacted?

a. First/Last Name: Sarah L. Garza Credential: N/A
Organization Name: Port of Corpus Christi Authority Title: Director Environmental Planning
Mailing Address: P.O. Box 1541
City: Corpus Christi State: Texas ZIP Code: 78403
Phone No.: 361-885-6163 Ext.: N/A Fax No.: N/A
E-mail Address: sarah@pocca.com
Check one or both: ☒ Administrative Contact ☒ Technical Contact

b. First/Last Name: N/A Credential: Click here to enter text.
Organization Name: Click here to enter text. Title: Click here to enter text.
Mailing Address: Click here to enter text.
City: Click here to enter text. State: Click here to enter text. ZIP Code: Click here to enter text.
Phone No.: Click here to enter text. Ext.: Click here to enter text. Fax No.: Click here to enter text.
E-mail Address: Click here to enter text.
Check one or both: ☐ Administrative Contact ☐ Technical Contact

Attachment: N/A

4. PERMIT CONTACT INFORMATION (Instructions, Page 22)

Provide two names of individuals that can be contacted throughout the permit term.

a. First/Last Name: Sean Strawbridge Credential: N/A
Organization Name: Port of Corpus Christi Authority Title: Chief Executive Officer
Mailing Address: P.O. Box 1541
City: Corpus Christi State: Texas ZIP Code: 78403
Phone No.: 361-882-5633 Ext.: N/A Fax No.: N/A
E-mail Address: sstrawbridge@pocca.com

b. First/Last Name: Sarah L. Garza Credential: N/A
Organization Name: Port of Corpus Christi Authority Title: Director Environmental Planning
Mailing Address: P.O. Box 1541
City: Corpus Christi State: Texas ZIP Code: 78403
Phone No.: 361-885-6163 Ext.: N/A Fax No.: N/A
E-mail Address: sarah@pocca.com

Attachment: N/A

If **no**, **or a new permit application**, please give an accurate description:

N/A

d. Are the point(s) of discharge and the discharge route(s) in the existing permit correct?

☒ Yes ☐ No

If **no**, **or a new or amendment permit application**, provide an accurate description:

This is a new permit application. The discharge route is via an HDPE pipeline to a multi-port diffuser approximately 229 ft off shore on the south side of Harbor Island in Corpus Christi Channel (Segment 2481). From this point, the discharge is tidal, and will flow either into the Gulf of Mexico via Aransas Pass or through the Corpus Christi Channel toward Corpus Christi Bay.

e. City nearest the outfall(s): Port Aransas

f. County in which the outfalls(s) is/are located: Nueces

g. Outfall Latitude: 27.844412° Longitude: -97.063602°

h. Is or will the treated wastewater discharge to a city, county, or state highway right-of-way, or a flood control district drainage ditch?

☐ Yes ☒ No

If **yes**, indicate by a check mark if:

☐ Authorization granted ☐ Authorization pending

For **new and amendment** applications, provide copies of letters that show proof of contact and the approval letter upon receipt.

Attachment: N/A

i. For all applications involving an average daily discharge of 5 MGD or more, provide the names of all counties located within 100 statute miles downstream of the point(s) of discharge.

N/A – The point of discharge is Corpus Christi Ship Channel. No counties are located downstream of the point of discharge.

j. For TLAPs, is the location of the effluent disposal site in the existing permit accurate?

☐ Yes ☐ No

If **no, or a new or amendment permit application**, provide an accurate description:

N/A

k. City nearest the disposal site: N/A

l. County in which the disposal site is located: N/A

11. SIGNATURE PAGE (Instructions, Page29)

Permit Number: WQ0005253000

Applicant: Port of Corpus Christi Authority of Nueces County

Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code §305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signatory name (typed or printed): Sean Strawbridge

Signatory title: Chief Executive Officer

Signature: Sean C Strawbridge Date: 6-25-2021

(Use blue ink)

Subscribed and Sworn to before me by the said 25

on this June day of 2021, 20____.

My commission expires on the 20 day of 11, 2022.

Notary Public

NOTARY PUBLIC STATE OF FLORIDA

VANESSA TORRES
Commission # GG 278465
Expires November 20, 2022
Bonded Thru Budget Notary Services

[SEAL]

Vanessa Torres
County, ~~Texas~~ Florida

If co-applicants are necessary, each entity must submit an original, separate signature page.

Photograph Location and Direction

001 Proposed Diffuser Location

Discharge Route

Property Boundary

Plant Boundary

0 300 600 900 1,200 Feet

N

Attachment 3

Photograph Location Map

Port of Corpus Christi
Proposed Desalination Plant
Harbor Island, Port Aransas, Texas

PARSONS

5. List the county in which the facility is located: Nueces

6. If the property is publicly owned and the owner is different than the permittee/applicant, please list the owner of the property.

N/A

7. Provide a description of the effluent discharge route. The discharge route must follow the flow of effluent from the point of discharge to the nearest major watercourse (from the point of discharge to a classified segment as defined in *30 TAC Chapter 307*). If known, please identify the classified segment number.

This is a new permit application. The discharge route is via an HDPE pipeline to a multi-port diffuser approximately 229 ft off shore on the south side of Harbor Island in Corpus Christi Channel (Segment 2481). From this point, the discharge is tidal, and will flow either into the Gulf of Mexico via Aransas Pass or through the Corpus Christi Channel toward Corpus Christ Bay.

8. Please provide a separate 7.5-minute USGS quadrangle map with the project boundaries plotted and a general location map showing the project area. Please highlight the discharge route from the point of discharge for a distance of one mile downstream. (This map is required in addition to the map in the administrative report).

9. Provide original photographs of any structures 50 years or older on the property.

10. Does your project involve any of the following? Check all that apply.

- ☒ Proposed access roads, utility lines, construction easements
- ☐ Visual effects that could damage or detract from a historic property's integrity
- ☒ Vibration effects during construction or as a result of project design
- ☐ Additional phases of development that are planned for the future
- ☐ Sealing caves, fractures, sinkholes, other karst features
- ☒ Disturbance of vegetation or wetlands

11. List proposed construction impact (surface acres to be impacted, depth of excavation, sealing of caves, or other karst features):

Construction will impact approximately 33 acres of Harbor Island in a former fuel tank storage area. The discharge pipe will enter Corpus Christi Channel on the southeast side of the island. The pipeline will feed a multiport diffuser oriented parallel to and located approximately 229 ft off the shoreline.

12. Describe existing disturbances, vegetation, and land use:

The property is the former site of a petroleum tank farm. Currently, the site is vacant and covered with intermittent natural vegetation.

THE FOLLOWING ITEMS APPLY ONLY TO APPLICATIONS FOR NEW TPDES PERMITS AND MAJOR AMENDMENTS TO TPDES PERMITS

13. List construction dates of all buildings and structures on the property:

N/A – No existing structures.

14. Provide a brief history of the property, and name of the architect/builder, if known.

The property is the location of the Former Atofina and Exxon Pipeline Tank Terminals. The tank farms have been removed many years ago and now the property is vacant with no current development.

d. Attach a facility map (drawn to scale) with the following information:

- Production areas, maintenance areas, materials-handling areas, and waste-disposal areas
- The location of each unit of the wastewater treatment plant including the location of wastewater collection sumps, impoundments, and outfalls (also include locations of sampling points if significantly different from outfall locations)

Attachment: 9

e. Is this a new permit application for an existing facility?

☐ Yes ☒ No

If **yes**, provide background discussion below.

Click here to enter text

f. Is the treatment facility/disposal site located above the 100-year frequency flood level?

☒ Yes ☐ No

List source(s) used to determine 100-year frequency flood plain:

FEMA Flood Insurance Rate Map Panel Number 485498 0001 F dated September 30, 1992. The facility is located in Zone X, outside the 500 year flood plain.

If **no**, provide the elevation of the 100-year frequency flood plain and describe what protective measures are in use or planned to be used to prevent flooding of the treatment facility/disposal area.

Click here to enter text

g. For new or amendment permit applications, will any construction operations result in a discharge of fill material into a water in the state?

☒ Yes ☐ No

If **no**, proceed to Item 2.

h. If **yes** to the above question, has the applicant applied for a U.S. Army Corps of Engineers 404 Dredge and Fill permit?

☐ Yes ☒ No

If **yes**, provide the permit number: TBD

If **no**, provide the approximate date you anticipate submitting your application to the Corps: After TPDES permit is issued.

4. OUTFALL/DISPOSAL METHOD INFORMATION (Instructions, Pages 39-40)

Complete the following tables to describe the location and wastewater discharge or disposal operations for each outfall for discharge operations and for each point of disposal for TLAP operations.

For TLAP permit applications: Indicate the disposal method and each individual irrigation area (I), evaporation pond (E), or subsurface drainage system (S) by providing the appropriate letter designation for the disposal method followed by a numerical designation for each disposal area in the space provided for "Outfall" designation (e.g. "E1" for evaporation pond 1, "I2" for irrigation area No. 2, etc.).

Outfall Latitude and Longitude

Outfall Number	Latitude-degrees	Latitude-minutes	Latitude-seconds	Longitude-degrees	Longitude-minutes	Longitude-seconds
001	27	50	39.8826	-97	03	48.9672

Outfall Location Description

Outfall Number	Location Description
001	Outfall will consist of a buried/submerged pipeline and diffuser into the Corpus Christi Channel.

Description of Sampling Points (if different from Outfall location)

Outfall Number	Description of Sampling Point
001	The sampling point will be on land following comingling of all wastewaters and prior to discharging into Corpus Christi Channel.

7. DOMESTIC SEWAGE, SEWAGE SLUDGE, AND SEPTAGE MANAGEMENT AND DISPOSAL (Instructions, Pages 41-42)

a. Please check the appropriate method(s) of domestic sewage and domestic sewage sludge treatment/disposal and complete Worksheet 5.0 or Item 7.b if directed to do so.

☐ Facility is connected to a wastewater treatment plant permitted to receive domestic sewage, or the domestic sewage is transported off-site to a permitted facility for treatment, disposal, or both. COMPLETE ITEM 7.b BELOW.

☒ Domestic sewage is disposed of by an on-site septic tank and drainfield system. COMPLETE ITEM 7.b BELOW.

☐ Both domestic and industrial treatment sludge ARE commingled prior to use or disposal.

☐ Industrial wastewater and domestic sewage are treated separately, and the respective sludge IS NOT commingled prior to sludge use or disposal. COMPLETE WORKSHEET 5.0 OF THIS APPLICATION.

☐ Facility is a POTW. COMPLETE WORKSHEET 5.0 OF THIS APPLICATION.

☐ Domestic sewage is not generated on-site.

☐ Other (e.g., portable toilets): Please provide a detailed description:

Click here to enter text.

b. Provide the name and TCEQ, NPDES, or TPDES Permit No. of the waste-disposal facility which receives the domestic sewage/septage. If hauled by motorized vehicle, provide the name and TCEQ Registration No. of the hauler.

Domestic Sewage Plant/Hauler Name

Plant/Hauler Name	Permit/Registration No.
N/A	

8. IMPROVEMENTS OR COMPLIANCE/ENFORCEMENT REQUIREMENTS (Instructions, Page 42)

Is the permittee currently required to meet any implementation schedule for compliance or enforcement?

☐ Yes ☒ No

If **yes**, provide a brief summary of the requirements and a status update.

Click here to enter text.

9. TOXICITY TESTING (Instructions, Pages 42-43)

Have any biological tests for acute or chronic toxicity been made on any of your discharges or on a receiving water in relation to your discharge within the last three years?

☒ Yes ☐ No

If **yes**, identify the tests and describe their purposes below. Please attach a copy of all tests performed that have not been previously sent to the TCEQ or the EPA.

Attachment: See Attachment 11 - Laboratory reports for salinity toxicity in synthetic sea water.

10. OFF-SITE/THIRD PARTY WASTES (Instructions, Page 43)

Do you receive wastes from off-site sources for any or all of the following: treatment in your facility, disposal on-site via land application, or discharge via a permitted outfall?

☐ Yes ☒ No

If **no**, proceed to Item 11.

If **yes**, provide responses to Items a, b, and c below.

a. Attach the following information to the application:

- List of wastes received
- Characterization of wastes received
- Volumes of each waste received
- Information on compatibility with on-site wastes
- Identified sources of wastes received
- Name and addresses of generators
- Description of the relationship of waste source(s) with your facility's activities

Attachment: Click here to enter text.

b. Is wastewater from a TCEQ, NPDES, or TPDES permitted facility commingled with your wastewater after your final treatment and prior to discharge via your final outfall/point of disposal?

☐ Yes ☐ No

If **yes**, provide the name, address, and TCEQ, NPDES, or TPDES permit number of the contributing facility and a copy of any agreements or contracts relating to this activity.

Attachment: Click here to enter text.

c. Is your facility a Publicly Owned Treatment Works (POTW) that accepts process wastewater from any Significant Industrial User (SIU) and has or is required to have an approved pretreatment program under the NPDES/TPDES program?

☐ Yes ☐ No

If **yes**, complete **Worksheet 6.0** of this application.

Table 1 for Outfall No.: Sample 1 and 2 from GOM intake location and Average estimated for 40% recovery in Outfall 001

Samples are (check one): ☐ **Composites** ☒ **Grabs**

Pollutant	Sample 1 (mg/L)	Sample 2 (mg/L)	Sample 3 (mg/L)	Sample 4 (mg/L)	Average (mg/L)
BOD (5-day)	< 2.00	< 2.00			ND
CBOD (5-day)	< 2.00	2.18			< 1
Chemical oxygen demand	60.0	55.0			< 5
Total organic carbon	2.09	2.08			< 1
Dissolved oxygen					ambient
Ammonia nitrogen	< 0.050	< 0.050			ND
Total suspended solids	8.40	6.70			15
Nitrate nitrogen	< 10.0	< 5.00			ND
Total organic nitrogen	< 0.50	< 0.50			ND
Total phosphorus	< 0.0500	< 0.0500			ND
Oil and grease	3.00	2.58			< 5
Total residual chlorine					ND
Total dissolved solids	33,400	33,800			51,100
Sulfate	2,340	2,350			3,560
Chloride	16,400	16,200			25,000
Fluoride	< 10.0	< 5.00			<10
Total alkalinity (mg/L as $CaCO_3$)	118	119			180
Temperature (°F)					14 - 32
pH (standard units)					7.5 - 8.5

Table 2 for Outfall No.: Sample 1 and 2 from GOM intake location and Average estimated for 40% recovery in Outfall 001

Samples are (check one): ☐ **Composites** ☒ **Grabs**

Pollutant	Sample 1 (µg/L)	Sample 2 (µg/L)	Sample 3 (µg/L)	Sample 4 (µg/L)	Average (µg/L)	MAL (µg/L)
Aluminum, total	74.6 J	122			150	2.5
Antimony, total	< 5.30	< 5.30			< 8.1	5
Arsenic, total	3.01 J	< 2.50			4.5	0.5
Barium, total	19.9 J	20.8 J			32	3
Beryllium, total	< 0.910	< 0.910			< 1.4	0.5
Cadmium, total	< 0.770	< 0.770			< 1.2	1
Chromium, total	< 2.51	< 2.51			< 3.8	3
Chromium, hexavalent	< 20.0	< 20.0			< 30.5	3
Chromium, trivalent	< 10.0	< 10.0			< 15.2	N/A
Copper, total	1.82 J	1.80 J			2.7	2
Cyanide, available	< 2.0	< 2.0			< 4.0	2/10
Lead, total	< 1.20	< 1.20			< 2.0	0.5
Mercury, total	0.00058	0.00066			0.0010	0.005/0.0005
Nickel, total	1.63 J	1.69 J			2.6	2
Selenium, total	< 8.60	< 8.60			< 13.1	5

Pollutant	Sample 1 (µg/L)	Sample 2 (µg/L)	Sample 3 (µg/L)	Sample 4 (µg/L)	Average (µg/L)	MAL (µg/L)
Silver, total	< 0.440	< 0.440			< 0.70	0.5
Thallium, total	< 2.50	< 2.50			< 3.4	0.5
Zinc, total	< 10.0	< 10.0			< 15	5.0

TABLE 3 (Instructions, Page 54).

Completion of Table 3 is required for all external outfalls which discharge process wastewater.

Partial completion of Table 3 is required for all external outfalls with non-process wastewater discharges.

For discharges of stormwater runoff commingled with other wastestreams, complete Table 3 as instructed

Table 3 for Outfall No.: Sample 1 and 2 from GOM intake location and Average estimated for 40% recovery in Outfall 001

Samples are (check one): ☐ **Composites** ☒ **Grabs**

Pollutant	Samp. 1 (µg/L)*	Samp. 2 (µg/L)*	Samp. 3 (µg/L)*	Samp. 4 (µg/L)*	Avg. (µg/L)*	MAL (µg/L)*
Acrylonitrile	< 10.0	< 10.0			ND	50
Anthracene	< 5.00	< 5.00			ND	10
Benzene	< 5.00	< 5.00			ND	10
Benzidine	< 5.00	< 5.00			ND	50
Benzo(a)anthracene	< 5.00	< 5.00			ND	5
Benzo(a)pyrene	< 5.00	< 5.00			ND	5
Bis(2-chloroethyl)ether	< 5.00	< 5.00			ND	10
Bis(2-ethylhexyl)phthalate	< 5.00	< 5.00			ND	10
Bromodichloromethane [Dichlorobromomethane]	< 5.00	< 5.00			ND	10
Bromoform	< 5.00	< 5.00			ND	10
Carbon tetrachloride	< 5.00	< 5.00			ND	2
Chlorobenzene	< 5.00	< 5.00			ND	10
Chlorodibromomethane [Dibromochloromethane]	< 5.00	< 5.00			ND	10
Chloroform	< 5.00	< 5.00			ND	10
Chrysene	< 5.00	< 5.00			ND	5
m-Cresol [3-Methylphenol]	< 5.00	< 5.00			ND	10
o-Cresol [2-Methylphenol]	< 5.00	< 5.00			ND	10
p-Cresol [4-Methylphenol]	< 5.00	< 5.00			ND	10
1,2-Dibromoethane	< 5.00	< 5.00			ND	10
m-Dichlorobenzene [1,3-Dichlorobenzene]	< 5.00	< 5.00			ND	10
o-Dichlorobenzene [1,2-Dichlorobenzene]	< 5.00	< 5.00			ND	10
p-Dichlorobenzene [1,4-Dichlorobenzene]	< 5.00	< 5.00			ND	10
3,3'-Dichlorobenzidine	< 5.00	< 5.00			ND	5

Pollutant	Samp. 1 (µg/L)*	Samp. 2 (µg/L)*	Samp. 3 (µg/L)*	Samp. 4 (µg/L)*	Avg. (µg/L)*	MAL (µg/L)*
1,2-Dichloroethane	< 5.00	< 5.00			ND	10
1,1-Dichloroethene [1,1-Dichloroethylene]	< 5.00	< 5.00			ND	10
Dichloromethane [Methylene chloride]	< 10.0	< 10.0			ND	20
1,2-Dichloropropane	< 5.00	< 5.00			ND	10
1,3-Dichloropropene [1,3-Dichloropropylene]	< 5.00	< 5.00			ND	10
2,4-Dimethylphenol	< 5.00	< 5.00			ND	10
Di-n-Butyl phthalate	< 5.00	< 5.00			ND	10
Ethylbenzene	< 5.00	< 5.00			ND	10
Fluoride	< 10,000	< 5,000			ND	500
Hexachlorobenzene	< 5.00	< 5.00			ND	5
Hexachlorobutadiene	< 5.00	< 5.00			ND	10
Hexachlorocyclopentadiene	< 5.00	< 5.00			ND	10
Hexachloroethane	< 5.00	< 5.00			ND	20
Methyl ethyl ketone	< 10.0	< 10.0			ND	50
Nitrobenzene	< 5.00	< 5.00			ND	10
N-Nitrosodiethylamine	< 5.00	< 5.00			ND	20
N-Nitroso-di-n-butylamine	< 5.00	< 5.00			ND	20
Nonylphenol	< 5.00	< 5.00			ND	333
Pentachlorobenzene	< 5.00	< 5.00			ND	20
Pentachlorophenol	< 5.00	< 5.00			ND	5
Phenanthrene	< 5.00	< 5.00			ND	10
Polychlorinated biphenyls (PCBs) (**)	< 0.0125	< 0.0125			ND	0.2
Pyridine	< 5.00	< 5.00			ND	20
1,2,4,5-Tetrachlorobenzene	< 5.00	< 5.00			ND	20
1,1,2,2-Tetrachloroethane	< 5.00	< 5.00			ND	10
Tetrachloroethene [Tetrachloroethylene]	< 5.00	< 5.00			ND	10
Toluene	< 5.00	< 5.00			ND	10
1,1,1-Trichloroethane	< 5.00	< 5.00			ND	10
1,1,2-Trichloroethane	< 5.00	< 5.00			ND	10
Trichloroethene [Trichloroethylene]	< 5.00	< 5.00			ND	10
2,4,5-Trichlorophenol	< 5.00	< 5.00			ND	50
TTHM (Total trihalomethanes)	< 5.00	< 5.00			ND	10
Vinyl chloride	< 2.00	< 2.00			ND	10

(*) Indicate units if different from µg/L.

(**) Total of detects for PCB-1242, PCB-1254, PCB-1221, PCB-1232, PCB-1248, PCB-1260, and PCB-1016. If all non-detects, enter the highest non-detect preceded by a "<".

TABLE 6 (Instructions, Page 56)

Completion of Table 6 is required for all external outfalls but is not required for internal outfalls.

Table 6 for Outfall No.: Sample 1 and 2 from GOM intake location and Average estimated for 40% recovery with Maximum estimated for 50% recovery in Outfall 001

Samples are (check one): ☐ Composites ☒ Grabs

Pollutants	Believed Present	Believed Absent	Average Concentration (mg/L)	Maximum Concentration (mg/L)	No. of Samples	MAL (µg/L)*
Bromide	☒	☐	75	88	2	400
Color (PCU)	☒	☐	5	5	2	—
Nitrate-Nitrite (as N)	☐	☒	< 30	< 35	2	—
Sulfide (as S)	☐	☒	< 0.075	< 0.087	2	—
Sulfite (as SO3)	☐	☐				—
Surfactants	☐	☒	< 0.075	< 0.087	2	—
Boron, total	☒	☐	6	7	2	20
Cobalt, total	☐	☒	< 0.0006	< 0.0007	2	0.3
Iron, total	☐	☒	< 0.75	< 0.87	2	7
Magnesium, total	☒	☐	1,610	1,860	2	20
Manganese, total	☒	☐	0.012	0.014	2	0.5
Molybdenum, total	☒	☐	0.014	0.016	2	1
Tin, total	☐	☒	< 0.00088	< 0.00101	2	5
Titanium, total	☒	☐	0.010	0.015	2	30

* Indicate units if different from µg/L.

J - Analyte detected, estimated concentration.

WORKSHEET 4.0
RECEIVING WATERS

This worksheet **is required** for all renewal, amendment, and new TPDES permit applications.

1. DOMESTIC DRINKING WATER SUPPLY (Instructions, Page 78)

Is there a surface water intake for domestic drinking water supply located within 5 (five) miles downstream from the point/proposed point of discharge?

☐ Yes ☒ No

If **yes**, identify owner of the drinking water supply, the distance and direction to the intake, and locate and identify the intake on the USGS map.

☐ Indicate with an 'x' in the box that the requested information is provided.

2. DISCHARGE INTO TIDALLY INFLUENCED WATERS (Instructions, Page 78)

a. Width of the receiving water at the outfall? Approximately 1,200 feet

b. Are there oyster reefs in the vicinity of the discharge?

☐ Yes ☒ No

If **yes**, indicate approximate distance and direction from outfall(s):

Click here to enter text.

c. Are there any sea grasses within the vicinity of the point of discharge?

☐ Yes ☒ No

If **yes**, provide the distance and direction to the grasses:

Click here to enter text.

3. CLASSIFIED SEGMENT (Instructions, Page 78)

Is the discharge directly into (or within 300 feet of) a classified segment?

☒ Yes ☐ No

If **yes, stop here**. It is not necessary to complete Items 4 and 5, and it is not necessary to complete Worksheet 4.1.

If **no**, complete Items 4 and 5.

ATTACHMENT 8

Process Design Basis and Narrative

Process Design Basis and Narrative
Port of Corpus Christi Industrial Seawater Desalination
Harbor Island

Introduction

The Port of Corpus Christi Authority (PCCA) is developing a project to provide a sustainable supply of potable water for the Corpus Christi area that is not dependent upon rainwater. The proposed system will provide up to 50 million gallons per day (MGD) of permeate through the process of desalination. The purpose of this project is to develop a basis of design in sufficient detail to complete the Texas Commission on Environmental Quality (TCEQ) Industrial Wastewater (TPDES) Permit Application. The proposed facility will have discharges of the following effluents:

- Reject from the membrane desalination process, which is high in Total Dissolved Solids (TDS); and
- Supernatant and filtrate from sediment and sludge dewatering.

The proposed facility will be located on Harbor Island. The plant intake will consist of seawater pumped from the Gulf of Mexico. Pre-treatment will include removing sediment in the form of total suspended solids (TSS). The plant will use several clarification and filtration pretreatment processes for this purpose. The final treatment step willbe membrane desalination using Reverse Osmosis. The low TDS permeate will then be treated to reduce corrosiveness, chlorinated, and distributed for potable water use. The suspended solids will be concentrated into a dried sludge for offsite disposal. The dewatering filtrate, thickener supernatant and the membrane reject are the subject of the Industrial Wastewater Permit Application**.**

Project Objective

The overall Project Objective is to develop a sustainable supply of potable water for the Corpus Christi area that is not dependent upon rainwater. This Process Design Basis and Narrative provides information in support of the TPDES Industrial Wastewater Permit application.

Proposed Pre-Treatment and Treatment Unit Processes

The following unit processes will be utilized in the desalination facility:

- Intake screens to remove large particulate from seawater
- Intake clarification with chemical coagulation to remove algae and suspended solids
- Strainers to remove fine debris
- Ultrafiltration to remove fine TSS
- Reverse Osmosis to remove TDS
- Calcite filters to add alkalinity to the permeate to reduce its corrosiveness
- Chlorination
- Distribution pumping

- Energy recovery
- Discharge of the membrane brine or reject under a TPDES permit
- Thickening of the clarifier underflow
- Consolidation of the ultrafiltration membrane backwash solids with thickened clarifier underflow
- Dewatering of consolidated sludge streams
- Discharge of the thickener supernatant and dewatering filtrate under a TPDES permit

Process Narrative

Seawater will be drawn into the plant from the Gulf of Mexico through coarse screens that will keep large material from entering the pre-treatment processes. The screen will reject captured solids as industrial solid waste into a dumpster. Sodium Hypochlorite (NaOCl) will be added as required to clear marine growth from the screens. The water will enter a rapid mixing unit where one or more treatment chemicals are added. It will then enter the Clarifier Center well, where flocculent is added. It will then flow into the main clarifier tank, where suspended solids will settle. The settled solids will be removed periodically as underflow to the Sludge Thickener. The clarifier effluent will flow to the Settled Water Clearwell, where NaOCl may also be added for oxidation of manganese and for partial disinfection.

From the Settled Water Clearwell, flow will pass into the strainer where solids and debris will be removed as necessary to protect the Ultrafiltration (UF) membranes. The Strainers will be backwashed to the Sludge Thickener. NaOCl may also be added to the strainers, as required. Particles exceeding a diameter greater than 0.001 µm will then be removed by passing the water under high pressure through the UF membranes. This process is semi-continuous, with some UF units in forward flow and others in Backwash or Cleaning mode. Backwash flows will be sent to the UF Reject Tank and then stored for processing in the Sludge Thickener. UF Permeate will be sent to a Clearwell where NaOCl will be added, if required.

From the Clearwell, water will be pumped through Cartridge Filters, the last unit to protect the Desalination reverse osmosis (RO) skids. The RO units will then remove particles larger than 0.1 nm. Pumps taking suction from the Clearwell will apply high pressure to force the seawater through the RO membranes, leaving the TDS behind. The process will be semi-continuous, with some RO units in forward flow and others in Reject or Cleaning mode. RO Permeate will be passed through a calcite filter to add alkalinity and reduce the corrosivity of the product water. The water will then be chlorinated and placed into one of two Permeate Storage Tanks for distribution as potable water. The RO reject will be discharged to a Brine Tank, and then pumped to Outfall 001.

Solids and sludge from the Clarifiers, Strainers, and UF Reject will be passed into a Mix Tank where Coagulant may be added, as required, to increase the diameter of the solids and then into a Sludge Thickener. A Flocculent may be added to the center well of the Thickener to enhance solids separation. The Supernatant overflow will pass over the Thickener weirs to the Outfall Storage Tank. Underflow from the thickener will be pumped into a Belt Filter press (BFP) for dewatering. Solids will be taken off site via truck. BFP Filtrate flow will flow to the Outfall Storage Tank where it will combine with the Thickener Supernatant for discharge to Outfall 001.

If chlorine is required for use in the process and if a chlorine residual is present in the final Outfall 001, then a dechlorination step will be conducted prior to the final discharge to the diffuser. If any additional compounds are present at unacceptable levels for discharge, PCCA will add treatment technology to reduce the concentration to acceptable levels prior to discharge.

A Block Flow Diagram of the process is shown in **Figure 1**. The corresponding water balance is shown in **Table 1**. The water balance shows that the intake of the facility will be 150.7MGD to produce 50 MGD of Permeate. The water balance is based on the following design assumptions:

- 5% sludge removal in the clarifier;
- 3% backwash at the strainers;
- 90% permeate recovery in the UF system;
- 55% of RO feed routed through energy recovery;
- 40% permeate recovery in the RO system;
- 50% decant from the thickener; and
- 60% filtrate recovery from the filter press.

Flow Basis and Material Balance

A summary of the projected Wastewater Stream Concentration is show in **Table 2** below. The projected effluent concentrations are based on Parsons sampling in the Gulf of Mexico and the design assumptions identified previously for the water balance. Constituent concentrations for average effluent conditions are derived by assuming 40% recovery of RO permeate, while maximum constituent concentrations are derived by assuming 50% RO permeate recovery. Note that the treatment system is designed to remove suspended solids and associated total organic carbon.

Outfall 001

Diffuser modeling information replaced with attached modeling memo.

Table 1: 50 MGD Desalination Facility Water Balance Based on 40% Recovery Rate

Stream #	Stream Description	Design Flow (MGD)
01	Seawater Intake	150.7
02	Screened Seawater	150.7
03	Clarifier Feed	150.7
04	Settled Seawater from Clarifier	143.2
05	Clarifier Sludge to Thickener	7.5
06	Settled Seawater toStrainers	143.2
07	UF Feed from Strainers	138.9
08	Strainer Backwash to Thickener	4.3
09	UF Permeate	125
10	UF Reject	13.9
11	UF Permeate Feed to RO	125
12	RO Feed HP Pump Flow	56.3
13	RO Permeate	50
14	RO Permeate from Calcite Filters	50
15	Water to Distribution Pumps	50
16	RO Reject Thru ERU	75
17	RO Feed Thru ERU	68.8
18	RO Reject to Disposal	75
19	Waste from UF Reject Tank	13.9
20	Combined Wastes to Rapid Mixer	25.7
21	Combined Wastes to Thickener	25.7
22	Thickener Decant to Outfall Tank	12.9
23	Thickener Slurry to Filter Presses	12.9
24	Filter Press Filtrate to Outfall Tank	7.7
25	Filter Cake Solids to Landfill	5.1
26	Outfall to Disposal	20.6

Table 2: 50 MGD Desalination Facility Design Basis Source Water and Effluent Constituent Concentrations

Parameter	Units	Source Water Quality Design Basis[1]	40% Recovery Outfall 001 Effluent[2]	50% Recovery Outfall 001 Effluent[3]
Flow	MGD	150.7	95.6	83.1
Sodium (Na)	mg/L	9,597	14,500	16,700
Calcium (Ca)	mg/L	360	546	627
Magnesium (Mg)	mg/L	1,093	1,660	1,900
Potassium (K)	mg/L	328	497	571
Barium (Ba)	mg/L	21	32	37
Strontium (Sr)	mg/L			
Iron (Fe)	mg/L	ND	ND	ND
Alkalinity (as $CaCO_3$)	mg/L	120	180	207
Chloride (Cl)	mg/L	16,500	25,000	28,700
Sulfate (SO_4)	mg/L	2,350	3,560	4,090
Nitrate (NO_3)	mg/L	ND	ND	ND
Floride (F)	mg/L	ND	ND	ND
Silicon Dioxide (SiO_2)	mg/L			
Boron (B)	mg/L	3.7	5.6	6.4
Total Dissolved Solids	mg/L	33,700	51,100	58,700
pH	S.U.	8.02 - 8.20	7.5 - 8.5	7.5 - 8.5
Temperature	ºC	27.21 - 27.92	14 - 32	14 - 32
Total Organic Carbon	mg/L	2.0	ND	ND
Total Suspended Solids	mg/L	7.4	10	15

Note:
1. The source water quality design basis data are from intake area Gulf of Mexico sampling.
2. Constituent values based on 40% RO permeate recovery.
3. Constituent values based on 50% RO permeate recovery and the production of 62.5 MGD permeate.

N
W
E
S

Diffuser

Discharge Route

500 250 0 500 Feet

Figure 2

Approximate Diffuser Location

Port of Corpus Christi
Proposed Desalination Plant
Harbor Island Site, Port Aransas, Texas

PARSONS

Appendix A

Discharge Mixing Analysis

Tischler/Kocurek
Environmental Engineers

Memo

To: Sarah Garza, Port of Corpus Christi Authority

From: Lial Tischler, P.E., B.C.E.E.

C: Earnest Wotring, John Muir, Esqs; Baker Wotring, LLP

Date: June 24, 2021

Re: Harbor Island Desalination Plant – Effluent Diffuser Conceptual Design

---

This memorandum report presents the conceptual design of the high-rate diffuser that will discharge effluent from the proposed Harbor Island Desalination Plant that will be constructed by the Port of Corpus Christi Authority (PCCA). The report provides the necessary design and operation data that is required by the Texas Commission on Environmental Quality (TCEQ) to support the issuance of a TPDES discharge permit for the desalination plant.

This report provides the data and information for the diffuser that is identified in TCEQ's June 4, 2021 letter to Earnest Wotring[1] and is submitted as an attachment to the revised TPDES application cited in the letter.

Diffuser Location

The diffuser will be located on the north bank of the Corpus Christi Channel (Corpus Christi Bay, Segment 2481) approximately 300-350 meters (m) west of the confluence with the Lydia Ann Channel. This is the same geographical area as proposed in the original TPDES permit location. However, as described below, the distance of the diffuser from the North shoreline will be different than the 91.5 m (300 ft) specified in the previous design. This location is shown on Figure 1. Figure 1 also shows the bathymetry of the channel at, upstream, and downstream of the diffuser location using the data collected by Parsons Corporation in June 2021.

Diffuser Specifications

The diffuser barrel will be approximately parallel to the shoreline and will be located on the sloping north bank of the channel. The actual depth of the barrel below the water

---

[1] Kathy Humphreys, Staff Attorney, TCEQ

107 South Mays
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512.244.9058
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surface will be determined in the final design based on construction requirements and the side slope of the channel. The specific diffuser design conditions are provided in Table 1.

Table 1. Diffuser Specifications

Diffuser Specification	Value
Number of ports	20
Distance between risers	1.5 m
Distance between ports (one/riser)	1.5 m
Diffuser barrel length	30 m
Port diameter	0.18 m
Port angle to channel flow (flow outward to Gulf)	270°
Port angle to horizontal (water surface)	30°
Port height above bottom	7.9 m at MLT*
Depth of channel at location of discharge	27.4 m at MLT
Side slope of channel at discharge location (y/x)	~0.45

*Mean low tide

The diffuser will be located on the north slope of the eddy-generated "hole" in the channel. The channel depth at the point of discharge of 27.4 m (90 ft) is based on the bathymetry of the site as confirmed by the June 2021 study. The average depth of the water body in the 0.5-mile segments on either side of the discharge outside of the "hole" is approximately 18.3 m (60 feet).[2]

The ports will be affixed to risers that extend above the diffuser barrel to the design height above the bottom (Table 1). The ports will be attached to the risers with bolted flanges so that they can be blocked with a blind flange or can be changed to a different port diameter. If the initial implementation phase of the desalination plant results in an effluent flow significantly (e.g., >10%) below the design flow used in this design, the exit velocity will be increased by either blocking ports or by installing smaller diameter ports. For example, if the initial desalination plant is constructed at a capacity that is one-half the design capacity that is the basis of this diffuser design, 10 of the ports on the diffuser will be blocked and the critical effluent dilution will be the same as that for the final design capacity of the plant. Alternatively, the 20 risers can be fitted with ports with a diameter that will achieve the same exit velocity as used in this diffuser design (~8.2 m/s at the maximum monthly average discharge rate).

Effluent Characteristics

The intake for the PCCA desalination plant will be located in the Gulf of Mexico (GOM). Data from TCEQ's Surface Water Quality Monitoring (SWQM) station 13468 (GOM at Aransas Pass) are used to characterize the desalination plant effluent for the purposes of diffuser design and water quality impact analysis. These data were provided by Parsons Corporation.

[2] Because of CORMIX input limitations the average channel depth used in the model is 22 m (72.2 feet)

The desalination plant water balance provided in Table 1 of the AMEC Foster Wheeler *Process Design Basis and Narrative, Port of Corpus Christi Industrial Seawater Desalination, Harbor Island* (December 2017)(AMEC)[3] is used to calculate the effluent temperature, salinity, and density for the range of effluent conditions shown in Table 2. These conditions were provided by Parsons Corporation. The design effluent flow rate is 4.188 m^3/s (95.6 MGD) as a maximum monthly (30-day) average, based on the water balance in the AMEC report.

Table 2. Effluent Characteristics

Season	RO Recovery (percent)	Percentile	Salinity (ppt)	Temperature (°C)	Density (kg/m^3)
Summer	50	T5, S5	53.9	26.55	1037.01
Summer	50	T5, S95	68.7	26.55	1048.15
Summer	50	T95, S5	53.9	30.71	1035.43
Summer	50	T95, S95	68.7	30.71	1046.44
Winter	50	T5, S5	41.2	11.11	1031.62
Winter	50	T5, S95	59.4	11.11	1045.79
Winter	50	T95, S5	41.2	18.33	1030.00
Winter	50	T95, S95	59.4	18.33	1043.91
Summer	40	T5, S5	46.8	26.55	1031.74
Summer	40	T5, S95	59.7	26.55	1041.42
Summer	40	T95, S5	46.8	30.71	1030.22
Summer	40	T95, S95	59.7	30.71	1039.79
Winter	40	T5, S5	35.9	11.11	1027.41
Winter	40	T5, S95	51.6	11.11	1039.73
Winter	40	T95, S5	35.9	18.33	1025.87
Winter	40	T95, S95	51.6	18.33	1037.96

*Density used for diffuser design is shaded

Receiving Water Characteristics

PCCA is conducting a field study to verify the bathymetry and current characteristics at the proposed location of the diffuser as requested in the TCEQ June 4, 2021 letter. Because of the timing of the required submittal of the revisions to the TPDES application (based on the Commission Order) and the fact that the current data will be collected over a relatively short time period (approximately one week), the currents used to model the proposed diffuser design with CORMIX are a range of 0.05 m/s to 1.2 m/s based on the long-term record from the University of Texas Marine Science Institute current meter located in Port Aransas and data obtained from the Texas Water Development Board for a Corpus Christi Bay Inflow Survey conducted on May 5-7, 2000. The field data collected at the diffuser site in June 2021 by Parsons Corporation document that this range of velocities is representative of the diffuser site. However, it is important to recognize that the maximum and minimum currents in a tidally driven environment are transient conditions that persist only for a matter of minutes and the 24-hour average current is the best measure of diffuser performance in terms of the 24-hour average

[3] TPDES Permit Application (December 2019), Technical Report, Attachment 8

dilution that is achieved. The 50th percentile current in the Port Aransas database is 0.8 m/s and the dilution at this current approximates the 24-hour average dilution.

The lower end of the range modelled, 0.05 m/s, represents near slack-tide conditions and is used rather than a value of zero (0) current because of CORMIX computational limitations. Again, this a transient condition that occurs typically less than 10-15 minutes per tidal cycle.

The ambient salinity, temperature, and density data used to calculate the achievable effluent dilution with the diffuser are based on data from SWQM Station 16492 (Aransas Bay in Lydia Ann Channel). These conditions are shown in Table 3.

Table 3. Receiving Water Characteristics

Season	Percentile	Salinity (ppt)	Temperature (°C)	Density* (kg/m^3)
Summer	T5, S5	29.93	27.61	1018.75
Summer	T5, S95	40.57	27.61	1026.70
Summer	T95, S5	29.93	30.56	1017.76
Summer	T95, S95	40.57	30.56	1025.64
Winter	T5, S5	23.24	10.76	1017.83
Winter	T5, S95	33.20	10.76	1025.40
Winter	T95, S5	23.24	17.53	1016.39
Winter	T95, S95	33.20	17.53	1024.03

*Density used for diffuser design is shaded

Diffuser Performance

The effluent dilutions and predicted salinities in the Corpus Christi Channel were simulated with the CORMIX2 module of CORMIX Version 11.0GT.[4]

Two summer and two winter combinations of effluent and ambient densities that represent the greatest density differences effluent/ambient density conditions were modelled for the proposed diffuser design. These density differences represent the greatest differences between the effluent salinity and ambient salinity and result decreased mixing of effluent and ambient water at the boundaries of the effluent plume.

Table 4 presents the results of the diffuser performance modelling.

TCEQ has a consistent policy for establishing mixing zones for high-rate diffusers.[5] TCEQ designates three categories of mixing zone; (1) the zone of initial dilution (ZID), which is the aquatic life acute mixing zone; (2) the aquatic life chronic mixing zone that is identified as the mixing zone (MZ); and (3) the human health mixing zone (HHMZ).[6] The mixing zone policy is intended to address the specific language at 30 TAC 307.8(b), which defines the size of the ZID. The regulatory language specifies the size of the ZID

[4] The brine module of CORMIX was evaluated for this application but the brine module limitations on the slope of the near shore bank did not permit its application to this location and diffuser design because the side slope of the channel is too steep.
[5] TCEQ, June 2010. *Procedures to Implement the Texas Surface Water Quality Standards*, RG-194, p. 82.
[6] Ibid, pp. 70-82.

and indicates that for diffusers, the ZID will have an area or volume equivalent to the size specified in the regulation.

The zone of initial dilution (ZID) and the aquatic life and human health mixing zones for a multi-port diffuser are based on an equivalent rectangular area and associated volume representing the following lateral dimensions: ZID = 50-foot radius (15.2 meters); mixing zone = 200-foot radius (60.9 m); and human health mixing zone = 400-foot radius (121.9 m). The mixing zones extend from the water surface to the bottom of the receiving water. Applying the TCEQ mixing zone policy described above, the ZID and mixing zone dimensions for the multi-port diffuser design are as follows:

- ZID: x = 56.1 m (measured perpendicular to the direction the ports point and centered at the center of the diffuser barrel); y = 13 m (centered on and measured toward the center of the channel along the length of the diffuser barrel).
- Aquatic life MZ: x = 168.6 m; y = 69.3 m using the same coordinates as the ZID.
- HHMZ: x = 145.5 m; y = 321 m using the same coordinates as the ZID.

These mixing zones are used by TCEQ for evaluation of compliance with the Texas Surface Water Quality Standards (SWQS) for the toxic constituents identified in Tables 1 and 2 of 30 Texas Administrative Code (TAC) 307.6. They are also used to determine the critical effluent dilutions used in whole effluent toxicity (WET) tests of the effluent.

These mixing zone definitions are **not** applicable to assessing the naturally occurring, inorganic chemical constituents that constitute salinity in marine waters and, in this case, the salinity of the desalination plant effluent. Therefore, the TCEQ ZID and mixing zone dimensions are used in this analysis to evaluate the effectiveness of the diffuser in achieving mixing and dilution of the plant effluent with the receiving water in the Corpus Christi Channel at the specified distances from the diffuser.

Critical Conditions

The critical conditions represent the least efficient mixing of the effluent with the ambient water and the resulting highest effluent concentrations at the plume boundaries. As shown in Table 3, the critical conditions at the ZID, mixing zone, and HHMZ in terms of the percent effluent at the edge of these zones occur at ambient currents ≥ 0.4 m/s for both the 40% recovery and 50% recovery desalination plant designs. These critical dilutions are:

- ZID – 10.7% effluent
- MZ – 4.9% effluent
- HHMZ – 3.4% effluent

The percent effluent dilution at the ZID, MZ and HHMZ are essentially identical at all ambient currents > 0.4 m/s. Therefore, the 24-hour average dilution achieved by the diffuser (at 0.8 m/s) is equivalent to the critical dilutions shown above.

Two of the CORMIX model prediction files for the critical conditions are included in the Appendix to this report as examples. These are selected because they predict the greatest

percent difference between ambient and plume salinity at the ZID. These are the model runs designated as pcca_new_es_50_5_95(1.0) and pcca_new_ew_50_5_95(1.0). The effluent salinities are for the 50% recovery desalination efficiency, the ambient current is 1.0 m/s, the ambient temperature is the 5th percentile, and the ambient salinity is the 95th percentile, for both summer and winter conditions. All of the CORMIX prediction files will be provided on request.

Tischler/Kocurek
107 South Mays
Round Rock, Texas 78664
512.244.9058
512.388.3409 FAX

Table 4. Diffuser Performance

Run No.	Season	RO Recovery (%)
pcca_new_ es_40_5_95(0.0	Summer	40
pcca_new_ es_40_5_95(0.4	Summer	40
pcca_new_ es_40_5_95(1.0	Summer	40
pcca_new_ es_40_5_95(1.2	Summer	40
pcca_new_ew_40_95_5(0.0	Winter	40
pcca)new_ew_40_95_5(0.5	Winter	40
pcca_new_ew_40_95_5(1.0	Winter	40
pcca_new_es_50_5_95(0.05	Summer	50
pcca_new_es_50_5_95(0.4)	Summer	50
pcca_new_es_50_5_95(0.8)	Summer	50
pcca_new_es_50_5_95(1.0)	Summer	50
pcca_new_es_50_5_95(1.2)	Summer	50
pcca_new_ew_50_95_5(0.0	Winter	50
pcca_new_ew_50_95_5(0.5	Winter	50
pcca_new_ew_50_95_5(1.0	Winter	50

Run No.	Ambient Density	Ambient Salinity (ppt)	Effluent Density	Effluent Salinity (ppt)	Ambient Velocity (m/s)	ZID (x,y)	ZID (% Effluent)	ΔSalinity (ppt)	Salinity % Above Ambient	MZ (x,y)	MZ (% Effluent)	ΔSalinity (ppt)	Salinity % Above Ambient	HHMZ (x,y)	HHMZ (% Effluent)	ΔSalinity (ppt)	Salinity % Above Ambient
pcca_new_ es_40_5_95(0.05)	1026.7	40.57	1041.42	59.7	0.05	y	4.6	0.88	2.2	y	3.3	0.63	1.6	y	2.6	0.50	1.2
pcca_new_ es_40_5_95(0.4)	1026.7	40.57	1041.42	59.7	0.4	x	10.7	2.05	5.0	x	4.7	0.90	2.2	x	3.3	0.63	1.6
pcca_new_ es_40_5_95(1.0)	1026.7	40.57	1041.42	59.7	1	x	10.7	2.05	5.0	x	4.6	0.88	2.2	x	3.1	0.59	1.5
pcca_new_ es_40_5_95(1.2)	1026.7	40.57	1041.42	59.7	1.2	x	10.7	2.05	5.0	x	4.7	0.90	2.2	x	3.2	0.61	1.5
pcca_new_ew_40_95_5(0.05)	1016.39	23.24	1025.87	35.9	0.05	y	4.6	0.58	2.5	y	3.3	0.42	1.8	y	2.6	0.33	1.4
pcca)new_ew_40_95_5(0.5)	1016.39	23.24	1025.87	35.9	0.5	x	10.7	1.35	5.8	x	4.9	0.62	2.7	x	3.4	0.43	1.9
pcca_new_ew_40_95_5(1.0)	1016.39	23.24	1025.87	35.9	1	x	10.7	1.35	5.8	x	4.7	0.60	2.6	x	3.3	0.42	1.8
pcca_new_es_50_5_95(0.05)	1026.7	40.57	1048.15	68.7	0.05	y	4.6	1.29	3.2	y	3.3	0.93	2.3	y	2.6	0.73	1.8
pcca_new_es_50_5_95(0.4)	1026.7	40.57	1048.15	68.7	0.4	x	10.7	3.01	7.4	x	4.6	1.29	3.2	x	3.2	0.90	2.2
pcca_new_es_50_5_95(0.8)	1026.7	40.57	1048.15	68.7	0.8	x	10.7	3.01	7.4	x	4.6	1.29	3.2	x	3.1	0.87	2.1
pcca_new_es_50_5_95(1.0)	1026.7	40.57	1048.15	68.7	1	x	10.7	3.01	7.4	x	4.6	1.29	3.2	x	3.1	0.87	2.1
pcca_new_es_50_5_95(1.2)	1026.7	40.57	1048.15	68.7	1.2	x	10.7	3.01	7.4	x	4.6	1.29	3.2	x	3.1	0.87	2.1
pcca_new_ew_50_95_5(0.05)	1016.39	23.24	1030	41.2	0.05	y	4.6	0.83	3.6	y	3.3	0.59	2.6	y	2.6	0.47	2.0
pcca_new_ew_50_95_5(0.5)	1016.39	23.24	1030	41.2	0.5	x	10.7	1.92	8.3	x	4.7	0.84	3.6	x	3.3	0.59	2.6
pcca_new_ew_50_95_5(1.0)	1016.39	23.24	1030	41.2	1	x	10.7	1.92	8.3	x	4.7	0.84	3.6	x	3.2	0.57	2.5

	ZID (m) (x,y)	MZ (m) (x,y)	HHMZ (m) (x,y)
20-Port Diffuser			
30-m Length	56, 13	168.6, 69.3	321, 145.5

Percent effluent values for ZID, MZ and HHMZ are taken from closest distance value in the CORMIX output - they are not extrapoloted betweeen distances.

107 South Mays
Round Rock, Texas 78664
512.244.9058
512.388.3409 FAX

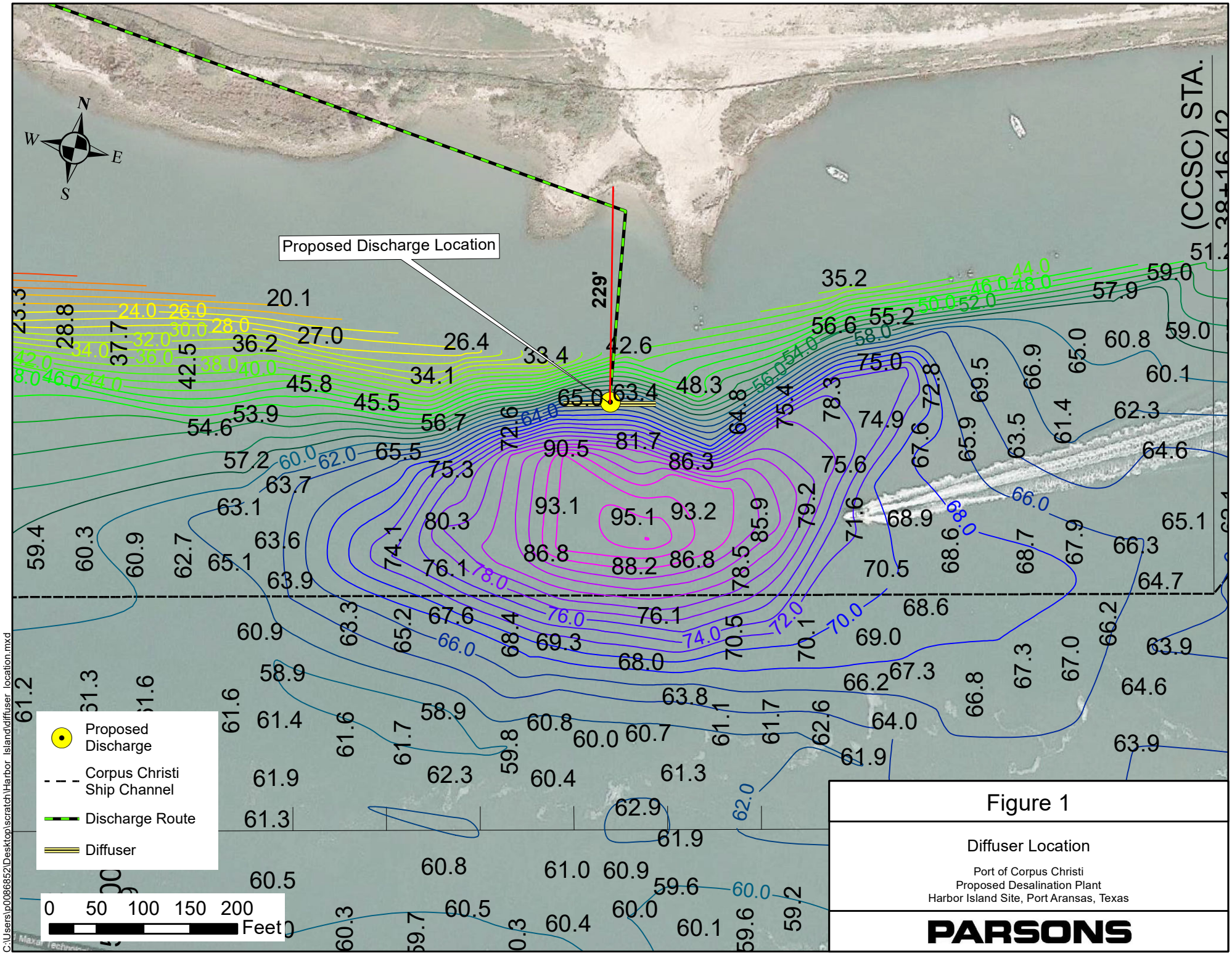

Figure 1

Diffuser Location

Port of Corpus Christi
Proposed Desalination Plant
Harbor Island Site, Port Aransas, Texas

PARSONS

C:\Users\p0086852\Desktop\scratch\Harbor_Island\diffuser_location.mxd

Appendix

Example CORMIX Prediction Files – Critical Conditions

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```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                               CORMIX Version 11.0GTD
                      HYDRO2 Version 11.0.1.0 August 2019
-----------------------------------------------------------------------------------------------
-----------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   PCCA Harbor Island
 Design case:       pcca_es50_5_95(1.0)
 FILE NAME:         C:\Projects\pcca 2021\pcca_new_es50_5_95(1.0).prd
 Time stamp:        06/23/2021--11:54:32

ENVIRONMENT PARAMETERS (metric units)
 Unbounded section
 HA    =     22.00  HD    =     27.40
 UA    =      1.000 F     =      0.009 USTAR =0.3425E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM = 1026.7000

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_parallel
 BANK  =  LEFT      DISTB =     69.80  YB1   =     69.80  YB2   =     69.80
 LD    =     30.00  NOPEN =   20       NRISER=   20       SPAC  =      1.58    NPPERR =    1
 D0    =      0.180 A0    =      0.025 H0    =      7.90  SUB0  =     19.50
 D0INP =      0.180 CR0   =      1.000 B0    =0.1612E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =      0.00  THETA =     30.00  SIGMA =    270.00  BETA  =     90.00
 U0    =      8.229 Q0    =      4.188 Q0A   =0.4188E+01
 RHO0  = 1048.1500  DRHO0 =-.2145E+02  GP0   =-.2049E+00
 C0    =0.1000E+03  CUNITS=  %
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1396E+00         SIGNJ0=     -1.0
 m0 =U0^2*B0 =0.1091E+01   j0 =U0*GP0*B0 =-.2717E-01   (based on slot width B0)
 m0 =U0*q0   =0.1149E+01   j0 =q0*GP0    =-.2860E-01   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.017 lM    =     12.04  lm    =      1.15
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.4188E+01  M0    =0.3274E+02  J0    =-.8151E+00
 Associated 3-d length scales (meters)
 LQ    =      0.16  LM    =     15.16  Lm    =      5.87  Lb    =      0.86
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =    143.20  FRD0  =     42.85  R     =      8.23  PL    =  140.00
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      8.229 D0    =      0.180 A0    =      0.025 THETA =     30.00
 FR0   =    143.20  FRD0  =     42.85  R     =      8.23
```

Tischler/Kocurek
107 South Mays
Round Rock, Texas 78664
512.244.9058
512.388.3409 FAX

```
 (slot)             (riser group)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MNU9         2
 2  Applicable layer depth HS =    27.40        2
 2222222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.1000E+03  CUNITS=  %
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1500.00  XMAX  =   1500.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        69.80 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 100 display intervals per module
-----------------------------------------------------------------------------------------------
-----------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    7.90     1.0 0.100E+03   0.01    15.00     8.229   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-----------------------------------------------------------------------------------------------
-----------------------------------------------------------------------------------------------
BEGIN MOD273: UNIDIRECTIONAL CROSS-FLOWING DIFFUSER (TEE) IN STRONG CURRENT

 Because of the strong ambient current the diffuser plume of this crossflowing
   discharge gets RAPIDLY DEFLECTED.
 A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire
   layer depth.  Full mixing is achieved at a downstream distance of about
   five (5) layer depths.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, measured horizontally in Y-direction
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
      0.00     0.00    7.90     1.0 0.100E+03   0.01    15.00 .00000E+00
```

1.52	-0.01	7.84	2.4	0.422E+02	0.32	14.86	.15200E+01
3.04	-0.01	7.77	2.9	0.341E+02	0.62	14.72	.30400E+01
4.56	-0.02	7.71	3.4	0.297E+02	0.92	14.58	.45600E+01
6.08	-0.03	7.64	3.7	0.267E+02	1.23	14.44	.60800E+01
7.60	-0.03	7.58	4.1	0.246E+02	1.53	14.31	.76000E+01
9.12	-0.04	7.51	4.4	0.230E+02	1.84	14.17	.91200E+01
10.64	-0.04	7.45	4.6	0.216E+02	2.14	14.03	.10640E+02
12.16	-0.05	7.39	4.9	0.205E+02	2.44	13.89	.12160E+02
13.68	-0.06	7.32	5.1	0.196E+02	2.75	13.75	.13680E+02
15.20	-0.06	7.26	5.3	0.188E+02	3.05	13.61	.15200E+02
16.72	-0.07	7.19	5.5	0.180E+02	3.36	13.47	.16720E+02
18.24	-0.08	7.13	5.7	0.174E+02	3.66	13.33	.18240E+02
19.76	-0.08	7.06	5.9	0.168E+02	3.96	13.20	.19760E+02
21.28	-0.09	7.00	6.1	0.163E+02	4.27	13.06	.21280E+02
22.80	-0.09	6.93	6.3	0.159E+02	4.57	12.92	.22800E+02
24.32	-0.10	6.87	6.5	0.154E+02	4.87	12.78	.24320E+02
25.84	-0.11	6.81	6.6	0.150E+02	5.18	12.64	.25840E+02
27.36	-0.11	6.74	6.8	0.147E+02	5.48	12.50	.27360E+02
28.88	-0.12	6.68	7.0	0.144E+02	5.79	12.36	.28880E+02
30.40	-0.13	6.61	7.1	0.140E+02	6.09	12.22	.30400E+02
31.92	-0.13	6.55	7.3	0.137E+02	6.39	12.09	.31920E+02
33.44	-0.14	6.48	7.4	0.135E+02	6.70	11.95	.33440E+02
34.96	-0.14	6.42	7.6	0.132E+02	7.00	11.81	.34960E+02
36.48	-0.15	6.36	7.7	0.130E+02	7.31	11.67	.36480E+02
38.00	-0.16	6.29	7.8	0.127E+02	7.61	11.53	.38000E+02
39.52	-0.16	6.23	8.0	0.125E+02	7.91	11.39	.39520E+02
41.04	-0.17	6.16	8.1	0.123E+02	8.22	11.25	.41040E+02
42.56	-0.18	6.10	8.2	0.121E+02	8.52	11.11	.42560E+02
44.08	-0.18	6.03	8.4	0.119E+02	8.82	10.98	.44080E+02
45.60	-0.19	5.97	8.5	0.118E+02	9.13	10.84	.45600E+02
47.12	-0.19	5.91	8.6	0.116E+02	9.43	10.70	.47120E+02
48.64	-0.20	5.84	8.7	0.114E+02	9.74	10.56	.48640E+02
50.16	-0.21	5.78	8.9	0.113E+02	10.04	10.42	.50160E+02
51.68	-0.21	5.71	9.0	0.111E+02	10.34	10.28	.51680E+02
53.20	-0.22	5.65	9.1	0.110E+02	10.65	10.14	.53200E+02
54.72	-0.23	5.58	9.2	0.109E+02	10.95	10.00	.54720E+02
56.24	-0.23	5.52	9.3	0.107E+02	11.26	9.87	.56240E+02
57.76	-0.24	5.45	9.4	0.106E+02	11.56	9.73	.57760E+02
59.28	-0.25	5.39	9.6	0.105E+02	11.86	9.59	.59280E+02
60.80	-0.25	5.33	9.7	0.104E+02	12.17	9.45	.60800E+02
62.32	-0.26	5.26	9.8	0.102E+02	12.47	9.31	.62320E+02
63.84	-0.26	5.20	9.9	0.101E+02	12.77	9.17	.63840E+02
65.36	-0.27	5.13	10.0	0.100E+02	13.08	9.03	.65360E+02
66.88	-0.28	5.07	10.1	0.992E+01	13.38	8.89	.66880E+02
68.40	-0.28	5.00	10.2	0.982E+01	13.69	8.76	.68400E+02
69.92	-0.29	4.94	10.3	0.972E+01	13.99	8.62	.69920E+02
71.44	-0.30	4.88	10.4	0.963E+01	14.29	8.48	.71440E+02
72.96	-0.30	4.81	10.5	0.954E+01	14.60	8.34	.72960E+02
74.48	-0.31	4.75	10.6	0.945E+01	14.90	8.20	.74480E+02
76.00	-0.31	4.68	10.7	0.936E+01	15.21	8.06	.76000E+02
77.52	-0.32	4.62	10.8	0.928E+01	15.51	7.92	.77520E+02
79.04	-0.33	4.55	10.9	0.920E+01	15.81	7.78	.79040E+02
80.56	-0.33	4.49	11.0	0.912E+01	16.12	7.65	.80560E+02
82.08	-0.34	4.43	11.1	0.904E+01	16.42	7.51	.82080E+02
83.60	-0.35	4.36	11.2	0.897E+01	16.73	7.37	.83600E+02
85.12	-0.35	4.30	11.2	0.889E+01	17.03	7.23	.85120E+02
86.64	-0.36	4.23	11.3	0.882E+01	17.33	7.09	.86640E+02

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88.16	-0.36	4.17	11.4	0.875E+01	17.64	6.95	.88160E+02
89.68	-0.37	4.10	11.5	0.868E+01	17.94	6.81	.89680E+02
91.20	-0.38	4.04	11.6	0.862E+01	18.24	6.67	.91200E+02
92.72	-0.38	3.97	11.7	0.855E+01	18.55	6.53	.92720E+02
94.24	-0.39	3.91	11.8	0.849E+01	18.85	6.40	.94240E+02
95.76	-0.40	3.85	11.9	0.843E+01	19.16	6.26	.95760E+02
97.28	-0.40	3.78	12.0	0.837E+01	19.46	6.12	.97280E+02
98.80	-0.41	3.72	12.0	0.831E+01	19.76	5.98	.98800E+02
100.32	-0.42	3.65	12.1	0.825E+01	20.07	5.84	.10032E+03
101.84	-0.42	3.59	12.2	0.819E+01	20.37	5.70	.10184E+03
103.36	-0.43	3.52	12.3	0.814E+01	20.68	5.56	.10336E+03
104.88	-0.43	3.46	12.4	0.808E+01	20.98	5.42	.10488E+03
106.40	-0.44	3.40	12.5	0.803E+01	21.28	5.29	.10640E+03
107.92	-0.45	3.33	12.5	0.798E+01	21.59	5.15	.10792E+03
109.44	-0.45	3.27	12.6	0.793E+01	21.89	5.01	.10944E+03
110.96	-0.46	3.20	12.7	0.787E+01	22.19	4.87	.11096E+03
112.48	-0.47	3.14	12.8	0.783E+01	22.50	4.73	.11248E+03
114.00	-0.47	3.07	12.9	0.778E+01	22.80	4.59	.11400E+03
115.52	-0.48	3.01	12.9	0.773E+01	23.11	4.45	.11552E+03
117.04	-0.48	2.95	13.0	0.768E+01	23.41	4.31	.11704E+03
118.56	-0.49	2.88	13.1	0.764E+01	23.71	4.18	.11856E+03
120.08	-0.50	2.82	13.2	0.759E+01	24.02	4.04	.12008E+03
121.60	-0.50	2.75	13.2	0.755E+01	24.32	3.90	.12160E+03
123.12	-0.51	2.69	13.3	0.751E+01	24.63	3.76	.12312E+03
124.64	-0.52	2.62	13.4	0.746E+01	24.93	3.62	.12464E+03
126.16	-0.52	2.56	13.5	0.742E+01	25.23	3.48	.12616E+03
127.68	-0.53	2.49	13.5	0.738E+01	25.54	3.34	.12768E+03
129.20	-0.53	2.43	13.6	0.734E+01	25.84	3.20	.12920E+03
130.72	-0.54	2.37	13.7	0.730E+01	26.14	3.07	.13072E+03
132.24	-0.55	2.30	13.8	0.726E+01	26.45	2.93	.13224E+03
133.76	-0.55	2.24	13.8	0.722E+01	26.75	2.79	.13376E+03
135.28	-0.56	2.17	13.9	0.719E+01	27.06	2.65	.13528E+03
136.80	-0.57	2.11	14.0	0.715E+01	27.36	2.51	.13680E+03
138.32	-0.57	2.04	14.1	0.711E+01	27.40	2.37	.13832E+03
139.84	-0.58	1.98	14.1	0.708E+01	27.40	2.23	.13984E+03
141.36	-0.58	1.92	14.2	0.704E+01	27.40	2.09	.14136E+03
142.88	-0.59	1.85	14.3	0.701E+01	27.40	1.96	.14288E+03
144.40	-0.60	1.79	14.3	0.697E+01	27.40	1.82	.14440E+03
145.92	-0.60	1.72	14.4	0.694E+01	27.40	1.68	.14592E+03
147.44	-0.61	1.66	14.5	0.690E+01	27.40	1.54	.14744E+03
148.96	-0.62	1.59	14.6	0.687E+01	27.40	1.40	.14896E+03
150.48	-0.62	1.53	14.6	0.684E+01	27.40	1.26	.15048E+03
152.00	-0.63	1.46	14.7	0.681E+01	27.40	1.12	.15200E+03

```
 Cumulative travel time =         152.0000 sec  (    0.04 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD273: UNIDIRECTIONAL CROSS-FLOWING DIFFUSER (TEE) IN STRONG CURRENT
-------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **
-------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
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ZL = lower plume boundary (Z-coordinate)

S = hydrodynamic average (bulk) dilution

C = average (bulk) concentration (includes reaction effects, if any)

TT = Cumulative travel time

Plume Stage 1 (not bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL	TT
152.00	-0.63	0.00	14.7	0.681E+01	27.40	1.12	27.40	0.00	.15200E+03
161.09	-0.63	0.00	20.0	0.501E+01	10.91	3.83	10.91	0.00	.16109E+03
170.18	-0.63	0.00	22.1	0.452E+01	8.05	5.75	8.05	0.00	.17018E+03
179.27	-0.63	0.00	23.5	0.425E+01	6.67	7.39	6.67	0.00	.17927E+03
188.36	-0.63	0.00	24.6	0.406E+01	5.82	8.86	5.82	0.00	.18836E+03
197.45	-0.63	0.00	25.5	0.391E+01	5.23	10.22	5.23	0.00	.19745E+03
206.54	-0.63	0.00	26.3	0.380E+01	4.80	11.49	4.80	0.00	.20654E+03
215.63	-0.63	0.00	27.0	0.371E+01	4.45	12.69	4.45	0.00	.21563E+03
224.72	-0.63	0.00	27.6	0.362E+01	4.18	13.83	4.18	0.00	.22472E+03
233.81	-0.63	0.00	28.1	0.355E+01	3.95	14.93	3.95	0.00	.23381E+03
242.90	-0.63	0.00	28.7	0.349E+01	3.75	15.98	3.75	0.00	.24290E+03
251.99	-0.63	0.00	29.1	0.343E+01	3.59	17.01	3.59	0.00	.25199E+03
261.08	-0.63	0.00	29.6	0.338E+01	3.44	18.00	3.44	0.00	.26108E+03
270.17	-0.63	0.00	30.0	0.333E+01	3.31	18.96	3.31	0.00	.27017E+03
279.26	-0.63	0.00	30.4	0.329E+01	3.20	19.89	3.20	0.00	.27926E+03
288.35	-0.63	0.00	30.8	0.325E+01	3.10	20.81	3.10	0.00	.28835E+03
297.44	-0.63	0.00	31.1	0.321E+01	3.01	21.70	3.01	0.00	.29744E+03
306.53	-0.63	0.00	31.5	0.317E+01	2.92	22.57	2.92	0.00	.30653E+03
315.62	-0.63	0.00	31.8	0.314E+01	2.85	23.43	2.85	0.00	.31562E+03
324.72	-0.63	0.00	32.2	0.311E+01	2.78	24.26	2.78	0.00	.32472E+03
333.81	-0.63	0.00	32.5	0.308E+01	2.71	25.09	2.71	0.00	.33381E+03
342.90	-0.63	0.00	32.8	0.305E+01	2.65	25.89	2.65	0.00	.34290E+03
351.99	-0.63	0.00	33.1	0.302E+01	2.60	26.69	2.60	0.00	.35199E+03
361.08	-0.63	0.00	33.4	0.299E+01	2.55	27.47	2.55	0.00	.36108E+03
370.17	-0.63	0.00	33.8	0.296E+01	2.50	28.24	2.50	0.00	.37017E+03
379.26	-0.63	0.00	34.1	0.294E+01	2.46	29.00	2.46	0.00	.37926E+03
388.35	-0.63	0.00	34.4	0.291E+01	2.42	29.74	2.42	0.00	.38835E+03
397.44	-0.63	0.00	34.6	0.289E+01	2.38	30.48	2.38	0.00	.39744E+03
406.53	-0.63	0.00	34.9	0.286E+01	2.35	31.20	2.35	0.00	.40653E+03
415.62	-0.63	0.00	35.2	0.284E+01	2.31	31.92	2.31	0.00	.41562E+03
424.71	-0.63	0.00	35.5	0.281E+01	2.28	32.63	2.28	0.00	.42471E+03
433.80	-0.63	0.00	35.8	0.279E+01	2.25	33.33	2.25	0.00	.43380E+03
442.89	-0.63	0.00	36.1	0.277E+01	2.22	34.02	2.22	0.00	.44289E+03
451.98	-0.63	0.00	36.4	0.275E+01	2.20	34.70	2.20	0.00	.45198E+03
461.07	-0.63	0.00	36.7	0.273E+01	2.17	35.37	2.17	0.00	.46107E+03
470.16	-0.63	0.00	37.0	0.270E+01	2.15	36.04	2.15	0.00	.47016E+03
479.25	-0.63	0.00	37.3	0.268E+01	2.13	36.70	2.13	0.00	.47925E+03
488.34	-0.63	0.00	37.6	0.266E+01	2.11	37.36	2.11	0.00	.48834E+03
497.43	-0.63	0.00	37.9	0.264E+01	2.09	38.00	2.09	0.00	.49743E+03
506.52	-0.63	0.00	38.2	0.262E+01	2.07	38.64	2.07	0.00	.50652E+03
515.61	-0.63	0.00	38.5	0.260E+01	2.05	39.28	2.05	0.00	.51561E+03
524.70	-0.63	0.00	38.8	0.258E+01	2.03	39.90	2.03	0.00	.52470E+03
533.79	-0.63	0.00	39.1	0.256E+01	2.02	40.53	2.02	0.00	.53379E+03
542.88	-0.63	0.00	39.4	0.254E+01	2.00	41.14	2.00	0.00	.54288E+03
551.97	-0.63	0.00	39.7	0.252E+01	1.99	41.76	1.99	0.00	.55197E+03
561.06	-0.63	0.00	40.0	0.250E+01	1.98	42.36	1.98	0.00	.56106E+03
570.15	-0.63	0.00	40.3	0.248E+01	1.96	42.96	1.96	0.00	.57015E+03
579.24	-0.63	0.00	40.6	0.246E+01	1.95	43.56	1.95	0.00	.57924E+03
588.33	-0.63	0.00	40.9	0.244E+01	1.94	44.15	1.94	0.00	.58833E+03
597.42	-0.63	0.00	41.3	0.242E+01	1.93	44.74	1.93	0.00	.59742E+03

606.51	-0.63	0.00	41.6	0.240E+01	1.92	45.32	1.92	0.00	.60651E+03
615.60	-0.63	0.00	41.9	0.239E+01	1.91	45.90	1.91	0.00	.61560E+03
624.69	-0.63	0.00	42.2	0.237E+01	1.90	46.47	1.90	0.00	.62469E+03
633.78	-0.63	0.00	42.6	0.235E+01	1.90	47.04	1.90	0.00	.63378E+03
642.87	-0.63	0.00	42.9	0.233E+01	1.89	47.60	1.89	0.00	.64287E+03
651.97	-0.63	0.00	43.3	0.231E+01	1.88	48.17	1.88	0.00	.65197E+03
661.06	-0.63	0.00	43.6	0.229E+01	1.87	48.72	1.87	0.00	.66106E+03
670.15	-0.63	0.00	43.9	0.228E+01	1.87	49.28	1.87	0.00	.67015E+03
679.24	-0.63	0.00	44.3	0.226E+01	1.86	49.83	1.86	0.00	.67924E+03
688.33	-0.63	0.00	44.7	0.224E+01	1.86	50.37	1.86	0.00	.68833E+03
697.42	-0.63	0.00	45.0	0.222E+01	1.85	50.91	1.85	0.00	.69742E+03
706.51	-0.63	0.00	45.4	0.220E+01	1.85	51.45	1.85	0.00	.70651E+03
715.60	-0.63	0.00	45.8	0.219E+01	1.84	51.99	1.84	0.00	.71560E+03
724.69	-0.63	0.00	46.1	0.217E+01	1.84	52.52	1.84	0.00	.72469E+03
733.78	-0.63	0.00	46.5	0.215E+01	1.84	53.05	1.84	0.00	.73378E+03
742.87	-0.63	0.00	46.9	0.213E+01	1.83	53.58	1.83	0.00	.74287E+03
751.96	-0.63	0.00	47.3	0.212E+01	1.83	54.10	1.83	0.00	.75196E+03
761.05	-0.63	0.00	47.7	0.210E+01	1.83	54.62	1.83	0.00	.76105E+03
770.14	-0.63	0.00	48.1	0.208E+01	1.83	55.14	1.83	0.00	.77014E+03
779.23	-0.63	0.00	48.5	0.206E+01	1.82	55.65	1.82	0.00	.77923E+03
788.32	-0.63	0.00	48.9	0.205E+01	1.82	56.16	1.82	0.00	.78832E+03
797.41	-0.63	0.00	49.3	0.203E+01	1.82	56.67	1.82	0.00	.79741E+03
806.50	-0.63	0.00	49.7	0.201E+01	1.82	57.18	1.82	0.00	.80650E+03
815.59	-0.63	0.00	50.1	0.200E+01	1.82	57.68	1.82	0.00	.81559E+03
824.68	-0.63	0.00	50.5	0.198E+01	1.82	58.18	1.82	0.00	.82468E+03
833.77	-0.63	0.00	51.0	0.196E+01	1.82	58.68	1.82	0.00	.83377E+03
842.86	-0.63	0.00	51.4	0.195E+01	1.82	59.17	1.82	0.00	.84286E+03
851.95	-0.63	0.00	51.8	0.193E+01	1.82	59.67	1.82	0.00	.85195E+03
861.04	-0.63	0.00	52.3	0.191E+01	1.82	60.16	1.82	0.00	.86104E+03
870.13	-0.63	0.00	52.7	0.190E+01	1.82	60.65	1.82	0.00	.87013E+03
879.22	-0.63	0.00	53.2	0.188E+01	1.82	61.13	1.82	0.00	.87922E+03
888.31	-0.63	0.00	53.6	0.186E+01	1.82	61.62	1.82	0.00	.88831E+03
897.40	-0.63	0.00	54.1	0.185E+01	1.82	62.10	1.82	0.00	.89740E+03
906.49	-0.63	0.00	54.6	0.183E+01	1.83	62.58	1.83	0.00	.90649E+03
915.58	-0.63	0.00	55.0	0.182E+01	1.83	63.06	1.83	0.00	.91558E+03
924.67	-0.63	0.00	55.5	0.180E+01	1.83	63.53	1.83	0.00	.92467E+03
933.76	-0.63	0.00	56.0	0.179E+01	1.83	64.00	1.83	0.00	.93376E+03
942.85	-0.63	0.00	56.5	0.177E+01	1.83	64.48	1.83	0.00	.94285E+03
951.94	-0.63	0.00	57.0	0.175E+01	1.84	64.95	1.84	0.00	.95194E+03
961.03	-0.63	0.00	57.5	0.174E+01	1.84	65.41	1.84	0.00	.96103E+03
970.12	-0.63	0.00	58.0	0.172E+01	1.84	65.88	1.84	0.00	.97012E+03
979.21	-0.63	0.00	58.5	0.171E+01	1.85	66.34	1.85	0.00	.97921E+03
988.31	-0.63	0.00	59.0	0.169E+01	1.85	66.80	1.85	0.00	.98831E+03
997.40	-0.63	0.00	59.5	0.168E+01	1.85	67.26	1.85	0.00	.99740E+03
1006.49	-0.63	0.00	60.1	0.166E+01	1.86	67.72	1.86	0.00	.10065E+04
1015.58	-0.63	0.00	60.6	0.165E+01	1.86	68.18	1.86	0.00	.10156E+04
1024.67	-0.63	0.00	61.2	0.164E+01	1.87	68.63	1.87	0.00	.10247E+04
1033.76	-0.63	0.00	61.7	0.162E+01	1.87	69.08	1.87	0.00	.10338E+04
1042.85	-0.63	0.00	62.2	0.161E+01	1.87	69.54	1.87	0.00	.10428E+04
1051.94	-0.63	0.00	62.8	0.159E+01	1.88	69.99	1.88	0.00	.10519E+04
1061.03	-0.63	0.00	63.4	0.158E+01	1.88	70.43	1.88	0.00	.10610E+04

Cumulative travel time = 1061.0280 sec (0.29 hrs)

Plume is ATTACHED to LEFT bank/shore.

Plume width is now determined from LEFT bank/shore.

Tischler/Kocurek
107 South Mays
Round Rock, Texas 78664
512.244.9058
512.388.3409 FAX

Plume Stage 2 (bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL	TT
1061.03	69.80	0.00	63.4	0.158E+01	1.88	140.87	1.88	0.00	.10610E+04
1065.42	69.80	0.00	63.6	0.157E+01	1.89	141.05	1.89	0.00	.10654E+04
1069.81	69.80	0.00	63.9	0.157E+01	1.89	141.23	1.89	0.00	.10698E+04
1074.20	69.80	0.00	64.1	0.156E+01	1.90	141.42	1.90	0.00	.10742E+04
1078.59	69.80	0.00	64.4	0.155E+01	1.90	141.60	1.90	0.00	.10786E+04
1082.98	69.80	0.00	64.6	0.155E+01	1.91	141.78	1.91	0.00	.10830E+04
1087.37	69.80	0.00	64.9	0.154E+01	1.91	141.96	1.91	0.00	.10874E+04
1091.76	69.80	0.00	65.1	0.154E+01	1.92	142.15	1.92	0.00	.10918E+04
1096.15	69.80	0.00	65.3	0.153E+01	1.92	142.33	1.92	0.00	.10961E+04
1100.54	69.80	0.00	65.6	0.152E+01	1.93	142.51	1.93	0.00	.11005E+04
1104.93	69.80	0.00	65.9	0.152E+01	1.93	142.69	1.93	0.00	.11049E+04
1109.31	69.80	0.00	66.1	0.151E+01	1.94	142.88	1.94	0.00	.11093E+04
1113.70	69.80	0.00	66.4	0.151E+01	1.94	143.06	1.94	0.00	.11137E+04
1118.09	69.80	0.00	66.6	0.150E+01	1.95	143.24	1.95	0.00	.11181E+04
1122.48	69.80	0.00	66.9	0.150E+01	1.95	143.42	1.95	0.00	.11225E+04
1126.87	69.80	0.00	67.1	0.149E+01	1.96	143.60	1.96	0.00	.11269E+04
1131.26	69.80	0.00	67.4	0.148E+01	1.96	143.79	1.96	0.00	.11313E+04
1135.65	69.80	0.00	67.6	0.148E+01	1.97	143.97	1.97	0.00	.11357E+04
1140.04	69.80	0.00	67.9	0.147E+01	1.97	144.15	1.97	0.00	.11400E+04
1144.43	69.80	0.00	68.1	0.147E+01	1.98	144.33	1.98	0.00	.11444E+04
1148.82	69.80	0.00	68.4	0.146E+01	1.98	144.51	1.98	0.00	.11488E+04
1153.21	69.80	0.00	68.7	0.146E+01	1.99	144.70	1.99	0.00	.11532E+04
1157.60	69.80	0.00	68.9	0.145E+01	1.99	144.88	1.99	0.00	.11576E+04
1161.99	69.80	0.00	69.2	0.145E+01	2.00	145.06	2.00	0.00	.11620E+04
1166.38	69.80	0.00	69.4	0.144E+01	2.00	145.24	2.00	0.00	.11664E+04
1170.77	69.80	0.00	69.7	0.143E+01	2.01	145.42	2.01	0.00	.11708E+04
1175.16	69.80	0.00	70.0	0.143E+01	2.01	145.60	2.01	0.00	.11752E+04
1179.55	69.80	0.00	70.2	0.142E+01	2.02	145.78	2.02	0.00	.11796E+04
1183.94	69.80	0.00	70.5	0.142E+01	2.02	145.97	2.02	0.00	.11839E+04
1188.33	69.80	0.00	70.7	0.141E+01	2.03	146.15	2.03	0.00	.11883E+04
1192.72	69.80	0.00	71.0	0.141E+01	2.03	146.33	2.03	0.00	.11927E+04
1197.11	69.80	0.00	71.3	0.140E+01	2.04	146.51	2.04	0.00	.11971E+04
1201.50	69.80	0.00	71.5	0.140E+01	2.04	146.69	2.04	0.00	.12015E+04
1205.89	69.80	0.00	71.8	0.139E+01	2.05	146.87	2.05	0.00	.12059E+04
1210.28	69.80	0.00	72.1	0.139E+01	2.05	147.05	2.05	0.00	.12103E+04
1214.67	69.80	0.00	72.3	0.138E+01	2.06	147.23	2.06	0.00	.12147E+04
1219.06	69.80	0.00	72.6	0.138E+01	2.06	147.41	2.06	0.00	.12191E+04
1223.45	69.80	0.00	72.9	0.137E+01	2.07	147.59	2.07	0.00	.12234E+04
1227.84	69.80	0.00	73.1	0.137E+01	2.07	147.77	2.07	0.00	.12278E+04
1232.23	69.80	0.00	73.4	0.136E+01	2.08	147.95	2.08	0.00	.12322E+04
1236.62	69.80	0.00	73.7	0.136E+01	2.08	148.13	2.08	0.00	.12366E+04
1241.01	69.80	0.00	74.0	0.135E+01	2.09	148.32	2.09	0.00	.12410E+04
1245.40	69.80	0.00	74.2	0.135E+01	2.09	148.50	2.09	0.00	.12454E+04
1249.79	69.80	0.00	74.5	0.134E+01	2.10	148.68	2.10	0.00	.12498E+04
1254.18	69.80	0.00	74.8	0.134E+01	2.10	148.86	2.10	0.00	.12542E+04
1258.57	69.80	0.00	75.0	0.133E+01	2.11	149.04	2.11	0.00	.12586E+04
1262.96	69.80	0.00	75.3	0.133E+01	2.11	149.22	2.11	0.00	.12630E+04
1267.35	69.80	0.00	75.6	0.132E+01	2.12	149.40	2.12	0.00	.12673E+04
1271.74	69.80	0.00	75.9	0.132E+01	2.12	149.58	2.12	0.00	.12717E+04
1276.13	69.80	0.00	76.1	0.131E+01	2.13	149.76	2.13	0.00	.12761E+04
1280.52	69.80	0.00	76.4	0.131E+01	2.13	149.94	2.13	0.00	.12805E+04
1284.91	69.80	0.00	76.7	0.130E+01	2.14	150.12	2.14	0.00	.12849E+04
1289.30	69.80	0.00	77.0	0.130E+01	2.14	150.30	2.14	0.00	.12893E+04
1293.69	69.80	0.00	77.3	0.129E+01	2.15	150.47	2.15	0.00	.12937E+04
1298.08	69.80	0.00	77.5	0.129E+01	2.16	150.65	2.16	0.00	.12981E+04

1302.46	69.80	0.00	77.8	0.129E+01	2.16	150.83	2.16	0.00	.13025E+04
1306.85	69.80	0.00	78.1	0.128E+01	2.17	151.01	2.17	0.00	.13069E+04
1311.24	69.80	0.00	78.4	0.128E+01	2.17	151.19	2.17	0.00	.13112E+04
1315.63	69.80	0.00	78.7	0.127E+01	2.18	151.37	2.18	0.00	.13156E+04
1320.02	69.80	0.00	78.9	0.127E+01	2.18	151.55	2.18	0.00	.13200E+04
1324.41	69.80	0.00	79.2	0.126E+01	2.19	151.73	2.19	0.00	.13244E+04
1328.80	69.80	0.00	79.5	0.126E+01	2.19	151.91	2.19	0.00	.13288E+04
1333.19	69.80	0.00	79.8	0.125E+01	2.20	152.09	2.20	0.00	.13332E+04
1337.58	69.80	0.00	80.1	0.125E+01	2.20	152.27	2.20	0.00	.13376E+04
1341.97	69.80	0.00	80.4	0.124E+01	2.21	152.45	2.21	0.00	.13420E+04
1346.36	69.80	0.00	80.7	0.124E+01	2.21	152.63	2.21	0.00	.13464E+04
1350.75	69.80	0.00	80.9	0.124E+01	2.22	152.80	2.22	0.00	.13508E+04
1355.14	69.80	0.00	81.2	0.123E+01	2.22	152.98	2.22	0.00	.13551E+04
1359.53	69.80	0.00	81.5	0.123E+01	2.23	153.16	2.23	0.00	.13595E+04
1363.92	69.80	0.00	81.8	0.122E+01	2.23	153.34	2.23	0.00	.13639E+04
1368.31	69.80	0.00	82.1	0.122E+01	2.24	153.52	2.24	0.00	.13683E+04
1372.70	69.80	0.00	82.4	0.121E+01	2.24	153.70	2.24	0.00	.13727E+04
1377.09	69.80	0.00	82.7	0.121E+01	2.25	153.88	2.25	0.00	.13771E+04
1381.48	69.80	0.00	83.0	0.121E+01	2.26	154.05	2.26	0.00	.13815E+04
1385.87	69.80	0.00	83.3	0.120E+01	2.26	154.23	2.26	0.00	.13859E+04
1390.26	69.80	0.00	83.6	0.120E+01	2.27	154.41	2.27	0.00	.13903E+04
1394.65	69.80	0.00	83.8	0.119E+01	2.27	154.59	2.27	0.00	.13947E+04
1399.04	69.80	0.00	84.1	0.119E+01	2.28	154.77	2.28	0.00	.13990E+04
1403.43	69.80	0.00	84.4	0.118E+01	2.28	154.95	2.28	0.00	.14034E+04
1407.82	69.80	0.00	84.7	0.118E+01	2.29	155.12	2.29	0.00	.14078E+04
1412.21	69.80	0.00	85.0	0.118E+01	2.29	155.30	2.29	0.00	.14122E+04
1416.60	69.80	0.00	85.3	0.117E+01	2.30	155.48	2.30	0.00	.14166E+04
1420.99	69.80	0.00	85.6	0.117E+01	2.30	155.66	2.30	0.00	.14210E+04
1425.38	69.80	0.00	85.9	0.116E+01	2.31	155.83	2.31	0.00	.14254E+04
1429.77	69.80	0.00	86.2	0.116E+01	2.31	156.01	2.31	0.00	.14298E+04
1434.16	69.80	0.00	86.5	0.116E+01	2.32	156.19	2.32	0.00	.14342E+04
1438.55	69.80	0.00	86.8	0.115E+01	2.33	156.37	2.33	0.00	.14385E+04
1442.94	69.80	0.00	87.1	0.115E+01	2.33	156.55	2.33	0.00	.14429E+04
1447.33	69.80	0.00	87.4	0.114E+01	2.34	156.72	2.34	0.00	.14473E+04
1451.72	69.80	0.00	87.7	0.114E+01	2.34	156.90	2.34	0.00	.14517E+04
1456.11	69.80	0.00	88.0	0.114E+01	2.35	157.08	2.35	0.00	.14561E+04
1460.50	69.80	0.00	88.3	0.113E+01	2.35	157.26	2.35	0.00	.14605E+04
1464.89	69.80	0.00	88.6	0.113E+01	2.36	157.43	2.36	0.00	.14649E+04
1469.28	69.80	0.00	89.0	0.112E+01	2.36	157.61	2.36	0.00	.14693E+04
1473.67	69.80	0.00	89.3	0.112E+01	2.37	157.79	2.37	0.00	.14737E+04
1478.06	69.80	0.00	89.6	0.112E+01	2.37	157.96	2.37	0.00	.14781E+04
1482.45	69.80	0.00	89.9	0.111E+01	2.38	158.14	2.38	0.00	.14824E+04
1486.84	69.80	0.00	90.2	0.111E+01	2.39	158.32	2.39	0.00	.14868E+04
1491.22	69.80	0.00	90.5	0.111E+01	2.39	158.50	2.39	0.00	.14912E+04
1495.61	69.80	0.00	90.8	0.110E+01	2.40	158.67	2.40	0.00	.14956E+04
1500.00	69.80	0.00	91.1	0.110E+01	2.40	158.85	2.40	0.00	.15000E+04

Cumulative travel time = 1500.0000 sec (0.42 hrs)

Simulation limit based on maximum specified distance = 1500.00 m.
This is the REGION OF INTEREST limitation.

END OF MOD241: BUOYANT AMBIENT SPREADING

CORMIX2: Multiport Diffuser Discharges End of Prediction File

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Tischler/Kocurek
107 South Mays
Round Rock, Texas 78664
512.244.9058
512.388.3409 FAX

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                              CORMIX Version 11.0GTD
                      HYDRO2 Version 11.0.1.0 August 2019
-----------------------------------------------------------------------------------------------
-----------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   PCCA Harbor Island
 Design case:       pcca_ew50_95_5(1.0)
 FILE NAME:         C:\Projects\pcca 2021\pcca_new_ew50_95_5(1.0).prd
 Time stamp:        06/23/2021--12:04:54

ENVIRONMENT PARAMETERS (metric units)
 Unbounded section
 HA    =     22.00  HD    =     27.40
 UA    =      1.000 F     =      0.009 USTAR =0.3425E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM = 1016.3900

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_parallel
 BANK  =  LEFT      DISTB =     69.80  YB1   =     69.80  YB2   =     69.80
 LD    =     30.00  NOPEN =   20       NRISER=   20       SPAC  =      1.58    NPPERR =    1
 D0    =      0.180 A0    =      0.025 H0    =      7.90  SUB0  =     19.50
 D0INP =      0.180 CR0   =      1.000 B0    =0.1612E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =      0.00  THETA =     30.00  SIGMA =    270.00  BETA  =     90.00
 U0    =      8.229 Q0    =      4.188 Q0A   =0.4188E+01
 RHO0  = 1030.0000  DRHO0 =-.1361E+02  GP0   =-.1313E+00
 C0    =0.1000E+03  CUNITS=  %
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1396E+00         SIGNJ0=     -1.0
 m0 =U0^2*B0 =0.1091E+01   j0 =U0*GP0*B0 =-.1742E-01   (based on slot width B0)
 m0 =U0*q0   =0.1149E+01   j0 =q0*GP0    =-.1833E-01   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.017 lM    =     16.20  lm    =      1.15
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.4188E+01  M0    =0.3274E+02  J0    =-.5225E+00
 Associated 3-d length scales (meters)
 LQ    =      0.16  LM    =     18.94  Lm    =      5.87  Lb    =      0.55
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =    178.87  FRD0  =     53.52  R     =      8.23  PL    =  140.00
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
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Tischler/Kocurek
107 South Mays
Round Rock, Texas 78664
512.244.9058
512.388.3409 FAX

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 Properties of riser group with  1 ports/nozzles each:
 U0    =      8.229 D0    =      0.180 A0    =      0.025 THETA =     30.00
 FR0   =    178.87  FRD0  =     53.52  R     =      8.23
 (slot)             (riser group)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MNU9         2
 2  Applicable layer depth HS =    27.40        2
 2222222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.1000E+03  CUNITS=  %
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1500.00  XMAX  =   1500.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        69.80 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 100 display intervals per module
-----------------------------------------------------------------------------------------------
-----------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    7.90     1.0 0.100E+03   0.01    15.00     8.229   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-----------------------------------------------------------------------------------------------
-----------------------------------------------------------------------------------------------
BEGIN MOD273: UNIDIRECTIONAL CROSS-FLOWING DIFFUSER (TEE) IN STRONG CURRENT

 Because of the strong ambient current the diffuser plume of this crossflowing
   discharge gets RAPIDLY DEFLECTED.
 A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire
   layer depth.  Full mixing is achieved at a downstream distance of about
   five (5) layer depths.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, measured horizontally in Y-direction
```

Tischler/Kocurek
107 South Mays
Round Rock, Texas 78664
512.244.9058
512.388.3409 FAX

S = hydrodynamic average (bulk) dilution

C = average (bulk) concentration (includes reaction effects, if any)

TT = Cumulative travel time

X	Y	Z	S	C	BV	BH	TT
0.00	0.00	7.90	1.0	0.100E+03	0.01	15.00	.00000E+00
1.52	-0.01	7.84	2.4	0.422E+02	0.32	14.86	.15200E+01
3.04	-0.01	7.77	2.9	0.341E+02	0.62	14.72	.30400E+01
4.56	-0.02	7.71	3.4	0.297E+02	0.92	14.58	.45600E+01
6.08	-0.03	7.64	3.7	0.267E+02	1.23	14.44	.60800E+01
7.60	-0.03	7.58	4.1	0.246E+02	1.53	14.31	.76000E+01
9.12	-0.04	7.51	4.4	0.230E+02	1.84	14.17	.91200E+01
10.64	-0.04	7.45	4.6	0.216E+02	2.14	14.03	.10640E+02
12.16	-0.05	7.39	4.9	0.205E+02	2.44	13.89	.12160E+02
13.68	-0.06	7.32	5.1	0.196E+02	2.75	13.75	.13680E+02
15.20	-0.06	7.26	5.3	0.188E+02	3.05	13.61	.15200E+02
16.72	-0.07	7.19	5.5	0.180E+02	3.36	13.47	.16720E+02
18.24	-0.08	7.13	5.7	0.174E+02	3.66	13.33	.18240E+02
19.76	-0.08	7.06	5.9	0.168E+02	3.96	13.20	.19760E+02
21.28	-0.09	7.00	6.1	0.163E+02	4.27	13.06	.21280E+02
22.80	-0.09	6.93	6.3	0.159E+02	4.57	12.92	.22800E+02
24.32	-0.10	6.87	6.5	0.154E+02	4.87	12.78	.24320E+02
25.84	-0.11	6.81	6.6	0.150E+02	5.18	12.64	.25840E+02
27.36	-0.11	6.74	6.8	0.147E+02	5.48	12.50	.27360E+02
28.88	-0.12	6.68	7.0	0.144E+02	5.79	12.36	.28880E+02
30.40	-0.13	6.61	7.1	0.140E+02	6.09	12.22	.30400E+02
31.92	-0.13	6.55	7.3	0.137E+02	6.39	12.09	.31920E+02
33.44	-0.14	6.48	7.4	0.135E+02	6.70	11.95	.33440E+02
34.96	-0.14	6.42	7.6	0.132E+02	7.00	11.81	.34960E+02
36.48	-0.15	6.36	7.7	0.130E+02	7.31	11.67	.36480E+02
38.00	-0.16	6.29	7.8	0.127E+02	7.61	11.53	.38000E+02
39.52	-0.16	6.23	8.0	0.125E+02	7.91	11.39	.39520E+02
41.04	-0.17	6.16	8.1	0.123E+02	8.22	11.25	.41040E+02
42.56	-0.18	6.10	8.2	0.121E+02	8.52	11.11	.42560E+02
44.08	-0.18	6.03	8.4	0.119E+02	8.82	10.98	.44080E+02
45.60	-0.19	5.97	8.5	0.118E+02	9.13	10.84	.45600E+02
47.12	-0.19	5.91	8.6	0.116E+02	9.43	10.70	.47120E+02
48.64	-0.20	5.84	8.7	0.114E+02	9.74	10.56	.48640E+02
50.16	-0.21	5.78	8.9	0.113E+02	10.04	10.42	.50160E+02
51.68	-0.21	5.71	9.0	0.111E+02	10.34	10.28	.51680E+02
53.20	-0.22	5.65	9.1	0.110E+02	10.65	10.14	.53200E+02
54.72	-0.23	5.58	9.2	0.109E+02	10.95	10.00	.54720E+02
56.24	-0.23	5.52	9.3	0.107E+02	11.26	9.87	.56240E+02
57.76	-0.24	5.45	9.4	0.106E+02	11.56	9.73	.57760E+02
59.28	-0.25	5.39	9.6	0.105E+02	11.86	9.59	.59280E+02
60.80	-0.25	5.33	9.7	0.104E+02	12.17	9.45	.60800E+02
62.32	-0.26	5.26	9.8	0.102E+02	12.47	9.31	.62320E+02
63.84	-0.26	5.20	9.9	0.101E+02	12.77	9.17	.63840E+02
65.36	-0.27	5.13	10.0	0.100E+02	13.08	9.03	.65360E+02
66.88	-0.28	5.07	10.1	0.992E+01	13.38	8.89	.66880E+02
68.40	-0.28	5.00	10.2	0.982E+01	13.69	8.76	.68400E+02
69.92	-0.29	4.94	10.3	0.972E+01	13.99	8.62	.69920E+02
71.44	-0.30	4.88	10.4	0.963E+01	14.29	8.48	.71440E+02
72.96	-0.30	4.81	10.5	0.954E+01	14.60	8.34	.72960E+02

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74.48	-0.31	4.75	10.6	0.945E+01	14.90	8.20	.74480E+02
76.00	-0.31	4.68	10.7	0.936E+01	15.21	8.06	.76000E+02
77.52	-0.32	4.62	10.8	0.928E+01	15.51	7.92	.77520E+02
79.04	-0.33	4.55	10.9	0.920E+01	15.81	7.78	.79040E+02
80.56	-0.33	4.49	11.0	0.912E+01	16.12	7.65	.80560E+02
82.08	-0.34	4.43	11.1	0.904E+01	16.42	7.51	.82080E+02
83.60	-0.35	4.36	11.2	0.897E+01	16.73	7.37	.83600E+02
85.12	-0.35	4.30	11.2	0.889E+01	17.03	7.23	.85120E+02
86.64	-0.36	4.23	11.3	0.882E+01	17.33	7.09	.86640E+02
88.16	-0.36	4.17	11.4	0.875E+01	17.64	6.95	.88160E+02
89.68	-0.37	4.10	11.5	0.868E+01	17.94	6.81	.89680E+02
91.20	-0.38	4.04	11.6	0.862E+01	18.24	6.67	.91200E+02
92.72	-0.38	3.97	11.7	0.855E+01	18.55	6.53	.92720E+02
94.24	-0.39	3.91	11.8	0.849E+01	18.85	6.40	.94240E+02
95.76	-0.40	3.85	11.9	0.843E+01	19.16	6.26	.95760E+02
97.28	-0.40	3.78	12.0	0.837E+01	19.46	6.12	.97280E+02
98.80	-0.41	3.72	12.0	0.831E+01	19.76	5.98	.98800E+02
100.32	-0.42	3.65	12.1	0.825E+01	20.07	5.84	.10032E+03
101.84	-0.42	3.59	12.2	0.819E+01	20.37	5.70	.10184E+03
103.36	-0.43	3.52	12.3	0.814E+01	20.68	5.56	.10336E+03
104.88	-0.43	3.46	12.4	0.808E+01	20.98	5.42	.10488E+03
106.40	-0.44	3.40	12.5	0.803E+01	21.28	5.29	.10640E+03
107.92	-0.45	3.33	12.5	0.798E+01	21.59	5.15	.10792E+03
109.44	-0.45	3.27	12.6	0.793E+01	21.89	5.01	.10944E+03
110.96	-0.46	3.20	12.7	0.787E+01	22.19	4.87	.11096E+03
112.48	-0.47	3.14	12.8	0.783E+01	22.50	4.73	.11248E+03
114.00	-0.47	3.07	12.9	0.778E+01	22.80	4.59	.11400E+03
115.52	-0.48	3.01	12.9	0.773E+01	23.11	4.45	.11552E+03
117.04	-0.48	2.95	13.0	0.768E+01	23.41	4.31	.11704E+03
118.56	-0.49	2.88	13.1	0.764E+01	23.71	4.18	.11856E+03
120.08	-0.50	2.82	13.2	0.759E+01	24.02	4.04	.12008E+03
121.60	-0.50	2.75	13.2	0.755E+01	24.32	3.90	.12160E+03
123.12	-0.51	2.69	13.3	0.751E+01	24.63	3.76	.12312E+03
124.64	-0.52	2.62	13.4	0.746E+01	24.93	3.62	.12464E+03
126.16	-0.52	2.56	13.5	0.742E+01	25.23	3.48	.12616E+03
127.68	-0.53	2.49	13.5	0.738E+01	25.54	3.34	.12768E+03
129.20	-0.53	2.43	13.6	0.734E+01	25.84	3.20	.12920E+03
130.72	-0.54	2.37	13.7	0.730E+01	26.14	3.07	.13072E+03
132.24	-0.55	2.30	13.8	0.726E+01	26.45	2.93	.13224E+03
133.76	-0.55	2.24	13.8	0.722E+01	26.75	2.79	.13376E+03
135.28	-0.56	2.17	13.9	0.719E+01	27.06	2.65	.13528E+03
136.80	-0.57	2.11	14.0	0.715E+01	27.36	2.51	.13680E+03
138.32	-0.57	2.04	14.1	0.711E+01	27.40	2.37	.13832E+03
139.84	-0.58	1.98	14.1	0.708E+01	27.40	2.23	.13984E+03
141.36	-0.58	1.92	14.2	0.704E+01	27.40	2.09	.14136E+03
142.88	-0.59	1.85	14.3	0.701E+01	27.40	1.96	.14288E+03
144.40	-0.60	1.79	14.3	0.697E+01	27.40	1.82	.14440E+03
145.92	-0.60	1.72	14.4	0.694E+01	27.40	1.68	.14592E+03
147.44	-0.61	1.66	14.5	0.690E+01	27.40	1.54	.14744E+03
148.96	-0.62	1.59	14.6	0.687E+01	27.40	1.40	.14896E+03
150.48	-0.62	1.53	14.6	0.684E+01	27.40	1.26	.15048E+03
152.00	-0.63	1.46	14.7	0.681E+01	27.40	1.12	.15200E+03

Cumulative travel time = 152.0000 sec (0.04 hrs)

Plume centerline may exhibit slight discontinuities in transition

Tischler/Kocurek
107 South Mays
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512.244.9058
512.388.3409 FAX

to subsequent far-field module.

END OF MOD273: UNIDIRECTIONAL CROSS-FLOWING DIFFUSER (TEE) IN STRONG CURRENT

** End of NEAR-FIELD REGION (NFR) **

BEGIN MOD241: BUOYANT AMBIENT SPREADING

Profile definitions:

BV = top-hat thickness, measured vertically
BH = top-hat half-width, measured horizontally in y-direction
ZU = upper plume boundary (Z-coordinate)
ZL = lower plume boundary (Z-coordinate)
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)
TT = Cumulative travel time

Plume Stage 1 (not bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL	TT
152.00	-0.63	0.00	14.7	0.681E+01	27.40	1.12	27.40	0.00	.15200E+03
163.25	-0.63	0.00	19.9	0.501E+01	10.95	3.81	10.95	0.00	.16325E+03
174.51	-0.63	0.00	22.1	0.453E+01	8.08	5.72	8.08	0.00	.17451E+03
185.76	-0.63	0.00	23.5	0.425E+01	6.70	7.35	6.70	0.00	.18576E+03
197.01	-0.63	0.00	24.6	0.406E+01	5.85	8.81	5.85	0.00	.19701E+03
208.27	-0.63	0.00	25.5	0.392E+01	5.26	10.16	5.26	0.00	.20827E+03
219.52	-0.63	0.00	26.3	0.380E+01	4.82	11.42	4.82	0.00	.21952E+03
230.77	-0.63	0.00	27.0	0.370E+01	4.48	12.61	4.48	0.00	.23077E+03
242.03	-0.63	0.00	27.6	0.362E+01	4.21	13.75	4.21	0.00	.24203E+03
253.28	-0.63	0.00	28.2	0.355E+01	3.98	14.84	3.98	0.00	.25328E+03
264.53	-0.63	0.00	28.7	0.348E+01	3.78	15.89	3.78	0.00	.26453E+03
275.79	-0.63	0.00	29.2	0.342E+01	3.62	16.91	3.62	0.00	.27579E+03
287.04	-0.63	0.00	29.7	0.337E+01	3.47	17.89	3.47	0.00	.28704E+03
298.29	-0.63	0.00	30.1	0.332E+01	3.35	18.85	3.35	0.00	.29829E+03
309.55	-0.63	0.00	30.6	0.327E+01	3.24	19.78	3.24	0.00	.30955E+03
320.80	-0.63	0.00	31.0	0.323E+01	3.14	20.69	3.14	0.00	.32080E+03
332.05	-0.63	0.00	31.4	0.318E+01	3.05	21.57	3.05	0.00	.33205E+03
343.31	-0.63	0.00	31.8	0.314E+01	2.97	22.44	2.97	0.00	.34331E+03
354.56	-0.63	0.00	32.2	0.311E+01	2.89	23.29	2.89	0.00	.35456E+03
365.81	-0.63	0.00	32.6	0.307E+01	2.83	24.12	2.83	0.00	.36581E+03
377.07	-0.63	0.00	33.0	0.303E+01	2.77	24.94	2.77	0.00	.37707E+03
388.32	-0.63	0.00	33.3	0.300E+01	2.71	25.75	2.71	0.00	.38832E+03
399.57	-0.63	0.00	33.7	0.297E+01	2.66	26.54	2.66	0.00	.39957E+03
410.82	-0.63	0.00	34.1	0.293E+01	2.61	27.31	2.61	0.00	.41082E+03
422.08	-0.63	0.00	34.5	0.290E+01	2.57	28.08	2.57	0.00	.42208E+03
433.33	-0.63	0.00	34.8	0.287E+01	2.53	28.83	2.53	0.00	.43333E+03
444.58	-0.63	0.00	35.2	0.284E+01	2.49	29.57	2.49	0.00	.44458E+03
455.84	-0.63	0.00	35.6	0.281E+01	2.46	30.31	2.46	0.00	.45584E+03
467.09	-0.63	0.00	36.0	0.278E+01	2.43	31.03	2.43	0.00	.46709E+03
478.34	-0.63	0.00	36.4	0.275E+01	2.40	31.74	2.40	0.00	.47834E+03
489.60	-0.63	0.00	36.8	0.272E+01	2.37	32.45	2.37	0.00	.48960E+03
500.85	-0.63	0.00	37.1	0.269E+01	2.35	33.14	2.35	0.00	.50085E+03
512.10	-0.63	0.00	37.5	0.266E+01	2.32	33.83	2.32	0.00	.51210E+03
523.36	-0.63	0.00	37.9	0.264E+01	2.30	34.51	2.30	0.00	.52336E+03
534.61	-0.63	0.00	38.3	0.261E+01	2.28	35.18	2.28	0.00	.53461E+03

545.86	-0.63	0.00	38.8	0.258E+01	2.26	35.85	2.26	0.00	.54586E+03
557.12	-0.63	0.00	39.2	0.255E+01	2.25	36.51	2.25	0.00	.55712E+03
568.37	-0.63	0.00	39.6	0.253E+01	2.23	37.16	2.23	0.00	.56837E+03
579.62	-0.63	0.00	40.0	0.250E+01	2.22	37.80	2.22	0.00	.57962E+03
590.88	-0.63	0.00	40.4	0.247E+01	2.20	38.44	2.20	0.00	.59088E+03
602.13	-0.63	0.00	40.9	0.245E+01	2.19	39.07	2.19	0.00	.60213E+03
613.38	-0.63	0.00	41.3	0.242E+01	2.18	39.70	2.18	0.00	.61338E+03
624.64	-0.63	0.00	41.8	0.239E+01	2.17	40.32	2.17	0.00	.62464E+03
635.89	-0.63	0.00	42.2	0.237E+01	2.16	40.94	2.16	0.00	.63589E+03
647.14	-0.63	0.00	42.7	0.234E+01	2.15	41.55	2.15	0.00	.64714E+03
658.40	-0.63	0.00	43.2	0.232E+01	2.14	42.15	2.14	0.00	.65840E+03
669.65	-0.63	0.00	43.7	0.229E+01	2.14	42.75	2.14	0.00	.66965E+03
680.90	-0.63	0.00	44.1	0.227E+01	2.13	43.35	2.13	0.00	.68090E+03
692.16	-0.63	0.00	44.6	0.224E+01	2.13	43.94	2.13	0.00	.69216E+03
703.41	-0.63	0.00	45.1	0.222E+01	2.12	44.53	2.12	0.00	.70341E+03
714.66	-0.63	0.00	45.7	0.219E+01	2.12	45.11	2.12	0.00	.71466E+03
725.92	-0.63	0.00	46.2	0.217E+01	2.12	45.69	2.12	0.00	.72592E+03
737.17	-0.63	0.00	46.7	0.214E+01	2.11	46.26	2.11	0.00	.73717E+03
748.42	-0.63	0.00	47.2	0.212E+01	2.11	46.83	2.11	0.00	.74842E+03
759.68	-0.63	0.00	47.8	0.209E+01	2.11	47.40	2.11	0.00	.75968E+03
770.93	-0.63	0.00	48.3	0.207E+01	2.11	47.96	2.11	0.00	.77093E+03
782.18	-0.63	0.00	48.9	0.204E+01	2.11	48.52	2.11	0.00	.78218E+03
793.44	-0.63	0.00	49.5	0.202E+01	2.11	49.07	2.11	0.00	.79344E+03
804.69	-0.63	0.00	50.1	0.200E+01	2.11	49.62	2.11	0.00	.80469E+03
815.94	-0.63	0.00	50.6	0.197E+01	2.11	50.17	2.11	0.00	.81594E+03
827.19	-0.63	0.00	51.2	0.195E+01	2.12	50.71	2.12	0.00	.82719E+03
838.45	-0.63	0.00	51.8	0.193E+01	2.12	51.26	2.12	0.00	.83845E+03
849.70	-0.63	0.00	52.5	0.191E+01	2.12	51.79	2.12	0.00	.84970E+03
860.95	-0.63	0.00	53.1	0.188E+01	2.12	52.33	2.12	0.00	.86095E+03
872.21	-0.63	0.00	53.7	0.186E+01	2.13	52.86	2.13	0.00	.87221E+03
883.46	-0.63	0.00	54.4	0.184E+01	2.13	53.39	2.13	0.00	.88346E+03
894.71	-0.63	0.00	55.0	0.182E+01	2.14	53.91	2.14	0.00	.89471E+03
905.97	-0.63	0.00	55.7	0.180E+01	2.14	54.44	2.14	0.00	.90597E+03
917.22	-0.63	0.00	56.4	0.177E+01	2.15	54.96	2.15	0.00	.91722E+03
928.47	-0.63	0.00	57.1	0.175E+01	2.15	55.48	2.15	0.00	.92847E+03
939.73	-0.63	0.00	57.7	0.173E+01	2.16	55.99	2.16	0.00	.93973E+03
950.98	-0.63	0.00	58.5	0.171E+01	2.17	56.50	2.17	0.00	.95098E+03
962.23	-0.63	0.00	59.2	0.169E+01	2.17	57.01	2.17	0.00	.96223E+03
973.49	-0.63	0.00	59.9	0.167E+01	2.18	57.52	2.18	0.00	.97349E+03
984.74	-0.63	0.00	60.6	0.165E+01	2.19	58.02	2.19	0.00	.98474E+03
995.99	-0.63	0.00	61.4	0.163E+01	2.20	58.53	2.20	0.00	.99599E+03
1007.25	-0.63	0.00	62.1	0.161E+01	2.20	59.03	2.20	0.00	.10072E+04
1018.50	-0.63	0.00	62.9	0.159E+01	2.21	59.52	2.21	0.00	.10185E+04
1029.75	-0.63	0.00	63.7	0.157E+01	2.22	60.02	2.22	0.00	.10298E+04
1041.01	-0.63	0.00	64.5	0.155E+01	2.23	60.51	2.23	0.00	.10410E+04
1052.26	-0.63	0.00	65.3	0.153E+01	2.24	61.00	2.24	0.00	.10523E+04
1063.51	-0.63	0.00	66.1	0.151E+01	2.25	61.49	2.25	0.00	.10635E+04
1074.77	-0.63	0.00	66.9	0.149E+01	2.26	61.98	2.26	0.00	.10748E+04
1086.02	-0.63	0.00	67.7	0.148E+01	2.27	62.46	2.27	0.00	.10860E+04
1097.27	-0.63	0.00	68.6	0.146E+01	2.28	62.95	2.28	0.00	.10973E+04
1108.53	-0.63	0.00	69.4	0.144E+01	2.29	63.43	2.29	0.00	.11085E+04
1119.78	-0.63	0.00	70.3	0.142E+01	2.30	63.91	2.30	0.00	.11198E+04
1131.03	-0.63	0.00	71.2	0.141E+01	2.31	64.38	2.31	0.00	.11310E+04
1142.29	-0.63	0.00	72.1	0.139E+01	2.33	64.86	2.33	0.00	.11423E+04

Tischler/Kocurek
107 South Mays
Round Rock, Texas 78664
512.244.9058
512.388.3409 FAX

1153.54	-0.63	0.00	73.0	0.137E+01	2.34	65.33	2.34	0.00	.11535E+04
1164.79	-0.63	0.00	73.9	0.135E+01	2.35	65.80	2.35	0.00	.11648E+04
1176.05	-0.63	0.00	74.8	0.134E+01	2.36	66.27	2.36	0.00	.11760E+04
1187.30	-0.63	0.00	75.7	0.132E+01	2.38	66.74	2.38	0.00	.11873E+04
1198.55	-0.63	0.00	76.7	0.130E+01	2.39	67.21	2.39	0.00	.11986E+04
1209.81	-0.63	0.00	77.6	0.129E+01	2.40	67.67	2.40	0.00	.12098E+04
1221.06	-0.63	0.00	78.6	0.127E+01	2.42	68.14	2.42	0.00	.12211E+04
1232.31	-0.63	0.00	79.6	0.126E+01	2.43	68.60	2.43	0.00	.12323E+04
1243.57	-0.63	0.00	80.6	0.124E+01	2.44	69.06	2.44	0.00	.12436E+04
1254.82	-0.63	0.00	81.6	0.123E+01	2.46	69.52	2.46	0.00	.12548E+04
1266.07	-0.63	0.00	82.6	0.121E+01	2.47	69.97	2.47	0.00	.12661E+04
1277.33	-0.63	0.00	83.6	0.120E+01	2.49	70.43	2.49	0.00	.12773E+04

Cumulative travel time = 1277.3254 sec (0.35 hrs)

Plume is ATTACHED to LEFT bank/shore.

Plume width is now determined from LEFT bank/shore.

Plume Stage 2 (bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL	TT
1277.33	69.80	0.00	83.6	0.120E+01	2.49	140.86	2.49	0.00	.12773E+04
1279.55	69.80	0.00	83.8	0.119E+01	2.49	140.94	2.49	0.00	.12796E+04
1281.78	69.80	0.00	84.0	0.119E+01	2.49	141.01	2.49	0.00	.12818E+04
1284.01	69.80	0.00	84.2	0.119E+01	2.50	141.09	2.50	0.00	.12840E+04
1286.23	69.80	0.00	84.4	0.119E+01	2.50	141.17	2.50	0.00	.12862E+04
1288.46	69.80	0.00	84.6	0.118E+01	2.51	141.25	2.51	0.00	.12885E+04
1290.69	69.80	0.00	84.7	0.118E+01	2.51	141.33	2.51	0.00	.12907E+04
1292.91	69.80	0.00	84.9	0.118E+01	2.52	141.41	2.52	0.00	.12929E+04
1295.14	69.80	0.00	85.1	0.117E+01	2.52	141.49	2.52	0.00	.12951E+04
1297.37	69.80	0.00	85.3	0.117E+01	2.52	141.56	2.52	0.00	.12974E+04
1299.59	69.80	0.00	85.5	0.117E+01	2.53	141.64	2.53	0.00	.12996E+04
1301.82	69.80	0.00	85.7	0.117E+01	2.53	141.72	2.53	0.00	.13018E+04
1304.05	69.80	0.00	85.9	0.116E+01	2.54	141.80	2.54	0.00	.13040E+04
1306.27	69.80	0.00	86.1	0.116E+01	2.54	141.88	2.54	0.00	.13063E+04
1308.50	69.80	0.00	86.3	0.116E+01	2.55	141.96	2.55	0.00	.13085E+04
1310.73	69.80	0.00	86.5	0.116E+01	2.55	142.04	2.55	0.00	.13107E+04
1312.95	69.80	0.00	86.7	0.115E+01	2.55	142.11	2.55	0.00	.13130E+04
1315.18	69.80	0.00	86.9	0.115E+01	2.56	142.19	2.56	0.00	.13152E+04
1317.41	69.80	0.00	87.0	0.115E+01	2.56	142.27	2.56	0.00	.13174E+04
1319.63	69.80	0.00	87.2	0.115E+01	2.57	142.35	2.57	0.00	.13196E+04
1321.86	69.80	0.00	87.4	0.114E+01	2.57	142.43	2.57	0.00	.13219E+04
1324.09	69.80	0.00	87.6	0.114E+01	2.58	142.51	2.58	0.00	.13241E+04
1326.32	69.80	0.00	87.8	0.114E+01	2.58	142.58	2.58	0.00	.13263E+04
1328.54	69.80	0.00	88.0	0.114E+01	2.58	142.66	2.58	0.00	.13285E+04
1330.77	69.80	0.00	88.2	0.113E+01	2.59	142.74	2.59	0.00	.13308E+04
1333.00	69.80	0.00	88.4	0.113E+01	2.59	142.82	2.59	0.00	.13330E+04
1335.22	69.80	0.00	88.6	0.113E+01	2.60	142.90	2.60	0.00	.13352E+04
1337.45	69.80	0.00	88.8	0.113E+01	2.60	142.98	2.60	0.00	.13374E+04
1339.68	69.80	0.00	89.0	0.112E+01	2.61	143.05	2.61	0.00	.13397E+04
1341.90	69.80	0.00	89.2	0.112E+01	2.61	143.13	2.61	0.00	.13419E+04
1344.13	69.80	0.00	89.4	0.112E+01	2.61	143.21	2.61	0.00	.13441E+04
1346.36	69.80	0.00	89.6	0.112E+01	2.62	143.29	2.62	0.00	.13464E+04
1348.58	69.80	0.00	89.8	0.111E+01	2.62	143.37	2.62	0.00	.13486E+04
1350.81	69.80	0.00	90.0	0.111E+01	2.63	143.45	2.63	0.00	.13508E+04

1353.04	69.80	0.00	90.2	0.111E+01	2.63	143.52	2.63	0.00	.13530E+04
1355.26	69.80	0.00	90.4	0.111E+01	2.64	143.60	2.64	0.00	.13553E+04
1357.49	69.80	0.00	90.6	0.110E+01	2.64	143.68	2.64	0.00	.13575E+04
1359.72	69.80	0.00	90.8	0.110E+01	2.64	143.76	2.64	0.00	.13597E+04
1361.94	69.80	0.00	91.0	0.110E+01	2.65	143.84	2.65	0.00	.13619E+04
1364.17	69.80	0.00	91.2	0.110E+01	2.65	143.92	2.65	0.00	.13642E+04
1366.40	69.80	0.00	91.3	0.109E+01	2.66	143.99	2.66	0.00	.13664E+04
1368.62	69.80	0.00	91.5	0.109E+01	2.66	144.07	2.66	0.00	.13686E+04
1370.85	69.80	0.00	91.7	0.109E+01	2.67	144.15	2.67	0.00	.13709E+04
1373.08	69.80	0.00	91.9	0.109E+01	2.67	144.23	2.67	0.00	.13731E+04
1375.30	69.80	0.00	92.1	0.109E+01	2.67	144.31	2.67	0.00	.13753E+04
1377.53	69.80	0.00	92.3	0.108E+01	2.68	144.39	2.68	0.00	.13775E+04
1379.76	69.80	0.00	92.5	0.108E+01	2.68	144.46	2.68	0.00	.13798E+04
1381.99	69.80	0.00	92.7	0.108E+01	2.69	144.54	2.69	0.00	.13820E+04
1384.21	69.80	0.00	92.9	0.108E+01	2.69	144.62	2.69	0.00	.13842E+04
1386.44	69.80	0.00	93.1	0.107E+01	2.70	144.70	2.70	0.00	.13864E+04
1388.67	69.80	0.00	93.3	0.107E+01	2.70	144.78	2.70	0.00	.13887E+04
1390.89	69.80	0.00	93.5	0.107E+01	2.70	144.86	2.70	0.00	.13909E+04
1393.12	69.80	0.00	93.7	0.107E+01	2.71	144.93	2.71	0.00	.13931E+04
1395.35	69.80	0.00	93.9	0.106E+01	2.71	145.01	2.71	0.00	.13953E+04
1397.57	69.80	0.00	94.1	0.106E+01	2.72	145.09	2.72	0.00	.13976E+04
1399.80	69.80	0.00	94.3	0.106E+01	2.72	145.17	2.72	0.00	.13998E+04
1402.03	69.80	0.00	94.5	0.106E+01	2.73	145.25	2.73	0.00	.14020E+04
1404.25	69.80	0.00	94.7	0.106E+01	2.73	145.32	2.73	0.00	.14043E+04
1406.48	69.80	0.00	94.9	0.105E+01	2.73	145.40	2.73	0.00	.14065E+04
1408.71	69.80	0.00	95.2	0.105E+01	2.74	145.48	2.74	0.00	.14087E+04
1410.93	69.80	0.00	95.4	0.105E+01	2.74	145.56	2.74	0.00	.14109E+04
1413.16	69.80	0.00	95.6	0.105E+01	2.75	145.64	2.75	0.00	.14132E+04
1415.39	69.80	0.00	95.8	0.104E+01	2.75	145.72	2.75	0.00	.14154E+04
1417.61	69.80	0.00	96.0	0.104E+01	2.76	145.79	2.76	0.00	.14176E+04
1419.84	69.80	0.00	96.2	0.104E+01	2.76	145.87	2.76	0.00	.14198E+04
1422.07	69.80	0.00	96.4	0.104E+01	2.77	145.95	2.77	0.00	.14221E+04
1424.29	69.80	0.00	96.6	0.104E+01	2.77	146.03	2.77	0.00	.14243E+04
1426.52	69.80	0.00	96.8	0.103E+01	2.77	146.11	2.77	0.00	.14265E+04
1428.75	69.80	0.00	97.0	0.103E+01	2.78	146.18	2.78	0.00	.14287E+04
1430.97	69.80	0.00	97.2	0.103E+01	2.78	146.26	2.78	0.00	.14310E+04
1433.20	69.80	0.00	97.4	0.103E+01	2.79	146.34	2.79	0.00	.14332E+04
1435.43	69.80	0.00	97.6	0.102E+01	2.79	146.42	2.79	0.00	.14354E+04
1437.66	69.80	0.00	97.8	0.102E+01	2.80	146.50	2.80	0.00	.14377E+04
1439.88	69.80	0.00	98.0	0.102E+01	2.80	146.57	2.80	0.00	.14399E+04
1442.11	69.80	0.00	98.2	0.102E+01	2.80	146.65	2.80	0.00	.14421E+04
1444.34	69.80	0.00	98.4	0.102E+01	2.81	146.73	2.81	0.00	.14443E+04
1446.56	69.80	0.00	98.6	0.101E+01	2.81	146.81	2.81	0.00	.14466E+04
1448.79	69.80	0.00	98.8	0.101E+01	2.82	146.89	2.82	0.00	.14488E+04
1451.02	69.80	0.00	99.0	0.101E+01	2.82	146.96	2.82	0.00	.14510E+04
1453.24	69.80	0.00	99.2	0.101E+01	2.83	147.04	2.83	0.00	.14532E+04
1455.47	69.80	0.00	99.4	0.101E+01	2.83	147.12	2.83	0.00	.14555E+04
1457.70	69.80	0.00	99.7	0.100E+01	2.84	147.20	2.84	0.00	.14577E+04
1459.92	69.80	0.00	99.9	0.100E+01	2.84	147.28	2.84	0.00	.14599E+04
1462.15	69.80	0.00	100.1	0.999E+00	2.84	147.35	2.84	0.00	.14622E+04
1464.38	69.80	0.00	100.3	0.997E+00	2.85	147.43	2.85	0.00	.14644E+04
1466.60	69.80	0.00	100.5	0.995E+00	2.85	147.51	2.85	0.00	.14666E+04
1468.83	69.80	0.00	100.7	0.993E+00	2.86	147.59	2.86	0.00	.14688E+04
1471.06	69.80	0.00	100.9	0.991E+00	2.86	147.67	2.86	0.00	.14711E+04

Tischler/Kocurek
107 South Mays
Round Rock, Texas 78664
512.244.9058
512.388.3409 FAX

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  1473.28    69.80    0.00   101.1 0.989E+00   2.87   147.74    2.87    0.00   .14733E+04
  1475.51    69.80    0.00   101.3 0.987E+00   2.87   147.82    2.87    0.00   .14755E+04
  1477.74    69.80    0.00   101.5 0.985E+00   2.87   147.90    2.87    0.00   .14777E+04
  1479.96    69.80    0.00   101.7 0.983E+00   2.88   147.98    2.88    0.00   .14800E+04
  1482.19    69.80    0.00   101.9 0.981E+00   2.88   148.06    2.88    0.00   .14822E+04
  1484.42    69.80    0.00   102.2 0.979E+00   2.89   148.13    2.89    0.00   .14844E+04
  1486.65    69.80    0.00   102.4 0.977E+00   2.89   148.21    2.89    0.00   .14866E+04
  1488.87    69.80    0.00   102.6 0.975E+00   2.90   148.29    2.90    0.00   .14889E+04
  1491.10    69.80    0.00   102.8 0.973E+00   2.90   148.37    2.90    0.00   .14911E+04
  1493.33    69.80    0.00   103.0 0.971E+00   2.91   148.45    2.91    0.00   .14933E+04
  1495.55    69.80    0.00   103.2 0.969E+00   2.91   148.52    2.91    0.00   .14956E+04
  1497.78    69.80    0.00   103.4 0.967E+00   2.91   148.60    2.91    0.00   .14978E+04
  1500.01    69.80    0.00   103.6 0.965E+00   2.92   148.68    2.92    0.00   .15000E+04
 Cumulative travel time =        1500.0001 sec  (    0.42 hrs)

 Simulation limit based on maximum specified distance =   1500.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD241: BUOYANT AMBIENT SPREADING
-----------------------------------------------------------------------------------------------
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CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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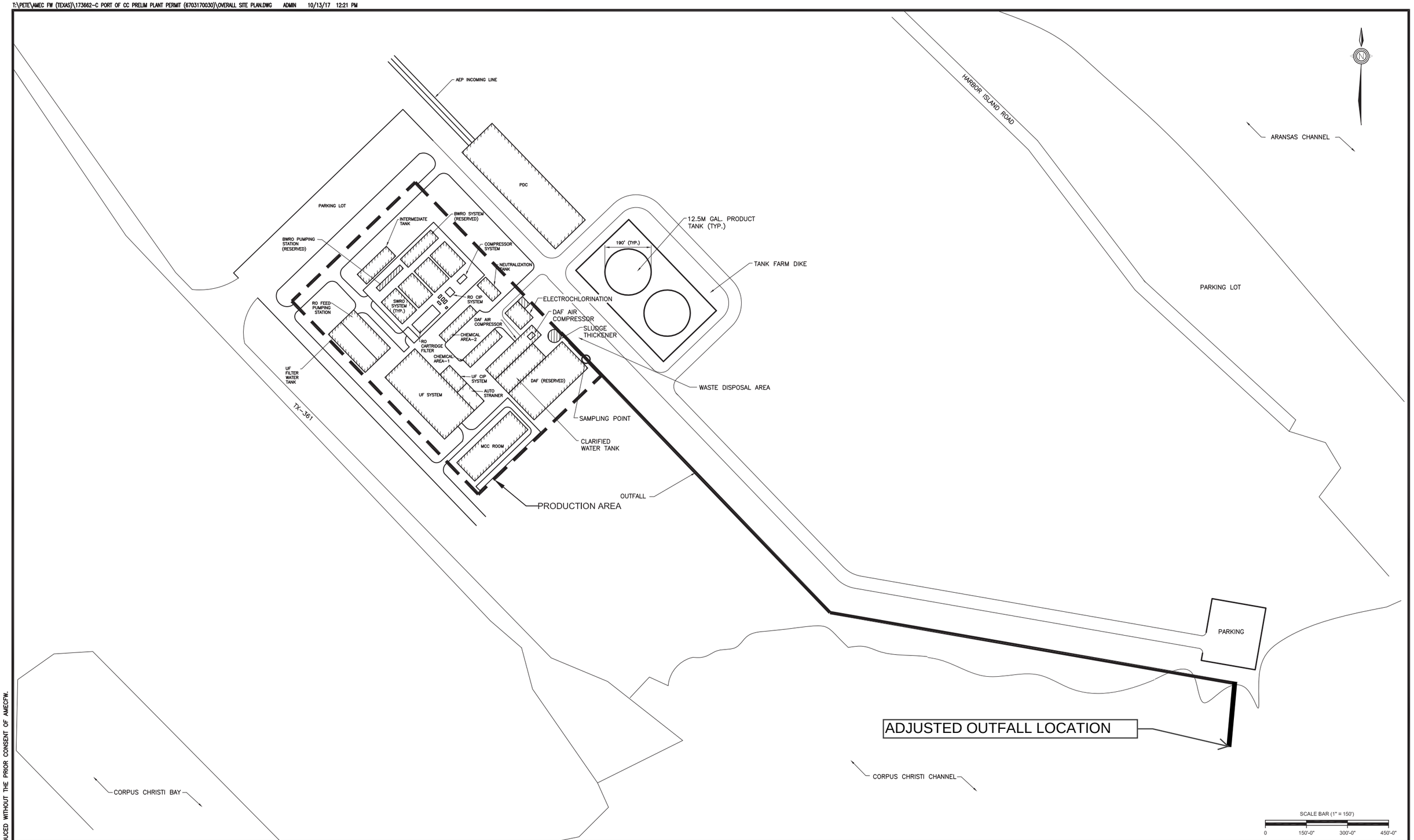
Tischler/Kocurek
107 South Mays
Round Rock, Texas 78664
512.244.9058
512.388.3409 FAX

ATTACHMENT 9

Facility Map



NOTES:

NO.	REVISION	DATE	DRAWN	CHECKED	TA	HSE	APP'D	CLIENT	SEAL
			/	/					
			/	/					
			/	/					
			/	/					
			/	/					
			/	/					
			/	/					
			/	/					
			/	/					

ENGINEER	DATE OCT 2017	SCALE 1"=150'
DRAWN LY	DATE OCT 2017	SHEET OF
CHECKED		70030
APPROVED		
CLIENT APPR	DATE	CLIENT
AMEC NO.		VERSION

MOD 25 JUNE 2021

PORT OF CORPUS CHRISTI
PROPOSED DESALINATION PLANT
HARBOR ISLAND, PORT ARANSAS
TEXAS 78373

FACILITY MAP

S-Application 000386

DRAWING NO. **ATTACHMENT 9** REV.

THIS DRAWING CANNOT BE REPRODUCED WITHOUT THE PRIOR CONSENT OF AMECFW.

ATTACHMENT 10

Effluent Salinity Calculations for Gulf of Mexico Intake

Prediction of Concentrations of Various Components in RO Reject Water

The preliminary design of the proposed desalination facility was performed by others.

As part of the permit application process, Parsons was tasked with predicting concentrations of the standard list of constituents in the permit application forms for the future flows to be discharged by the proposed desalination facility. Parsons performed sampling of seawater from the Gulf of Mexico in the area proposed as the intake location for the proposed desalination facility to better define the potential effluent discharge.

The preliminary process design was performed by others. The process stream is indicated on Figure 1, Process Flow Diagram, identified as page 000342 of the previously submitted permit application. The general design utilizes seawater reverse osmosis, and the design is commonly found.

The process includes significant pretreatment steps to remove undesireable materials in the water, typically suspended particulate matter, in advance of the reverse osmosis step. The pretreatment processes generate various waste streams, all with a salinity equal to the original seawater. These various waste streams are combined, then treated with traditional means of thickening and solids removal via a belt filter press. The solids from the filter press are taken off site, but the liquid waste streams from those two processes continue to the outfall, where they are mixed with the reject water. This process will dilute the concentration of the reject water with the pretreatment waste stream, at a concentration equal to sea water.

The original designers present a water balance on page 000340. This balance includes standard and appropriate assumptions for the waste stream generation. The water balance does not, however, reflect the combining of the reject water with the other waste streams as noted above.

Parsons repeated the water balance calculation, but also included the calculation combining the reject water and the other waste streams. In addition, Parsons utilized the data collected by our personnel specifically for this project to reflect the actual character of the seawater in the Gulf of Mexico near the proposed intake location. The values of various constituents in the intake water were then applied to the mass balance calculation. With the improved water balance calculation, and the use of actual analytical data, a more representative projection of the liquid to be discharged into the receiving water body is produced.

For this calculation, the water balance was calculated based on the salinity or total dissolved solids in the influent. The salinity of the combined waste flow to the outfall was calculated. Generally, the ratio of effluent salinity to influent salinity was calculated for various influent salinity and reverse osmosis permeate recovery values. The calculated effluent to influent ratio was applied to other constituents of the influent seawater, for those that are dissolved compounds. These are projected to not cross the reverse osmosis membrane in any appreciable amount, so all mass of those compounds remain in the reject water.

The projected effluent concentrations listed in Tables 1 through 6 of the permit application forms reflect this process. The first columns are the results of the 2 separate samples collected in early June, 2021. The values listed in the average column generally reflect the influent concentration multiplied by the salinity ratio in the water balance.

Example of water balance calculation to predict salinity effluent concentrations is presented below.

	Seawater Salinity	33.7	g/L			
	RO Recovery	40%				
Stream	Description	Q MG/day	Salt Conc kg/MG	Salt Flux kg/day	Salt Conc g/L	
1 - 3	Seawater Intake -->Clarifiers Feed	150.7	127,568	19,227,164	33.70	
5	Clarifier Sludge (5%)	7.5	127,568	961,358	33.70	
4, 6	Clarified Seawater -->Strainers Feed	143.2	127,568	18,265,805	33.70	
8	Strainer Backwash (3%)	4.3	127,568	547,974	33.70	
7	UF Feed	138.9	127,568	17,717,831	33.70	
10	UF Reject (10%)	13.9	127,568	1,771,783	33.70	
9, 11	RO FEED	**125.0**	127,568	15,946,048	33.70	
12	RO Feed HP Pump Flow (45%)	56.3	127,568	7,175,722	33.70	
17	ENERGY RECOVER RO FEED	68.8	127,568	8,770,326	33.70	
13 - 15	RO PERMEATE	50.0	1,893	94,635	0.50	
16, 18	RO Reject	**75.0**	211,352	15,851,413	55.83	
19	Waste from UF Reject Tank	13.9	127,568	1,771,783	33.70	
20, 21	Combined Wastes > Mixer > Thickener	25.7	127,568	3,281,115	33.70	
22	Thickener Decant to Outfall Tank (50%)	12.9	127,568	1,640,558	33.70	
23	Thickener Slurry to Filter Press	12.9	127,568	1,640,558	33.70	
24	Filter Press Filtrate to Outfall Tank (60%)	7.7	127,568	984,335	33.70	
25	Filter Cake Solids to Landfill	5.1	127,568	656,223	33.70	
26	Outfall to Disposal	20.6	127,568	2,624,892	33.70	
					-	**Ratio to Influent Salinity**
	Outfall 001	**95.6**	193,315	18,476,305	**51.07**	1.5154

Calculation of Ambient Salinity and Water Temperature for Water Intake and Discharge Locations

Data to estimate the statistical characteristics of salinity and temperature for the water intake were retrieved from the TCEQ's Surface Water Quality Web Reporting Tool (https://www80.tceq.texas.gov/SwqmisPublic/index.htm) for Station 13468, described as "Gulf of Mexico at Port Aransas." This is the nearest active monitoring station to the proposed water intake. Data collected after Jan. 1, 1999 were used in the analysis. Because data from water profiles were considered a better estimate of the overall temperature and salinity, single near-surface grab samples were excluded from the dataset. Seasons were assigned to sample collection dates by month, with December, January, and February considered to comprise winter, and June July, and August comprising summer. The averages for each water column profile were used in calculation of fifth and ninety-fifth percentiles (below), which were calculated using Microsoft Excel functions.

Salinity and Water Temperature at Station 13468 (Gulf of Mexico at Aransas Pass)

		Salinity (ppt)	Temperature (°C)
Summer	5th Percentile	30.74	26.55
Summer	95th Percentile	39.23	30.71
Winter	5th Percentile	23.54	11.11
Winter	95th Percentile	33.91	18.33

Similarly, ambient salinity and water temperature extremes at the discharge location was estimated from the nearest monitoring station (16492, Aransas Bay in Lydia Ann Channel).

Salinity and Water Temperature at Station 16492 (Aransas Bay in Lydia Ann Channel)

		Salinity (ppt)	Temperature (°C)
Summer	5th Percentile	29.93	27.61
Summer	95th Percentile	40.57	30.56
Winter	5th Percentile	23.24	10.76
Winter	95th Percentile	33.20	17.53

ATTACHMENT 11

Toxicity Test Results in Synthetic Sea Water

Toxicity Test Results in Synthetic Sea Water

Parsons Environment & Infrastructure Inc. (Parsons) contracted with Still Meadows Environmental Toxicology Laboratory in Sugar Land, Texas to conduct toxicity tests which would simulate potential exposure to effluent salinity concentrations. These toxicity tests were conducted on representative Texas species which are utilized for conducting Whole Effluent Toxicity Tests required in Texas Pollutant Discharge Elimination System (TPDES) permits by the Texas Commission on Environmental Quality (TCEQ) and the Region 6 Environmental Protection Agency (EPA). *Menidia Beryllina*, between 7 and 11 days post hatch and *Mysidopsis Bahia* at 7 days old were utilized in the tests as per EPA Methods *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms*. Third Edition, Oct. 2002, (EPA-821-R-02-014) Methods 1006.0 and 1007.0. The 7 day Static Renewal Short Term Chronic Toxicity Tests were conducted between June 11 – 18th, with each species at varying concentrations from 25 (control) to 45 ppt salinity at 5 ppt interval test concentrations utilizing synthetic sea water to simulate exposures to the effluent. These concentrations were selected to represent potential concentrations that may occur within the mixing zone. The tests results are presented below using the laboratory results tables for both survival and sublethal effects (growth) for both species over the 7 day test. In both cases, neither species showed any significant effects on survival or growth at the maximum test condition of 45 ppt salinity or any other lower salinity concentrations.

Table 4. Survival and mean dry weight for *M. beryllina* larvae exposed to test solutions for 7 days

Treatment (ppt)	Percent Survival (by day)				Dry Weight				Significant Effect Relative to Control	
					Original # of Fish		Surviving # of Fish			
	1	2	7	CV (%)	Mean (mg)	CV (%)	Mean (mg)	CV (%)	Survival	Mean Dry Weight[1]
25 (Control)	100	100	100	0.00	0.63	7.48	0.63	7.48		
30	100	100	100	0.00	0.67	6.43	0.67	6.43	NS[2]	NS
35	100	100	100	0.00	0.67	9.56	0.67	9.56	NS	NS
40	100	100	100	0.00	0.67	6.47	0.67	6.47	NS	NS
45	100	100	98	5.73	0.61	7.04	0.63	7.72	NS	NS

[1]Growth analysis for statistically significant effects relative to the control is based on the original number of fish.
[2]NS = Not Statistically Significant

Table 5. Summary of Statistical Endpoints.

Endpoint	Value (ppt)
Survival NOEC (No Observed Effect Concentration)	45
Growth NOEC	45

Table 4. Survival and mean dry weight for *M. bahia* exposed to test solutions for 7 days

Treatment (ppt)	Percent Survival (by day)				Dry Weight				Significant Effect Relative to Control	
					Original # of Mysids		Surviving # of Mysids			
	1	2	7	CV (%)	Mean (mg)	CV (%)	Mean (mg)	CV (%)	Survival	Mean Dry Weight[1]
25 (Control)	98	95	95	9.75	0.42	15.22	0.44	10.03		
30	100	100	100	0.00	0.44	5.55	0.44	5.55	NS[2]	NS
35	100	100	100	0.00	0.45	9.48	0.45	9.48	NS	NS
40	100	100	100	0.00	0.45	10.04	0.45	10.04	NS	NS
45	100	95	95	9.75	0.37	16.29	0.39	18.46	NS	NS

[1]Growth analysis for statistically significant effects relative to the control is based on the original number of fish.
[2]NS = Not Statistically Significant

Table 5. Summary of Statistical Endpoints

Endpoint	Value (ppt)
Survival NOEC (No Observed Effect Concentration)	45
Growth NOEC	45

Study Title

Short-Term Chronic Toxicity of Salinity
To the Inland Silverside (*Menidia beryllina*)
Under Static-Renewal Test Conditions

Performed For

Parsons Environment & Infrastructure Group
9101 Burnet Road, Suite 210
Austin, TX 78758

Project Officer
Randy Palachek

Author
Janelle Mikulas, M.S.

Study Period
11 June 2021 to 21 June 2021

Performing Laboratory

STILLMEADOW
INCORPORATED

Environmental Toxicology Laboratory
12852 Park One Drive
Sugar Land, Texas 77478

Telephone: (281) 240-8828
Fax: (281) 240-8448

Certificate Number T104704352-20-13

Project Number
21-607-001

STATEMENT OF PROCEDURAL COMPLIANCE

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. The information contained herein is accurate and complete.

Janelle Mikulas, M.S. — Date: 23 Jun 21

STATEMENT OF QUALITY ASSURANCE

The report and study data were audited to assure that the study was performed in accordance with STILLMEADOW, Inc. Standard Operating Procedures and regulatory guidelines. This report is an accurate reflection of the raw data.

Quality Assurance Auditor — Date: 23 Jun 21

EXECUTIVE SUMMARY

Objective	The objective of this study was to determine the chronic toxicity of Salinity for Parsons Environment & Infrastructure Group to the inland silverside, *Menidia beryllina*.			
Study Director	Janelle Mikulas, M.S.			
Test Type	7-Day Static Renewal Short Term Chronic Toxicity Test			
Test Method	United States Environmental Protection Agency (EPA-821-R-02-014) (2002) Method 1006.0			
Test Dates (Times)	11 June 2021 (0850) to 18 June 2021 (0942)			
Test Substance	Salt			
Dilution Water	Synthetic Seawater			
Test Concentrations	Control (25 ppt), 30 ppt, 35 ppt, 40 ppt, 45 ppt			
Source of Organisms	STILLMEADOW Inc. Culture Laboratory			
Age of Test Organisms	7-11 days			
Test Acceptability	**Parameter**		**Test Data**	**EPA Criterion**
	Survival	Control	100%	≥80%
		Control CV[1]	0.00%	≤40%
		Highest Salinity CV	5.73%	≤40%
	Growth	Control	0.63 mg	≥0.50 mg
		Control CV	7.48%	≤40%
		Highest Salinity CV	7.04%	≤40%
		PMSD[2]	11.6	---
Test Results	**Parameter**		**Critical Concentration**	**NOEC[3] Test Solution**
	Survival		Pass	45 ppt
	Growth		Pass	45 ppt

[1]CV = Coefficient of Variation
[2]PMSD = Percent Minimum Significant Difference
[3]NOEC = No Observed Effect Concentration

INTRODUCTION

The objective of this study was to determine the chronic toxicity to *Menidia beryllina* larvae of salinity for Parsons Environment & Infrastructure Group. This study is conducted in compliance with Texas Pollution Discharge Elimination System (TPDES) permit requirements; and in accordance with Texas Water Code Chapter 5, Subchapter R, Title 30 Texas Administrative Code Chapter 25 and the National Environmental Laboratory Accreditation Program (NELAP), Certificate Number T104704352-20-13. All original data, laboratory notebooks, and associated documentation are archived by the STILLMEADOW, Inc. Environmental Toxicology Laboratory.

METHODS AND MATERIALS

Test Substance/Dilution Water

Dilution water was synthetic seawater prepared according to USEPA (2002) guidelines. Initial characterization of the dilution and control water is given in Table 1. Dilution water was salted to the appropriate salinity for each test concentration.

Table 1. Chemical characterization of dilution water

Batch/Sample # Synthetic Seawater	Date Prepared	pH (SU)	Salinity (ppt)	Ammonia (mg/L NH_3N)	Total Residual Chlorine (mg/L)
QA21082	10 Jun 21	7.9	26	0.00	0.02
QA21084	14 Jun 21	7.8	24	0.00	0.01

TEST CONDITIONS

The 7-day short-term chronic test using *Menidia beryllina* and subsequent data analyses were carried out according to procedures specified by USEPA (2002) guidelines and STILLMEADOW, Inc. Environmental Toxicology Laboratory's Standard Operating Procedures. Table 2 lists a summary of the test conditions.

Table 2. Summary of test conditions

Organism lot #, Organism Source	AE210174, STILLMEADOW, Inc.
Organism age	7-11 days
Organisms per replicate	8
Replicates per concentration	5
Volume of test solution	500 mL
Test chamber	800-mL polystyrene beaker
Test temperature	25±1°C
Test duration	7 days
Dissolved oxygen	≥ 60% saturation
Photoperiod	16 L/ 8 D
Light intensity	50 – 100 ft c
Feeding regimen	twice daily, concentrated *Artemia* nauplii

Procedures

Test solutions (solutions for test renewals) were prepared daily at the STILLMEADOW, Inc. Environmental Toxicology Laboratory. The solutions were used for the renewals the day they were prepared.

Dissolved oxygen, salinity, pH, and temperature were measured in each treatment at the beginning and end of each 24-hour exposure period. Chamber temperature was also monitored daily. Aeration was not employed. The animals were fed twice daily during the test.

Test solutions were renewed by gently pouring old solutions out of the test beakers and replacing with new test solutions. During the renewal the larvae remained in the beaker along with approximately 20% of the old test solution.

At test initiation, at each renewal, and at test termination, the total number of live larvae was recorded for each test chamber. The unpreserved larvae from each test beaker were transferred to tared weigh boats at test termination and dried at 100-105°C for a minimum of 6 hours. The dried larvae were weighed to the nearest 0.001mg for determination of growth effects.

DATA ANALYSIS

All data were analyzed according to the statistical flow chart outlined in the EPA chronic testing manual (USEPA 2002). Table 3 lists the methods that were used in the analyses of the normality and homogeneity tests. A printout of statistical results is included in Appendix A.

TOXCALC™ Version 5.0 was used for all statistical evaluations. Survival and growth data were analyzed using hypothesis-testing techniques.

Table 3. Statistical methods used to analyze data for the toxicity test.

Endpoint	Comparison	Procedure
Survival	Transformation	Arc Sine $(y)^{1/2}$
	Normality	Shapiro-Wilk's Test ($\alpha \leq 0.01$)
	Homogeneity of Variances	Cannot Be Confirmed
	Reduction Relative to Control	Steel's Many-One Rank Test ($\alpha=0.05$)
Growth (Mean Dry Weight)	Transformation	No Transformation
	Normality	Shapiro-Wilk's Test ($\alpha \leq 0.01$)
	Homogeneity of Variances	Bartlett's Test ($\alpha \leq 0.01$)
	Reduction Relative to Control	Dunnett's Test ($\alpha=0.05$)

RESULTS

Survival and growth (mean dry weight) data for test organisms are provided in Table 4. Survival and mean dry weight at each concentration were compared to survival and weight of the control to determine statistically significant effects. The results of these comparisons are given in Table 5. Salinity over the course of the test is given in Table 6.

Table 4. Survival and mean dry weight for *M. beryllina* larvae exposed to test solutions for 7 days

Treatment (ppt)	Percent Survival (by day)				Dry Weight				Significant Effect Relative to Control	
					Original # of Fish		Surviving # of Fish			
	1	2	7	CV (%)	Mean (mg)	CV (%)	Mean (mg)	CV (%)	Survival	Mean Dry Weight[1]
25 (Control)	100	100	100	0.00	0.63	7.48	0.63	7.48		
30	100	100	100	0.00	0.67	6.43	0.67	6.43	NS[2]	NS
35	100	100	100	0.00	0.67	9.56	0.67	9.56	NS	NS
40	100	100	100	0.00	0.67	6.47	0.67	6.47	NS	NS
45	100	100	98	5.73	0.61	7.04	0.63	7.72	NS	NS

[1]Growth analysis for statistically significant effects relative to the control is based on the original number of fish.
[2]NS = Not Statistically Significant

Table 5. Summary of Statistical Endpoints.

Endpoint	Value (ppt)
Survival NOEC (No Observed Effect Concentration)	45
Growth NOEC	45

Table 6. Summary of Salinity.

Test Conc.	Salinity (parts per thousand)													
	Day 0	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7
	New	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	Old
25	25	24	25	25	25	24	24	24	24	25	25	26	26	26
30	30	30	31	30	31	30	30	29	29	30	31	30	31	30
35	35	35	36	35	36	35	35	34	34	35	36	35	36	36
40	40	40	41	40	41	40	40	40	40	40	41	40	40	41
45	45	45	46	45	46	46	45	44	44	45	46	45	46	46

REFERENCE TOXICANT TEST RESULTS

STILLMEADOW, Inc. conducts routine standard reference toxicant testing using *Menidia beryllina* obtained from STILLMEADOW, Inc. cultures. Sodium Dodecyl Sulfate (SDS) is used as the reference toxicant with synthetic seawater as the dilution water; the test method followed is USEPA method 1006.0 (USEPA, 2002). A copy of STILLMEADOW, Inc.'s most recent standard reference toxicant control chart for this species is presented in Appendix B.

STUDY DEVIATIONS

No deviations from the prescribed guidelines or standard operating procedures were identified during the study.

REFERENCES

U.S. Environmental Protection Agency (USEPA). 2002. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms*. Third Edition, October 2002. EPA-821-R-02-014.

Ives, Michael A. TOXCALC™ Version 5.0. 1994. TidePool Scientific Software. McKinleyville, California.

APPENDIX A

Statistical Analysis

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	6/11/2021	Test ID:	21-607-001	Sample ID:	Salt
End Date:	6/18/2021	Lab ID:	QA21082, 84	Sample Type:	
Sample Date:		Protocol:	EPA-821-R-02-014	Test Species:	MB-Menidia beryllina
Comments:					

Conc-ppt	1	2	3	4	5
:ontrol (25 ppt)	1.0000	1.0000	1.0000	1.0000	1.0000
30	1.0000	1.0000	1.0000	1.0000	1.0000
35	1.0000	1.0000	1.0000	1.0000	1.0000
40	1.0000	1.0000	1.0000	1.0000	1.0000
45	1.0000	0.8750	1.0000	1.0000	1.0000

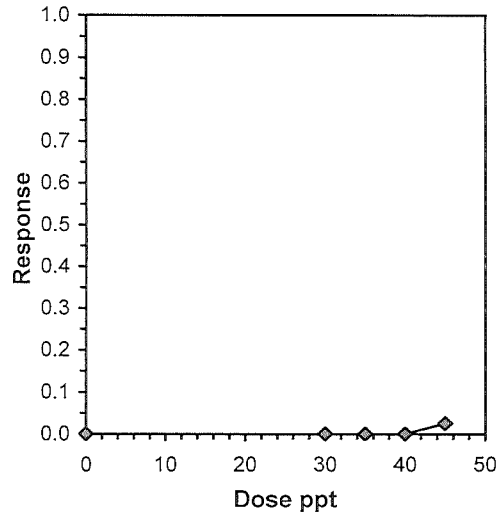
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-ppt	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
:ontrol (25 ppt)	1.0000	1.0000	1.3931	1.3931	1.3931	0.000	5			1.0000	1.0000
30	1.0000	1.0000	1.3931	1.3931	1.3931	0.000	5	27.50	17.00	1.0000	1.0000
35	1.0000	1.0000	1.3931	1.3931	1.3931	0.000	5	27.50	17.00	1.0000	1.0000
40	1.0000	1.0000	1.3931	1.3931	1.3931	0.000	5	27.50	17.00	1.0000	1.0000
45	0.9750	0.9750	1.3564	1.2094	1.3931	6.055	5	25.00	17.00	0.9750	0.9750

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.4503	0.888	-3.5721	16.6245
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	45	>45		

Linear Interpolation (200 Resamples)

Point	ppt	SD	95% CL(Exp)	Skew
IC05	>45			
IC10	>45			
IC15	>45			
IC20	>45			
IC25	>45			
IC40	>45			
IC50	>45			



ToxCalc v5.0.23

Reviewed by: 6/22/2021
6/23/2021

Larval Fish Growth and Survival Test-7 Day Biomass

Start Date:	6/11/2021	Test ID:	21-607-001	Sample ID:	Salt
End Date:	6/18/2021	Lab ID:	QA21082, 84	Sample Type:	
Sample Date:		Protocol:	EPA-821-R-02-014	Test Species:	MB-Menidia beryllina
Comments:					

Conc-ppt	1	2	3	4	5
;ontrol (25 ppt)	0.6104	0.6479	0.6055	0.5769	0.6988
30	0.6834	0.6290	0.6231	0.7005	0.7198
35	0.7134	0.5978	0.7216	0.7094	0.5991
40	0.7166	0.7131	0.6173	0.6436	0.6643
45	0.6241	0.5888	0.6353	0.5475	0.6568

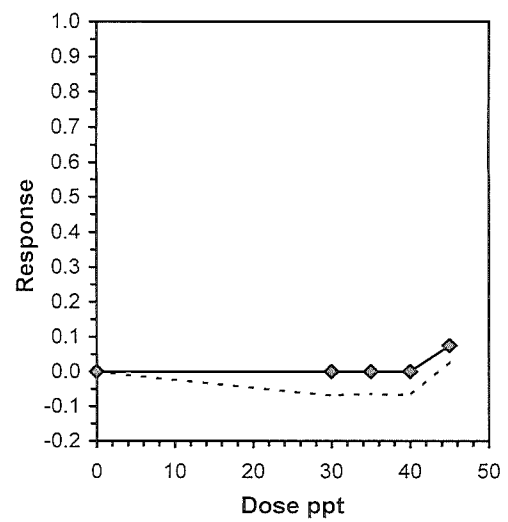
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-ppt	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
;ontrol (25 ppt)	0.6279	1.0000	0.6279	0.5769	0.6988	7.484	5				0.6596	1.0000
30	0.6712	1.0689	0.6712	0.6231	0.7198	6.433	5	-1.404	2.300	0.0709	0.6596	1.0000
35	0.6683	1.0643	0.6683	0.5978	0.7216	9.560	5	-1.310	2.300	0.0709	0.6596	1.0000
40	0.6710	1.0686	0.6710	0.6173	0.7166	6.471	5	-1.398	2.300	0.0709	0.6596	1.0000
45	0.6105	0.9723	0.6105	0.5475	0.6568	7.036	5	0.564	2.300	0.0709	0.6105	0.9256

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9216	0.888	-0.1773	-1.4047
Bartlett's Test indicates equal variances (p = 0.92)	0.94859	13.2767		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	45	>45			0.07091	0.11294	0.00409	0.00238	0.18492	4, 20

Linear Interpolation (200 Resamples)

Point	ppt	SD	95% CL(Exp)	Skew
IC05	43.359			
IC10	>45			
IC15	>45			
IC20	>45			
IC25	>45			
IC40	>45			
IC50	>45			



ToxCalc v5.0.23

Reviewed by: JM 22Jun21

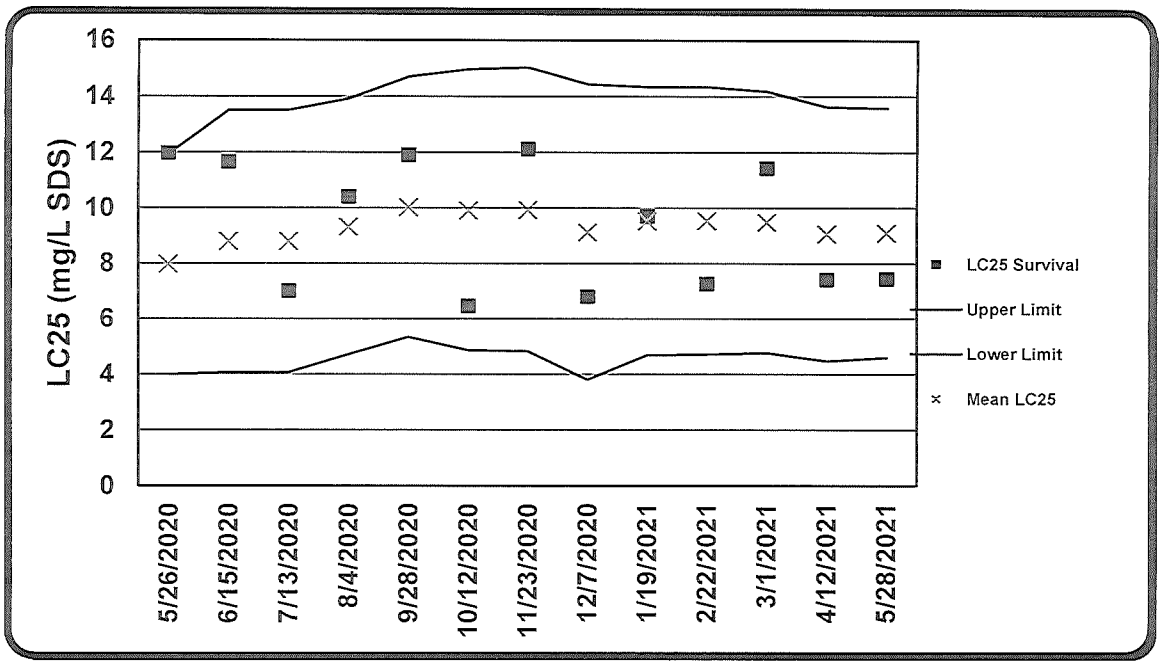
EL 23Jun21

APPENDIX B

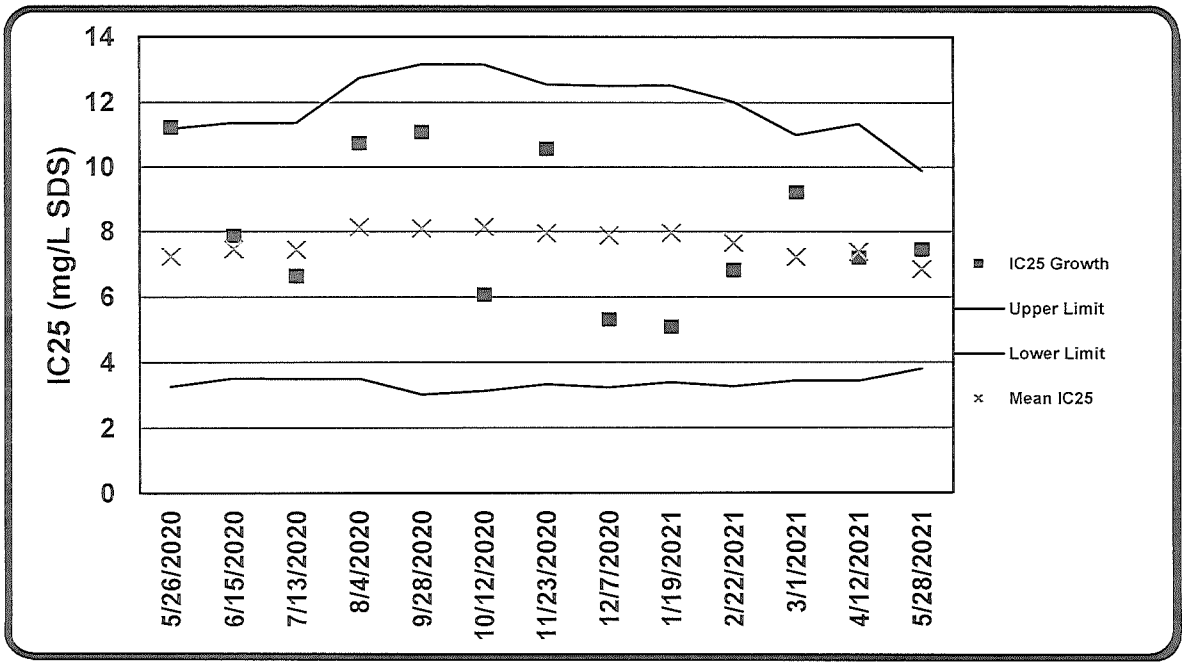
Standard Reference Toxicant Control Charts

Menidia beryllina Short-Term Chronic Standard Reference Toxicant Control Charts

LC25 (mg/L SDS) Survival



IC25 (mg/L SDS) Growth



Study Title

Short-Term Chronic Toxicity of Salinity
To the Mysid Shrimp (*Mysidopsis bahia*)
Under Static-Renewal Test Conditions

Performed For
Parsons Environment & Infrastructure Group
9101 Burnet Road, Suite 210
Austin, TX 78758

Project Officer
Randy Palachek

Author
Janelle Mikulas, M.S.

Study Period
11 June 2021 to 21 June 2021

Performing Laboratory

STILLMEADOW
INCORPORATED

Environmental Toxicology Laboratory
12852 Park One Drive
Sugar Land, Texas 77478

Telephone: (281) 240-8828
Fax: (281) 240-8448

Certificate Number T104704352-20-13

Project Number
21-607-002

STATEMENT OF PROCEDURAL COMPLIANCE

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. The information contained herein is accurate and complete.

Janelle Mikulas, M.S. — Date: 23 Jun 21

STATEMENT OF QUALITY ASSURANCE

The report and study data were audited to assure that the study was performed in accordance with STILLMEADOW, Inc. Standard Operating Procedures and regulatory guidelines. This report is an accurate reflection of the raw data.

Quality Assurance Auditor — Date: 23 Jun 21

EXECUTIVE SUMMARY

Objective	The objective of this study was to determine the chronic toxicity of Salinity for Parsons Environment & Infrastructure Group to the Mysid shrimp, *Mysidopsis bahia*.			
Study Director	Janelle Mikulas, M.S.			
Test Type	7-Day Static Renewal Short Term Chronic Toxicity Test			
Test Method	United States Environmental Protection Agency (EPA-821-R-02-014) (2002) Method 1007.0			
Test Dates (Times)	11 June 2021 (1110) to 18 June 2021 (0915)			
Test Substance	Salt			
Dilution Water	Synthetic Seawater			
Test Concentrations	Control (25 ppt), 30 ppt, 35 ppt, 40 ppt, 45 ppt			
Source of Organisms	STILLMEADOW, Inc. Culture Laboratory			
Age of Test Organisms	7 days			
Test Acceptability	**Parameter**		**Test Data**	**EPA Criterion**
	Survival	Control	95%	≥80%
		Control CV[1]	9.75%	≤40%
		Highest Salinity CV	9.75%	≤40%
	Growth	Control	0.44 mg	≥0.20 mg
		Control CV	15.22%	≤40%
		Highest Salinity CV	16.29%	≤40%
		PMSD[2]	13.6	---
Test Results	**Parameter**		**Critical Concentration**	**NOEC[3] Test Solution**
	Survival		Pass	45 ppt
	Growth		Pass	45 ppt

[1]CV = Coefficient of Variation
[2]PMSD = Percent Minimum Significant Difference
[3]NOEC = No Observed Effect Concentration

INTRODUCTION

The objective of this study was to determine the chronic toxicity to *Mysidopsis bahia* larvae of salinity for Parsons Environment & Infrastructure Group. This study is conducted in compliance with Texas Pollution Discharge Elimination System (TPDES) permit requirements; and in accordance with Texas Water Code Chapter 5, Subchapter R, Title 30 Texas Administrative Code Chapter 25 and the National Environmental Laboratory Accreditation Program (NELAP), Certificate Number T104704352-20-13. All original data, laboratory notebooks, and associated documentation are archived by the STILLMEADOW, Inc. Environmental Toxicology Laboratory.

METHODS AND MATERIALS

Test Substance

Test Substance/Dilution Water

Dilution water was synthetic seawater prepared according to USEPA (2002) guidelines. Initial characterization of the dilution and control water is given in Table 1. Dilution water was salted to the appropriate salinity for each test concentration.

Table 1. Chemical characterization of dilution water

Batch/Sample # Synthetic Seawater	Date Prepared	pH (SU)	Salinity (ppt)	Ammonia (mg/L NH_3N)	Total Residual Chlorine (mg/L)
QA21082	10 Jun 21	7.9	26	0.00	0.02
QA21084	14 Jun 21	7.8	24	0.00	0.01

TEST CONDITIONS

The 7-day short-term chronic test using *Mysidopsis bahia* and subsequent data analyses were carried out according to procedures specified by USEPA (2002) guidelines and STILLMEADOW, Inc. Environmental Toxicology Laboratory's Standard Operating Procedures. Table 2 lists a summary of the test conditions.

Table 2. Summary of test conditions

Organism lot #, Organism Source	AE210173, STILLMEADOW, Inc.
Organism age	7 days
Organisms per replicate	5
Replicates per concentration	8
Volume of test solution	300 mL
Test chamber	400-mL polystyrene beaker
Test temperature	26 ± 1 °C
Test duration	7 days
Dissolved oxygen	≥ 60% saturation
Photoperiod	16 L/ 8 D
Light intensity	50 – 100 ft c
Feeding regimen	twice daily, concentrated *Artemia* nauplii

Procedures

Test solutions (solutions for test renewals) were prepared daily at the STILLMEADOW, Inc. Environmental Toxicology Laboratory. The solutions were used for the renewals the day they were prepared.

Dissolved oxygen, salinity, pH, and temperature were measured in each treatment at the beginning and end of each 24-hour exposure period. Chamber temperature was also monitored daily. Aeration was not employed and the animals were fed twice daily during the test.

Test solutions were renewed by gently pouring old solutions out of the test beakers and replacing with new test solutions. During the renewal the larvae remained in the beaker along with approximately 20% of the old test solution.

At test initiation, at each renewal, and at test termination, the total number of live mysids was recorded for each test chamber. The unpreserved mysids from each test beaker were transferred to tared weigh boats at test termination and dried at 100-105°C for a minimum of 6 hours. The dried mysids were weighed to the nearest 0.001mg for determination of growth effects

DATA ANALYSIS

All data were analyzed according to the statistical flow chart outlined in the EPA chronic testing manual (USEPA 2002). Table 3 lists the methods that were used in the analyses of the normality and homogeneity tests. A printout of statistical results is included in Appendix A.

TOXCALC™ Version 5.0 was used for all statistical evaluations. Survival and growth data were analyzed using hypothesis-testing techniques.

Table 3. Statistical methods used to analyze data for the toxicity test.

Endpoint	Comparison	Procedure
Survival	Transformation	Arc Sine $(y)^{1/2}$
	Normality	Shapiro-Wilk's Test ($\alpha \leq 0.01$)
	Homogeneity of Variances	Cannot Be Confirmed
	Reduction Relative to Control	Steel's Many-One Rank Test ($\alpha=0.05$)
Growth (Mean Dry Weight)	Transformation	No Transformation
	Normality	Shapiro-Wilk's Test ($\alpha \leq 0.01$)
	Homogeneity of Variances	Bartlett's Test ($\alpha \leq 0.01$)
	Reduction Relative to Control	Dunnett's Test ($\alpha=0.05$)

RESULTS

Survival and growth (mean dry weight) data for test organisms are provided in Table 4. Survival and mean dry weight at each concentration were compared to survival and weight of the control to determine statistically significant effects. The results of these comparisons are given in Table 5. Salinity over the course of the test is given in Table 6.

Table 4. Survival and mean dry weight for *M. bahia* exposed to test solutions for 7 days

Treatment (ppt)	Percent Survival (by day)				Dry Weight				Significant Effect Relative to Control	
					Original # of Mysids		Surviving # of Mysids			
	1	2	7	CV (%)	Mean (mg)	CV (%)	Mean (mg)	CV (%)	Survival	Mean Dry Weight[1]
25 (Control)	98	95	95	9.75	0.42	15.22	0.44	10.03		
30	100	100	100	0.00	0.44	5.55	0.44	5.55	NS[2]	NS
35	100	100	100	0.00	0.45	9.48	0.45	9.48	NS	NS
40	100	100	100	0.00	0.45	10.04	0.45	10.04	NS	NS
45	100	95	95	9.75	0.37	16.29	0.39	18.46	NS	NS

[1]Growth analysis for statistically significant effects relative to the control is based on the original number of fish.
[2]NS = Not Statistically Significant

Table 5. Summary of Statistical Endpoints

Endpoint	Value (ppt)
Survival NOEC (No Observed Effect Concentration)	45
Growth NOEC	45

Table 6. Summary of Salinity.

Test Conc.	Salinity (parts per thousand)													
	Day 0	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7
	New	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	Old
25	25	24	26	25	25	24	25	24	24	25	25	26	26	26
30	30	30	31	30	31	30	30	29	29	30	31	30	31	30
35	35	35	36	35	36	35	35	34	34	35	36	35	36	36
40	40	40	41	40	41	40	40	40	41	40	41	40	41	41
45	45	45	46	45	46	46	45	44	46	45	46	45	45	46

REFERENCE TOXICANT TEST RESULTS

STILLMEADOW, Inc. conducts routine standard reference toxicant testing using *Mysidopsis bahia* obtained from STILLMEADOW, Inc. cultures. Sodium Dodecyl Sulfate (SDS) is used as the reference toxicant with synthetic seawater as the dilution water; the test method followed is USEPA method 1007.0 (USEPA, 2002). A copy of STILLMEADOW, Inc.'s most recent standard reference toxicant control chart for this species is presented in Appendix B.

STUDY DEVIATIONS

No deviations from the prescribed guidelines or standard operating procedures were identified during the study.

REFERENCES

U.S. Environmental Protection Agency (USEPA). 2002. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms*. Third Edition, October 2002. EPA-821-R-02-014.

Ives, Michael A. TOXCALC™ Version 5.0. 1994. TidePool Scientific Software. McKinleyville, California.

APPENDIX A

Statistical Analysis

Mysid Survival, Growth and Fecundity Test-7 Day Survival

Start Date:	6/11/2021	Test ID:	21-607-002	Sample ID:	Salt
End Date:	6/18/2021	Lab ID:	QA21082, 84	Sample Type:	
Sample Date:		Protocol:	EPA-821-R-02-014	Test Species:	MY-Mysidopsis bahia
Comments:					

Conc-ppt	1	2	3	4	5	6	7	8
ontrol (25 ppt)	1.0000	0.8000	0.8000	1.0000	1.0000	1.0000	1.0000	1.0000
30	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
35	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
40	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
45	1.0000	1.0000	1.0000	1.0000	0.8000	0.8000	1.0000	1.0000

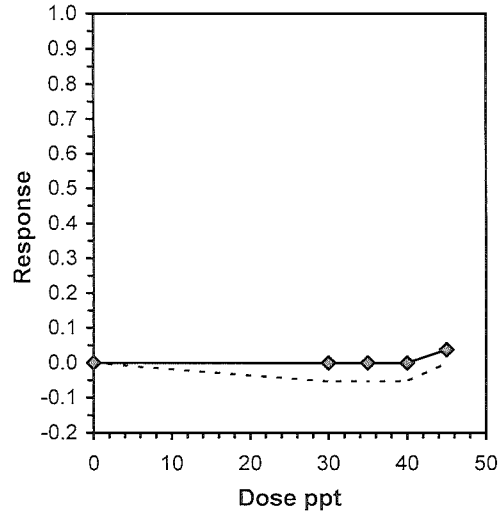
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-ppt	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
ontrol (25 ppt)	0.9500	1.0000	1.2857	1.1071	1.3453	8.574	8			0.9875	1.0000
30	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	8	76.00	47.00	0.9875	1.0000
35	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	8	76.00	47.00	0.9875	1.0000
40	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	8	76.00	47.00	0.9875	1.0000
45	0.9500	1.0000	1.2857	1.1071	1.3453	8.574	8	68.00	47.00	0.9500	0.9620

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.63802	0.919	-1.8977	3.38869
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	45	>45		

Linear Interpolation (200 Resamples)

Point	ppt	SD	95% CL	Skew
IC05	>45			
IC10	>45			
IC15	>45			
IC20	>45			
IC25	>45			
IC40	>45			
IC50	>45			



ToxCalc v5.0.23

Reviewed by: JM 22 Jun 21

Mysid Survival, Growth and Fecundity Test-Biomass

Start Date:	6/11/2021	Test ID:	21-607-002	Sample ID:	Salt
End Date:	6/18/2021	Lab ID:	QA21082, 84	Sample Type:	
Sample Date:		Protocol:	EPA-821-R-02-014	Test Species:	MY-Mysidopsis bahia
Comments:					

Conc-ppt	1	2	3	4	5	6	7	8
ontrol (25 ppt)	0.5266	0.3564	0.3238	0.4144	0.4392	0.4218	0.4614	0.3826
30	0.4582	0.4662	0.4352	0.4298	0.4574	0.3922	0.4240	0.4536
35	0.4478	0.4316	0.4600	0.4502	0.5252	0.4556	0.4882	0.3756
40	0.3640	0.4326	0.5096	0.4734	0.4624	0.4526	0.4968	0.4306
45	0.3906	0.3426	0.3802	0.3600	0.3974	0.3190	0.4682	0.2670

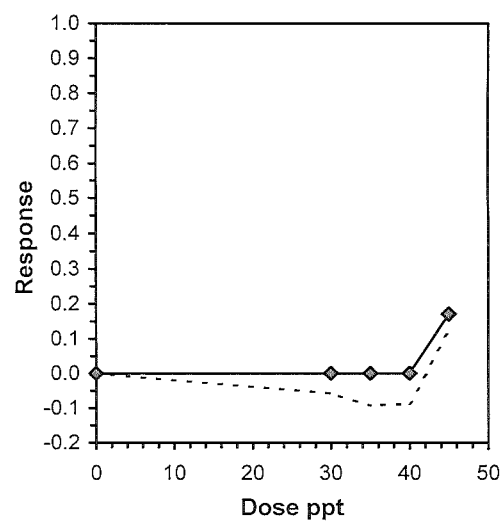
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-ppt	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
ontrol (25 ppt)	0.4158	1.0000	0.4158	0.3238	0.5266	15.221	8				0.4406	1.0000
30	0.4396	1.0572	0.4396	0.3922	0.4662	5.554	8	-0.969	2.239	0.0550	0.4406	1.0000
35	0.4543	1.0926	0.4543	0.3756	0.5252	9.479	8	-1.567	2.239	0.0550	0.4406	1.0000
40	0.4528	1.0889	0.4528	0.3640	0.5096	10.040	8	-1.505	2.239	0.0550	0.4406	1.0000
45	0.3656	0.8794	0.3656	0.2670	0.4682	16.289	8	2.042	2.239	0.0550	0.3656	0.8298

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9658	0.919	-0.0314	0.58143
Bartlett's Test indicates equal variances (p = 0.19)	6.13519	13.2767		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	45	>45			0.05499	0.13226	0.0109	0.00241	0.00479	4, 35

Linear Interpolation (200 Resamples)

Point	ppt	SD	95% CL		Skew
IC05	41.469	0.771	39.510	42.436	-2.1035
IC10	42.939				
IC15	44.408				
IC20	>45				
IC25	>45				
IC40	>45				
IC50	>45				



ToxCalc v5.0.23

Reviewed by: JM 22Jun21

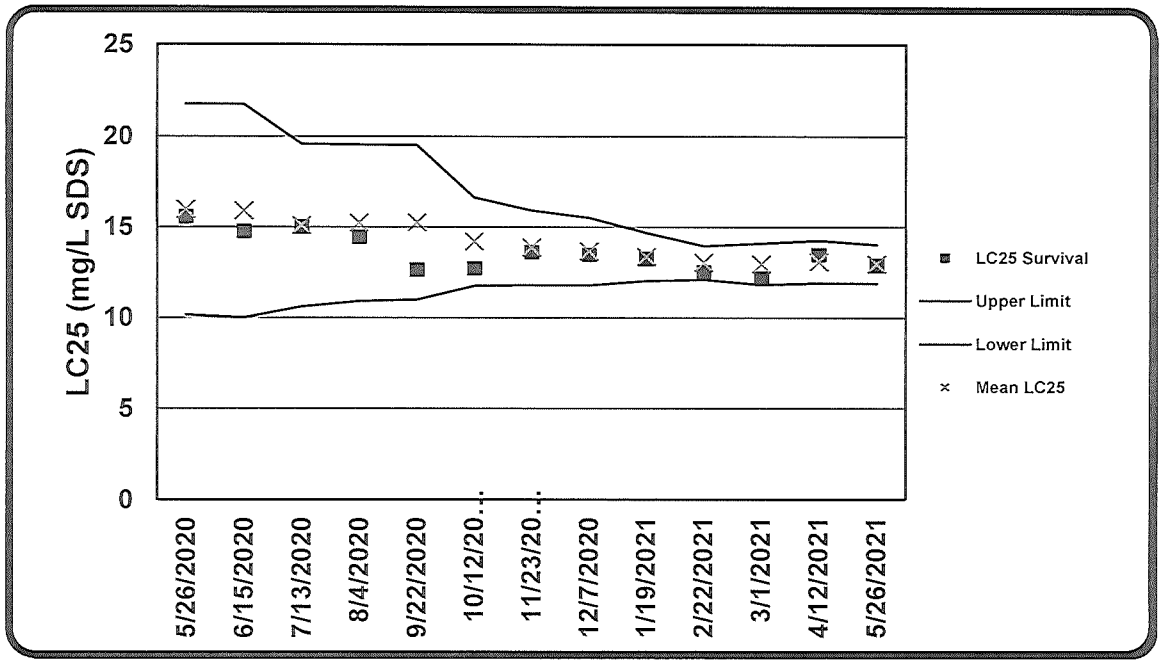
tmv EL 23Jun21

APPENDIX B

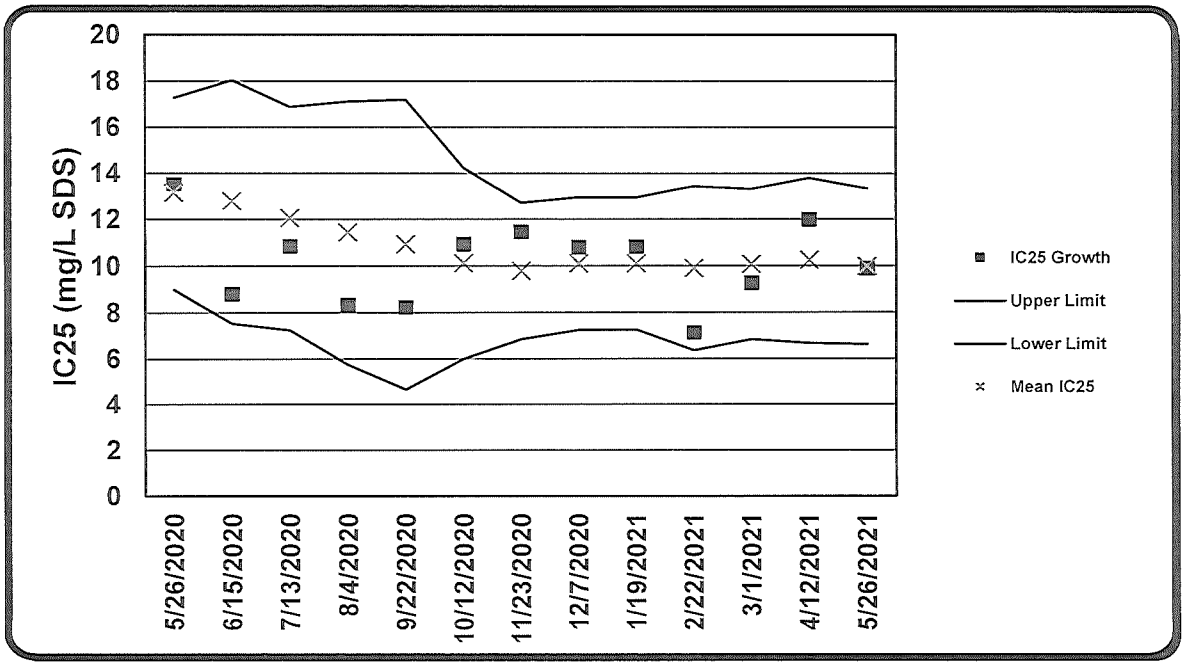
Standard Reference Toxicant Control Charts

Mysidopsis bahia Short-Term Chronic Standard Reference Toxicant Control Charts

LC25 (mg/L SDS) Survival



IC25 (mg/L SDS) Growth



SOAH DOCKET NO. 582-20-1895
TCEQ DOCKET NO. 2019-1156-IWD

IN THE MATTER OF THE APPLICATION OF PORT OF CORPUS CHRISTI AUTHORITY OF NUECES COUNTY FOR TPDES PERMIT NO. WQ0005253000	**§ § § § §**	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

PORT OF CORPUS CHRISTI AUTHORITY OF NUECES COUNTY'S AMENDED DESIGNATION OF EXPERTS

TO: Port Aransas Conservancy, by and through its attorneys, Craig Bennett and Sue D. Ayers, Jackson Walker LLP, 1000 Congress Avenue, Suite 1100, Austin, Texas 78701 and Richard Lowerre, Perales, Allmon & Ice, P.C., 1206 San Antonio, Austin, Texas 78701 and all other Protestants.

Applicant Port of Corpus Christi Authority of Nueces County ("Port Authority") serves this Amended Designation of Experts pursuant to Texas Rule of Civil Procedure 194.2(f).

Respectfully submitted,

BAKER • WOTRING LLP

/s/ Earnest W. Wotring
Earnest W. Wotring
State Bar No. 22012400
Debra Tsuchiyama Baker
State Bar No. 15089600
John Muir
State Bar No. 14630477
700 JPMorgan Chase Tower
600 Travis Street
Houston, Texas 77002
Telephone: (713) 980-1700
Facsimile: (713) 980-1701
dbaker@bakerwotring.com
ewotring@bakerwotring.com
jmuir@bakerwotring.com

ATTORNEYS FOR
PORT OF CORPUS CHRISTI AUTHORITY
OF NUECES COUNTY

CERTIFICATE OF SERVICE

I certify that on June 25, 2021, a true and correct copy of the foregoing was sent *via* e-mail to all parties and through electronic service.

/s/ Earnest W. Wotring
Earnest W. Wotring

PORT AUTHORITY'S AMENDED DESIGNATION OF EXPERTS

A. Randy Palachek
Parsons Environment & Infrastructure Group Inc.
2200 West Loop South, Suite 200
Houston, Texas 77027
(713) 871-7000

(1) the subject matter on which the expert will testify;

Mr. Palachek will testify based upon his experience, training, and education and the materials reviewed regarding whether the discharge from the Proposed Facility in the Revised Application will adversely impact: i) the marine environment, aquatic life, wildlife, including birds and endangered or threatened species, spawning eggs and larval migration; ii) fish and other seafood; iii) human consumption of fish and other seafood; and iv) recreational activities, commercial fishing, fisheries in Corpus Christi Bay and the ship channel. He will testify regarding the information in Parson's Field Sampling Technical Memorandum. He will testify on whether the revised modeling complies with applicable regulations to ensure the draft permit is protective of water quality. He will also testify regarding whether the Revised Application and its contents are complete and accurate. He will testify on whether the draft permit is consistent with the Texas Coastal Management Program's goals and policies and includes all appropriate and necessary requirements. He will also respond to any criticisms and expert opinions of those experts designated by the Port Aransas Conservancy ("PAC") or any other parties opposing the issuance of the permit, and he will address his qualifications and bases for offering his opinions in this matter.

(2) the general substance of the expert's mental impressions and opinions and a brief summary of the basis for them, or if the expert is not retained by, employed by, or otherwise subject to the control of the responding party, documents reflecting such information;

Mr. Palachek will testify regarding his qualifications to offer expert opinions in this matter. He will testify that his opinions are based upon reliable information, data, and evidence, and that his opinions are reliable and are based upon reasonable analysis and commonly accepted methods for experts within his field of expertise. The bases for Mr. Palachek's testimony are his education, training, and professional experience, the documents he reviewed in connection with this matter, the depositions in this matter, and other discovery exchanged among the parties.

Mr. Palachek will testify that the discharge from the Proposed Facility in the Revised Application will not adversely affect: i) the marine environment, aquatic life, wildlife, including birds and endangered or threatened species, spawning eggs and larval migration; ii) fish and other seafood; iii) human consumption of fish and other seafood; and iv) recreational activities, commercial fishing, fisheries in Corpus Christi Bay and the ship channel. He will testify that the revised modeling complies with applicable regulations to ensure the draft permit is protective of water quality. He will also testify that the Revised Application and its contents are complete and accurate. He will testify that the draft permit is consistent with the Texas Coastal Management

Program's goals and policies and includes all appropriate and necessary requirements. He disagrees with the expert opinions from PAC's experts that the issuance of the permit requires additional studying or assessment to be protective of the environment or human health outside the terms of the draft permit itself. Mr. Palachek will testify regarding the data collection provided in the Parson's Field Sampling Technical Memorandum and his interpretation of that data. Mr. Palachek will address the draft permit's specific requirements for additional testing and monitoring to ensure that any outfall from the proposed Facility in the Revised Application will be protective of human health and the environment. He will respond to any specific criticisms and expert opinions of those experts designated by PAC or any other parties opposing the issuance of the permit, including but not limited to comments submitted by PAC's designated experts. Mr. Palachek will testify that he is qualified to offer opinions in this matter.

Mr. Palachek reserves the right to offer opinions regarding any issues within his expertise raised by PAC's experts or the experts for any party opposing the permit. Mr. Palachek also reserves the right to supplement his opinions on the basis of additional information made available or any changes to the draft permit after the date of this designation.

(3) if the expert is retained by, employed by, or otherwise subject to the control of the responding party:

(A) all documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony; and

The documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony have been produced or are available for inspection and copying at a mutually agreeable time.

The documents provided to, reviewed by, or prepared by or for Mr. Palachek include the following:

- All documents produced by Protestant PAC in connection with its disclosure of experts in SOAH Docket No. 582-20-1895;
- All documents produced by the Port of Corpus Christi Authority in SOAH Docket No. 582-20-1895;
- Administrative Record Exhibits AR-1 through AR-8;
- The transcript and exhibits to the deposition of Katie Cunningham in SOAH Docket No. 582-20-1895;
- The documents produced by the Office of the Executive Director of the TCEQ in SOAH Docket No. 582-20-1895; and
- The documents found at: https://bakerwotring.sharefile.com/i/id716c41edfe422a8

(B) the expert's current resume and bibliography.

Please refer to Mr. Palachek's CV, which is attached as Exhibit A.

B. Kirk Dean, PhD, PE
Parsons Environment & Infrastructure Group Inc.
9101 Burnet Rd. # 210
Austin, Texas 78758
(512) 719-6000

(1) the subject matter on which the expert will testify;

Dr. Dean will testify based upon his experience, training, and education and the materials reviewed regarding the information in Parson's Field Sampling Technical Memorandum and the temperature, salinity and density data utilized in connection with the revised CORMIX modeling.

(2) the general substance of the expert's mental impressions and opinions and a brief summary of the basis for them, or if the expert is not retained by, employed by, or otherwise subject to the control of the responding party, documents reflecting such information;

Dr. Dean will testify regarding his qualifications to offer expert opinions in this matter. He will testify that his opinions are based upon reliable information, data, and evidence, and that his opinions are reliable and are based upon reasonable analysis and commonly accepted methods for experts within his field of expertise. The bases for Dr. Dean's testimony are his education, training, and professional experience, the documents he reviewed, and field testing performed in connection with this matter.

Dr. Dean will testify regarding the methods used to collect the data in Parsons's Field Sampling Technical Memorandum and his interpretation of that data and the methods for the statistical analysis of the temperature, salinity and density data utilized in connection with the revised CORMIX modeling.

He will respond to any specific criticisms and expert opinions of those experts designated by PAC or any other parties opposing the issuance of the permit regarding the subject matter of his opinions. Dr. Dean will testify that he is qualified to offer opinions in this matter.

Dr. Dean reserves the right to offer opinions regarding any issues within his expertise raised by PAC's experts or the experts for any party opposing the permit. Dr. Dean also reserves the right to supplement his opinions on the basis of additional information made available or any changes to the draft permit after the date of this designation.

(3) if the expert is retained by, employed by, or otherwise subject to the control of the responding party:

(A) all documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony; and

The documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony have been produced or are available for inspection and copying at a mutually agreeable time.

The documents provided to, reviewed by, or prepared by or for Dr. Dean include the following:

- The data from SWQM stations 16492 and 13468;
- ADCP hardware and software manuals;
- The documents found at: https://bakerwotring.sharefile.com/i/id716c41edfe422a8

(B) the expert's current resume and bibliography.

Please refer to Dr. Dean's CV, which is attached as Exhibit B.

C. Lial Tischler, PhD, PE, BCEE
Tischler/Kocurek
107 S Mays Street
Round Rock, Texas 78664
(512) 244-9058

(1) the subject matter on which the expert will testify;

Dr. Tischler will testify based upon his experience, training, and education and the materials reviewed regarding whether the discharge from the Proposed Facility in the Revised Application will adversely impact: i) the marine environment, aquatic life, wildlife, including birds and endangered or threatened species, spawning eggs and larval migration; ii) fish and other seafood; iii) human consumption of fish and other seafood; and iv) recreational activities, commercial fishing, fisheries in Corpus Christi Bay and the ship channel. He will testify regarding the redesign of the diffuser for the desalination facility to account for the ambient tidal velocity and local bathymetry and the updated modeling he performed and whether the updated modeling complies with applicable regulations to ensure the draft permit is protective of water quality, including utilizing accurate inputs. He will also testify regarding whether the Revised Application and its contents are complete and accurate. He will testify on whether the draft permit is consistent with the Texas Coastal Management Program's goals and policies and includes all appropriate and necessary requirements. He will also respond to any criticisms and expert opinions of those experts designated by the PAC or any other parties opposing the issuance of the permit, and he will address his qualifications and bases for offering his opinions in this matter.

(2) the general substance of the expert's mental impressions and opinions and a brief summary of the basis for them, or if the expert is not retained by, employed by, or otherwise subject to the control of the responding party, documents reflecting such information;

Dr. Tischler will testify regarding his qualifications to offer expert opinions in this matter. He will testify that his opinions are based upon reliable information, data, and evidence, and that his opinions are reliable and are based upon reasonable analysis and commonly accepted methods

for experts within his field of expertise. The bases for Dr. Tischler's testimony are his education, training, and professional experience, the documents he reviewed in connection with this matter, the depositions in this matter, and other discovery exchanged among the parties.

Dr. Tischler will testify that the discharge from the Proposed Facility in the Revised Application will not adversely affect: i) the marine environment, aquatic life, wildlife, including birds and endangered or threatened species, spawning eggs and larval migration; ii) fish and other seafood; iii) human consumption of fish and other seafood; and iv) recreational activities, commercial fishing, fisheries in Corpus Christi Bay and the ship channel. He will testify that the revised modeling which he performed complies with applicable regulations to ensure the draft permit is protective of water quality, including utilizing accurate inputs. He will also testify that the Revised Application and its contents are complete and accurate. He will testify that the draft permit is consistent with the Texas Coastal Management Program's goals and policies and includes all appropriate and necessary requirements. He disagrees with the expert opinions from PAC's experts that the draft permit requires additional studying or assessment to be protective of the environment or human health. Dr. Tischler will address the draft permit's specific requirements for additional testing and monitoring to ensure that any outfall from the proposed Facility in the Revised Application will be protective of human health and the environment. He will respond to any specific criticisms and expert opinions of those experts designated by PAC or any other parties opposing the issuance of the permit, including but not limited to comments submitted by PAC's designated experts. Dr. Tischler will testify that he is qualified to offer opinions in this matter.

Dr. Tischler reserves the right to offer opinions regarding any issues within his expertise raised by PAC's experts or the experts for any party opposing the permit. Dr. Tischler also reserves the right to supplement his opinions on the basis of additional information made available or any changes to the draft permit after the date of this designation.

(3) if the expert is retained by, employed by, or otherwise subject to the control of the responding party:

(A) all documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony; and

The documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony have been produced or are available for inspection and copying at a mutually agreeable time.

The documents provided to, reviewed by, or prepared by or for Dr. Tischler include the following:

- All documents produced by Protestant PAC in connection with its disclosure of experts in SOAH Docket No. 582-20-1895;
- All documents produced by the Port of Corpus Christi Authority in SOAH Docket No. 582-20-1895;

- Administrative Record Exhibits AR-1 through AR-8;
- The transcript and exhibits to the deposition of Katie Cunningham in SOAH Docket No. 582-20-1895;
- The documents produced by the Office of the Executive Director of the TCEQ in SOAH Docket No. 582-20-1895;
- All documents related to the revised diffuser conceptual design and CORMIX runs; and
- The documents found at: https://bakerwotring.sharefile.com/i/id716c41edfe422a8

(B) the expert's current resume and bibliography.

Please refer to Dr. Tischler's CV, which is attached as Exhibit C.

D. Jordan Furnans, PhD, PE, PG
LRE Water, LLC
1101 Satellite View #301
Round Rock, Texas 78665
(512) 736-6485

(1) the subject matter on which the expert will testify;

Dr. Furnans will testify based upon his experience, training, and education and the materials reviewed regarding whether the proposed discharge of brine from the Proposed Facility in the Application would likely result in environmental conditions that are potentially damaging to the Corpus Christi Bay ecosystem. He will also respond to any criticisms and expert opinions of those experts designated by the PAC or any other parties opposing the issuance of the permit regarding his opinions and within his area of expertise, and he will address his qualifications and bases for offering his opinions in this matter.

(2) the general substance of the expert's mental impressions and opinions and a brief summary of the basis for them, or if the expert is not retained by, employed by, or otherwise subject to the control of the responding party, documents reflecting such information;

Dr. Furnans will testify regarding his qualifications to offer expert opinions in this matter. He will testify that his opinions are based upon reliable information, data, and evidence, and that his opinions are reliable and are based upon reasonable analysis and commonly accepted methods for experts within his field of expertise. The bases for Dr. Furnans' testimony are his education, training, and professional experience, the work he performed in connection with the report titled Desalination Brine Discharge Modeling – Corpus Christi Bay System, the documents he reviewed in connection with this matter, the depositions in this matter, and other discovery exchanged among the parties and the additional information reviewed in relation to the Revised Application and modeling.

Dr. Furnans will testify that the revised CORMIX modeling does not change the conclusions based on the modeling he performed, that the discharge from the Proposed Facility in

the Revised Application will not lead to the formation of a highly-saline water layer along the channel bottom, nor will it lead to an ever-increasing average bottom salinity within the Corpus Christi Bay system. Additional details about his opinions can be found in the report titled Desalination Brine Discharge Modeling – Corpus Christi Bay System dated October 19, 2019, in his August 28, 2020 deposition, his October 13, 2020 deposition, his prefiled direct testimony, and his hearing testimony on November 5, 2020 provided in SOAH Docket No. 582-20-1895.

He will testify that he disagrees with the opinions from PAC's experts that are critical of either the modeling he performed, or the conclusions reached in the report Desalination Brine Discharge Modeling – Corpus Christi Bay System. He will respond to any specific criticisms and expert opinions of those experts designated by PAC or any other parties opposing the issuance of the permit, including but not limited to comments submitted by PAC's designated experts. Dr. Furnans will testify that he is qualified to offer opinions in this matter.

Dr. Furnans reserves the right to offer opinions regarding any issues within his expertise raised by PAC's experts or the experts for any party opposing the permit. Dr. Furnans also reserves the right to supplement his opinions on the basis of additional information or any changes to the draft permit made available after the date of this designation.

(3) if the expert is retained by, employed by, or otherwise subject to the control of the responding party:

(A) all documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony; and

The documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony have been produced or are available for inspection and copying at a mutually agreeable time.

The documents provided to, reviewed by or prepared by or for Dr. Furnans include the following:

- All documents produced by Protestant PAC in connection with its disclosure of experts in SOAH Docket No. 582-20-1895;
- All documents produced by the Port of Corpus Christi Authority in SOAH Docket No. 582-20-1895;
- Administrative Record Exhibits AR-1 through AR-8;
- The transcript and exhibits to the deposition of Katie Cunningham in SOAH Docket No. 582-20-1895;
- The documents produced by the Office of the Executive Director of the TCEQ in SOAH Docket No. 582-20-1895;
- All documents identified at his deposition taken on August 28, 2020 and his deposition taken on October 13, 2020[1]; and

[1] A complete copy of Dr. Furnans' data set has previously been produced.

- The documents found at https://bakerwotring.sharefile.com/i/id716c41edfe422a8.

(B) the expert's current resume and bibliography.

Please refer to Dr. Furnans' CV, which is attached as Exhibit D.

E. George Guillen, Ph.D.
15718 Mesa Verde Dr.
Houston, Texas 77059
281-804-5607

(1) the subject matter on which the expert will testify;

Dr. Guillen will testify based upon his experience, training, and education and the materials reviewed regarding the likelihood of potential impacts of the discharge from the Proposed Facility on local marine life including larval stages. He will also respond to any criticisms and expert opinions of those experts designated by the PAC or any other parties opposing the issuance of the permit regarding his opinions and within his area of expertise, and he will address his qualifications and bases for offering his opinions in this matter.

(2) the general substance of the expert's mental impressions and opinions and a brief summary of the basis for them, or if the expert is not retained by, employed by, or otherwise subject to the control of the responding party, documents reflecting such information;

Dr. Guillen will testify regarding his qualifications to offer expert opinions in this matter. He will testify that his opinions are based upon reliable information, data, and evidence, and that his opinions are reliable and are based upon reasonable analysis and commonly accepted methods for experts within his field of expertise. The bases for Dr. Guillen's testimony are his education, training, and professional experience, the documents he reviewed in connection with this matter, the depositions in this matter, and other discovery exchanged among the parties.

Dr. Guillen will testify that he disagrees with the opinions from PAC's experts that predict large scale negative impacts on the marine environment and local species. He will respond to any specific criticisms and expert opinions of those experts designated by PAC or any other parties opposing the issuance of the permit, including but not limited to comments submitted by PAC's designated experts. Dr. Guillen will testify that he is qualified to offer opinions in this matter.

Dr. Guillen reserves the right to offer opinions regarding any issues within his expertise raised by PAC's experts or the experts for any party opposing the permit. Dr. Guillen also reserves the right to supplement his opinions on the basis of additional information made available or any changes to the draft permit after the date of this designation.

(3) if the expert is retained by, employed by, or otherwise subject to the control of the responding party:

(A) all documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony; and

The documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony have been produced or are available for inspection and copying at a mutually agreeable time.

The documents provided to, reviewed by or prepared by or for Dr. Guillen or that will be provided to Dr. Guillen include the following:

- The pre-filed direct testimony, exhibits and hearing testimony of experts Lial Tischler, Gregory Stunz, Randy Palachek, Scott Holt, Jordan Furnans, Andrew Esbaugh and Brad Erisman in SOAH Docket No. 582-20-1895;
- The documents produced by the PAC in connection with its witnesses Greg Stunz, Scott Holt, Andrew Esbaugh and Brad Erisman, and any other experts to be named by PAC or any other parties in opposition to the proposed permit;
- All documents produced by the Port of Corpus Christi Authority in SOAH Docket No. 582-20-1895;
- Administrative Record Exhibits AR-1 through AR-8 and any revisions to the Administrative Record;
- The documents produced by the Office of the Executive Director of the TCEQ in SOAH Docket No. 582-20-1895; and
- The documents found at https://bakerwotring.sharefile.com/i/id716c41edfe422a8.

(B) the expert's current resume and bibliography.

Please refer to Dr. Guillen's CV, which is attached as Exhibit E.

F. Nathan Knott, Ph.D.
Senior Research Scientist—Marine Ecologist
Fisheries, NSW
NSW Dept. of Primary Industries
612-442-83009
Nathan.Knott@dpi.nsw.gov.au

(1) the subject matter on which the expert will testify;

Dr. Knott will testify based upon his experience, training, and education and the materials reviewed regarding the likelihood of potential impacts of the discharge from the Proposed Facility on local marine life. He will also respond to any criticisms and expert opinions of those experts designated by the PAC or any other parties opposing the issuance of the permit regarding his opinions and within his area of expertise, and he will address his qualifications and bases for offering his opinions in this matter. He will offer his opinions regarding "Proposed Harbor Island Saltwater Reverse Osmosis Desalination Facility" by Kristin Nielsen, Ph.D. ("Nielsen Paper").

(2) the general substance of the expert's mental impressions and opinions and a brief summary of the basis for them, or if the expert is not retained by, employed by, or otherwise subject to the control of the responding party, documents reflecting such information;

Dr. Knott will testify regarding his qualifications to offer expert opinions in this matter. He will testify that his opinions are based upon reliable information, data, and evidence, and that his opinions are based upon reasonable analysis and commonly accepted methods for experts within his field of expertise. The bases for Dr. Knott's testimony are his education, training, and professional experience and the documents he reviewed in connection with this matter. He will also base his opinions upon his experience with desalination facilities as reflected in his curriculum vitae.

Dr. Knott will testify that the Nielsen Paper is not representative, the interpretation of the scientific literature is not reasonable, and the Nielsen Paper makes unwarranted conclusions. Dr. Knott will testify that he is qualified to offer opinions in this matter. He will testify regarding the effect of desalination facilities on the marine environment and aquatic species as reflected in the studies he has conducted on desalination facilities and reviews that he has carried out. He may respond to other criticisms of desalination facilities offered by the expert witnesses for Protestants in this matter.

Dr. Knott reserves the right to offer opinions regarding any issues within his expertise raised by PAC's experts or the experts for any party opposing the permit. Dr. Knott also reserves the right to supplement his opinions on the basis of additional information made available or any changes to the draft permit after the date of this designation.

(3) if the expert is retained by, employed by, or otherwise subject to the control of the responding party:

(A) all documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony; and

The documents provided to, reviewed by or prepared by or for Dr. Knott include the following:

- The pre-filed direct testimony, exhibits and hearing testimony of experts Lial Tischler, Gregory Stunz, Randy Palachek, Scott Holt, Jordan Furnans, Andrew Esbaugh and Brad Erisman in SOAH Docket No. 582-20-1895;
- The documents produced by the PAC in connection with its witnesses Greg Stunz, Scott Holt, Andrew Esbaugh and Brad Erisman, and any other experts to be named by PAC or any other parties in opposition to the proposed permit;
- All documents produced by the Port of Corpus Christi Authority in SOAH Docket No. 582-20-1895; and
- Administrative Record Exhibits AR-1 through AR-8;

- The documents produced by the Office of the Executive Director of the TCEQ in SOAH Docket No. 582-20-1895;
- The documents found at https://bakerwotring.sharefile.com/i/id716c41edfe422a8.

(B) the expert's current resume and bibliography.

Please refer to Dr. Knott's CV, which is attached as Exhibit F.

G. Craig Jones, Ph.D.
Managing Principal
Integral
200 Washington St., Suite 201
Santa Cruz, CA 95062
831-466-9630

(1) the subject matter on which the expert will testify;

Dr. Jones will testify based upon his experience, training, and education and the materials reviewed regarding the likelihood of potential impacts of the discharge from the Proposed Facility on local marine life and other areas within his expertise. He will also respond to criticisms and expert opinions of those experts designated by the PAC or any other parties opposing the issuance of the permit regarding his opinions and within his area of expertise, and he will address his qualifications and bases for offering his opinions in this matter. Dr. Jones will testify regarding whether the discharge from the Proposed Facility in the Revised Application will adversely impact the marine environment. He will testify on whether the revised modeling complies with applicable regulations to ensure the draft permit is protective of water quality.

(2) the general substance of the expert's mental impressions and opinions and a brief summary of the basis for them, or if the expert is not retained by, employed by, or otherwise subject to the control of the responding party, documents reflecting such information;

Dr. Jones will testify regarding his qualifications to offer expert opinions in this matter. He will testify that his opinions are based upon reliable information, data, and evidence, and that his opinions are reliable and are based upon reasonable analysis and commonly accepted methods for experts within his field of expertise. The bases for Dr. Jones' testimony are his education, training, and professional experience, the documents he reviewed in connection with this matter, the depositions in this matter, and other discovery exchanged among the parties.

Dr. Jones will testify that he is qualified to offer opinions in this matter. He will testify regarding the effect of desalination facilities on the marine environment and aquatic species and that the discharge from the Proposed Facility in the Revised Application will not adversely affect the marine environment. He will testify that the revised modeling complies with applicable regulations and scientific standards to ensure the draft permit is protective of water quality. He may respond to other criticisms of desalination facilities offered by the expert witnesses for Protestants in this matter.

Dr. Jones reserves the right to offer opinions regarding any issues within his expertise raised by PAC's experts or the experts for any party opposing the permit. Dr. Jones also reserves the right to supplement his opinions on the basis of additional information made available or any changes to the draft permit after the date of this designation.

(3) if the expert is retained by, employed by, or otherwise subject to the control of the responding party:

(A) all documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony; and

The documents provided to, reviewed by or prepared by or for Dr. Jones include the following:

- The pre-filed direct testimony, exhibits and hearing testimony of experts Lial Tischler, Gregory Stunz, Randy Palachek, Scott Holt, Jordan Furnans, Andrew Esbaugh and Brad Erisman in SOAH Docket No. 582-20-1895;
- The documents produced by the PAC in connection with its witnesses Greg Stunz, Scott Holt, Andrew Esbaugh and Brad Erisman, and any other experts to be named by PAC or any other parties in opposition to the proposed permit;
- All documents produced by the Port of Corpus Christi Authority in SOAH Docket No. 582-20-1895;
- Administrative Record Exhibits AR-1 through AR-8;
- The documents produced by the Office of the Executive Director of the TCEQ in SOAH Docket No. 582-20-1895; and
- The documents found at https://bakerwotring.sharefile.com/i/id716c41edfe422a8.

(B) the expert's current resume and bibliography.

Please refer to Dr. Jones' CV, which is attached as Exhibit G.

H. Lance W. Fontenot, Ph.D., PWS
Principal
Integral Consulting Inc.
8550 United Plaza Blvd., Suite 702
Baton Rouge, LA 70809
(255) 346-9533

(1) the subject matter on which the expert will testify;

Dr. Fontenot will testify based upon his experience, training, and education and the materials reviewed regarding the likelihood of potential impacts of the discharge from the Proposed Facility on local marine life. He will also respond to criticisms and expert opinions of those experts designated by the PAC or any other parties opposing the issuance of the permit regarding his opinions and within his area of expertise, and he will address his qualifications and

bases for offering his opinions in this matter. Dr. Fontenot will testify based upon his experience, training, and education and the materials reviewed regarding whether the discharge from the Proposed Facility in the Revised Application will adversely impact the marine environment.

(2) the general substance of the expert's mental impressions and opinions and a brief summary of the basis for them, or if the expert is not retained by, employed by, or otherwise subject to the control of the responding party, documents reflecting such information;

Dr. Fontenot will testify regarding his qualifications to offer expert opinions in this matter. He will testify that his opinions are based upon reliable information, data, and evidence, and that his opinions are reliable and are based upon reasonable analysis and commonly accepted methods for experts within his field of expertise. The bases for Dr. Fontenot's testimony are his education, training, and professional experience, the documents he reviewed in connection with this matter, the depositions in this matter, and other discovery exchanged among the parties.

Dr. Fontenot will testify that he is qualified to offer opinions in this matter. He will testify regarding the effect of desalination facilities on the marine environment and aquatic species and that the discharge from the Proposed Facility in the Revised Application will not adversely affect the marine environment. He may respond to other criticisms of desalination facilities offered by the expert witnesses for Protestants in this matter.

Dr. Fontenot reserves the right to offer opinions regarding any issues within his expertise raised by PAC's experts or the experts for any party opposing the permit. Dr. Fontenot also reserves the right to supplement his opinions on the basis of additional information made available or any changes to the draft permit after the date of this designation.

(3) if the expert is retained by, employed by, or otherwise subject to the control of the responding party:

(A) all documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony; and

The documents provided to, reviewed by or prepared by or for Dr. Fontenot include the following:

- The pre-filed direct testimony, exhibits and hearing testimony of experts Lial Tischler, Gregory Stunz, Randy Palachek, Scott Holt, Jordan Furnans, Andrew Esbaugh and Brad Erisman in SOAH Docket No. 582-20-1895;
- The documents produced by the PAC in connection with its witnesses Greg Stunz, Scott Holt, Andrew Esbaugh and Brad Erisman, and any other experts to be named by PAC or any other parties in opposition to the proposed permit;
- All documents produced by the Port of Corpus Christi Authority in SOAH Docket No. 582-20-1895; and
- Administrative Record Exhibits AR-1 through AR-8;

- The documents produced by the Office of the Executive Director of the TCEQ in SOAH Docket No. 582-20-1895;
- The documents found at https://bakerwotring.sharefile.com/i/id716c41edfe422a8.

(B) the expert's current resume and bibliography.

Please refer to Dr. Fontenot's CV, which is attached as Exhibit H.

I. Alex E. Wesner, P.E.
Separation Processes, Inc.
3152 Lionshead Ave.
Carlsbad, CA 92010
760-400-3660
awesner@spi-engineering.com

(1) the subject matter on which the expert will testify;

Mr. Wesner will testify based upon his experience, training, and education and the materials reviewed regarding the likelihood of potential impacts of the discharge from the Proposed Facility on local marine life. He will also respond to any criticisms of those experts designated by the PAC or any other parties opposing the issuance of the permit regarding his opinions and within his area of expertise, and he will address his qualifications and bases for offering his opinions in this matter.

(2) the general substance of the expert's mental impressions and opinions and a brief summary of the basis for them, or if the expert is not retained by, employed by, or otherwise subject to the control of the responding party, documents reflecting such information;

Mr. Wesner will testify regarding his qualifications to offer expert opinions in this matter. He will testify that his opinions are based upon reliable information, data, and evidence, and that his opinions are reliable and are based upon reasonable analysis and commonly accepted methods for experts within his field of expertise. The bases for Mr. Wesner's testimony are his education, training, and professional experience, the documents he reviewed in connection with this matter, the depositions in this matter, and other discovery exchanged among the parties.

Mr. Wesner is a Senior Project Manager and chemical engineer with extensive experience in the planning, design and construction of membrane water treatment projects. Mr. Wesner has participated in the development of some of the large-scale microfiltration and reverse osmosis systems treating various water processes. Mr. Wesner also has extensive experience with various project delivery methods, including conventional design-bid-build and design-build. In recent years, his responsibilities include process design, equipment selection, equipment procurement, detailed piping and instrumentation diagrams, construction, startup, and ongoing operations assistance. Mr. Wesner will offer opinions with regard to available technologies (including system process designs, chemical and other treatment processes (including pretreatment steps), backwash treatment and recovery systems, and more) of significance to modern desalination facilities

(specifically, the Port's proposed facility). Mr. Wesner has or will review – and will continue to review – the Port facility's quality of water intake, the desalination process as a whole (including discussion of in-process treatments and technologies to address possible process issues), and the Port facility's effluent discharge. Mr. Wesner's testimony will address these same issues (quality of water intake, the desalination process as a whole, pretreatment processes, treatment processes (and all related technology in support of same)), and relevant flow rates, effluent streams, de-scaling, demineralizing, water quality evaluations, assessment of biological growth, corrosion, treatments/processes for component removal, and related desalination issues). Mr. Wesner will express his opinions on these matters stated herein, inclusive of his comments about the application of modern technologies and techniques in contrast to more outdated ones.

(3) if the expert is retained by, employed by, or otherwise subject to the control of the responding party:

(A) all documents, tangible things, reports, models, or data compilations that have been provided to, reviewed by, or prepared by or for the expert in anticipation of the expert's testimony; and

The documents provided to, reviewed by or prepared by or for Mr. Wesner include the following:

- The documents produced by the PAC in connection with its witnesses Greg Stunz, Scott Holt, Andrew Esbaugh and Brad Erisman, and any other experts to be named by PAC or any other parties in opposition to the proposed permit;
- All documents produced by the Port of Corpus Christi Authority in SOAH Docket No. 582-20-1895;
- Administrative Record Exhibits AR-1 through AR-8;
- The documents produced by the Office of the Executive Director of the TCEQ in SOAH Docket No. 582-20-1895; and
- The documents found at https://bakerwotring.sharefile.com/i/id716c41edfe422a8.

(B) the expert's current resume and bibliography.

Please refer to Mr. Wesner's CV, which is attached as Exhibit I.

Exhibit A

Firm:

Parsons

Years of Experience:

35

Education:

- Master of Science, Aquatic Toxicology, Texas State University
- Bachelor of Science, Fisheries Management, Texas A&M University

Certifications:

- Project Manager Certification, Parsons

Coursework/Training:

- Advanced Project Management, Parsons
- Leadership and Management Program, Parsons
- Target Zero: Proactive Safety Attitudes, Parsons

Professional Affiliations:

- Texas Water Conservation Association (TWCA), Water Quality Chairman

Awards:

- President's Award, Texas Water Conservation Association

Randy M. Palachek

Project Manager

Summary of Relevant Qualifications

Mr. Randy Palachek has extensive experience in the areas of biological sampling, ecological risk assessment, aquatic toxicity testing, water quality standards, watershed assessment, total maximum daily loads, hydraulic and water quality modeling, and regulatory analysis and permitting. Randy worked with the Texas Water Commission where he managed the unit responsible for National Pollutant Discharge Elimination System/TPDES water quality permits related to toxic parameters, toxicity testing, mixing zones,401/401 certifications, and other permitting-by-rule activities. He developed the states whole effluent toxicity testing requirements, and permit language as well as required TIE/TRE protocols for NPDES permits. While at the state he also developed the State's water quality standards for aquatic toxicity (35 aquatic life and 61 human health toxic standards, including dioxin); he performed wasteload allocation studies; correlated dissolved standards to total effluent limits in freshwater and marine environments has led risk assessments for human health and has extensive experience in ecological effects; water, sediment, and biota sampling, including ultraclean mercury and metals sampling and high-volume water sampling for bioaccumulatives including dioxins and polychlorinated biphenyls. He has performed fisheries and endangered species surveys; habitat, marine and aquatic species assessments; and environmental impact analysis and statements. In addition, he has managed several projects for RI/FS and CMS development in the RCRA program.

Randy was co-chair of the Environmental Protection Agency's Gulf of Mexico - Estuarine Assessment and Contaminant Problem Identification workshop. He served on the state of Texas fish tissue monitoring subcommittee and on the organizing committee of a workshop on contaminated sediments in the Gulf of Mexico. He has conducted dredging evaluations; dredge material and beneficial use assessments for many Corps of Engineers districts; site-specific water quality standards development and modifications for aluminum, lead, and copper, including recalculation of many Environmental Protection Agency criteria; and freshwater and marine water-effect ratio studies. He also developed site-specific sediment standards for dioxins and polychlorinated biphenyls.

Projects include conducting total maximum daily load or 303(d)-related studies on more than 50 water bodies; developing watershed protection plans, watershed control options, and best management practices; conducting many water and contaminated sediment toxicity and chemical identification evaluations. In addition, he certified US Army Corps of Engineers 401/404 projects (including dredging) and National Pollutant Discharge Elimination System permits to meet state water quality standards. Dredging evaluations included potential sediment contamination, water column changes, dredge disposal, and decontamination concerns. While head of the toxicity evaluation unit at

Texas Water Commission, he represented the state on many national and state workgroups, including the Environmental Protection Agency's contaminated sediments, dredged material evaluation and disposal, total maximum daily loads, and Gulf of Mexico pesticides and toxic substances subcommittee. Randy has conducted many stakeholder and public meetings and participated in contested hearings.

Work Experience

Project ManagerTCEQ and U of H, Houston Ship Channel and Galveston Bay Dioxin and Polychlorinated Biphenyl Total Maximum Daily Load, Texas. This extensive and comprehensive project has been underway for over 8 years to develop a total maximum daily load involving water, sediment, and tissue analysis, in the expansive Houston Ship Channel and Galveston Bay system. The project collected over 1,000 samples of all total and dissolved water dioxin and PCB congeners, sediments and fish tissues (multiple species). Site specifics bioaccumulation factors were developed for blue crab and catfish. The project developed a fully dynamic, 2D hydraulic model for the study area using RMA2 and linked the results to a WASP7 water and sediment dioxin/polychlorinated biphenyl model. Designed complex spreadsheets to complete mass flux balances using data from the model to support the load allocation process. Performed univariate and multivariate statistical data analysis. Developed customized databases to meet project needs and conducted thorough geographic information systems analysis. Implemented QUAL-TX, HSPF, and DYNHYD models for Houston bayous and the Houston Ship Channel. Evaluated and interpreted model results to develop a clear understanding of water quality issues and prepare a draft total maximum daily load report.

Project Manager. Managed water quality, sediment, toxicity, and fishery surveys for determination of potential impacts, use designations, or standards attainment in risk assessments and water quality bioaccumulation studies. Worked with many permittees to prepare, review, and meet with US Environmental Protection Agency and state agencies regarding special studies in water quality permits, National Pollutant Discharge Elimination System permit negotiations and evaluations, contaminated site investigations and remediation, and public and contested hearing participation. These have included work at many industrial and federal sites.

Project Manager. Shell Oil, Lubrizol, Rohm & Haas, and Oxy Vinyls, Patrick Bayou Outfalls and Total Maximum Daily Load, Deer Park, TX. Project involved comprehensive tasks for developing four total maximum daily loads for Patrick Bayou, a tributary of the Houston Ship Channel (Segment 1006A), listed on the state's Clean Water Act Section 303(d) list and later the US Environmental Protection Agency Superfund list for water quality impairments associated with sediment toxicity, ambient water toxicity, metals, organics, and temperature. Tasks included multiple outfall dye studies, mixing zones for seven outfalls, modeling, extensive water, sediment, biological, and toxicity sampling to identify toxicants and their effects on the environment. Multivariant statistical analyses were used to correlate benthic invertebrates, chemistry, and sediment toxicity data. Involved in all aspects of managing the project, including assessing existing data,

developing and implementing a sampling plan and a quality assurance project plan, and preparing technical reports to obtain acceptance of the model selection and results, approach, modeling scenario inputs.

Project Manager. Managed a large TIE/TRE effort for a power plant where cooling water was found to be toxic to fathead minnows due to use of tolytriazole, chlorine and bromine.

Project Manager. Managed a TIE/TRE effort for several chemical and petroleum facilities related to various effluent waste streams and stormwater runoff. Various solutions were determined to rid the facility of toxicity including use of carbon, changing of additives, house keeping and separating out waste streams.

Project Manager. Managed a TIE for 7 State of Texas Waterbodies for ambient river of sediment toxicity. Modified standard Phase 1 and 2 TIE protocols to utilize on ambient river water as well as on sediment and pore water to determine the cause in states water.

Project Manager. Managed TIE project to determine water and sediment toxicity in a small highly influenced industrial bayou in Houston Ship Channel area. Bayou was dominated by chemical, petroleum and municipal discharges.

Project Manager. Confidential Client, Freeport and Houston, TX. Managed a number of National Pollutant Discharge Elimination System/TPDES and water quality-related projects, permit application development, and negotiations with the Environmental Protection Agency and Texas Commission on Environmental Quality regulators including mixing zone analysis, water quality sampling, ultraclean metals and biological sampling, data evaluation.

Ecological Risk Assessor. Lead ecological risk assessor on large complex site in upstate New York for water, sediment, wetlands and natural area potentially affected by petrochemical facility. Risk assessment involved collection of over 400 samples including extensive river and sediment evaluations.

Technical Director. Oklahoma Department of Environmental Quality, Grand Lake Watershed Management Plan, Northeast Oklahoma. Developed hydrologic and water quality models of the watershed and lake using SWAT and a 3-D **EFDC** to evaluate the impact of land use changes and implementation of point and nonpoint source best management practices (BMPs) on resulting water quality in Grand Lake O' the Cherokees.

Technical Director. Lake Onondaga NY Water Quality and Nitrate Addition project. Work involved water quality modeling, water quality sampling and evaluations associated with pilot tests of nitrate addition to bottom of reservoir.

Technical Director. NYDEC water quality and river studies related to a closed photographic facility. Work included water and sediment data collection as well as ambient river toxicity testing.

Technical Advisor. Motiva Port Tampa Terminal, Mixing Zone Study, Tampa Bay, Florida. NPDES permitting assistance, Mixing Zone studies, dilution calculations, completed extensive data collection with side scanning acoustic Doppler profiler (ADP), water quality profile

data collection, water surface elevation logging and bathymetric data collection with a fathometer and integrated global positioning system (GPS) for implementation of a CORMIX model for a NPDES diffuser dispersion study.

Project Manager. Managed sediment and fish tissue sampling (many associated with river and lake contamination of heavy metal discharges from industry, including coal power plants, refineries, petro chemical), aquatic resource characterization, standards development, site-specific water quality standards revisions, water-effect ratio studies for freshwater and saltwater ecosystems, and determination of causes of toxicity in industrial and municipal effluent discharges utilizing the Toxicity Identification Evaluation (TIE) and Toxicity Reduction Evaluations (TRE) protocols. Sample collection included thousands of sediment and tissue analyses for heavy metals, including mercury, arsenic, selenium, polychlorinated biphenyls, dioxins, polycyclic aromatic hydrocarbons, and various organic compounds for bioaccumulation studies associated with individual outfalls. Sampling environments included lakes, rivers, estuaries, and bayous.

Project Manager. Lower Colorado River Authority, Colorado River Environmental Models System Phases 2 and 3, Austin, TX. Development of water quality models for Lakes Buchanan, Inks, LBJ, Marble Falls, and Travis using CE-QUAL-W2 and SWAT. Applied models to estimate impacts on water quality of watershed urbanization, changes in upstream loading, additional wastewater discharges, and regulations

Project Manager. Reliant Energy Inc., Galveston Marine Survey, Galveston, TX. Managed Reliant Energy's submerged 138 kV transmission line alignment, Section 404 and General Land Office permitting, bay bottom sediment classification, and archaeological surveys.

Permitting Task Manager. San Antonio Water System, Brackish Groundwater Desalination Facility Construction Management-at-Risk Construction Services, San Antonio, TX. Responsible for obtaining construction-related permits for the project, including city, county, state, and federal permits for the desalination plant, the pipeline, supply wells, and injection wells. Was also heavily involved in obtaining necessary state and federal environmental permits, such as threatened and endangered species, US Army Corp of Engineers Section 404, and historical permits along with National Environmental Policy Act-related approvals.

Project Manager. Environmental Protection Agency. Ouachita River, Mossy Lake, and Coffee Creek Use Attainability Analysis, Arkansas. Conducted a use attainability analysis to determine if appropriate water quality uses were established or if they should be modified. The project included sampling conducted at least quarterly for one year, including water chemistry, sediment, fish, and benthic analysis. Work was conducted in accordance with US Environmental Protection Agency QA/R6 guidance and Arkansas Department of Environmental Quality sampling and data analysis protocols. Developed and obtained approval for the detailed sampling and analysis plan and the quality assurance project plan. Working with the University of

Arkansas, completed five bimonthly sampling events at four stations over the 12-month period. Analysis included ultraclean metals analysis, sediment sampling, and water and sediment bioassays. The use attainability analysis was prepared to conform to Environmental Protection Agency and Arkansas Department of Environmental Quality standards and guidelines.

Project Manager, Environmental Protection Agency, Illinois River and Kings River Basins Watershed Assessments, Arkansas. Provided technical services for a comprehensive water quality assessment of the Illinois River, the Kings River, and their tributaries. Coordinated preparation of a quality assurance project plan and robust sampling design to address nutrient loading and determine whether designated uses were supported. A water quality assessment report was prepared and submitted to support the Clean Water Act Section 303(d) listing decision. Developed a weight-of-evidence approach using 11 different water chemistry, habitat, and biological parameters to determine if a designated use impairment existed in the narrative water quality standards.

Technical Director. Oversaw an investigation to assess potential exposure and biotransport of perchlorate in many biological receptors, including aquatic and terrestrial environments for the US Air Force. Provided direction on perchlorate issues, characterization of exposure pathways, identification of target trophic groups, and evaluation of potential for biotransport through various media and pathways. Project included collection of more than 1,000 samples in all media (water, sediment, plant, terrestrial tissue, and aquatic tissue) from six states and more than 100 locations. Project also developed a perchlorate WQ criteria which was utilized by EPA and many states

Project Manager. Managed four US Army Corps of Engineer projects in Galveston, Texas related to developing an alternative area for placement of dredged materials from the Gulf Intracoastal Waterway near Chocolate Bay and beneficial use of dredge material from Rincon Canal, including creation of rookery islands, tidal marshes, and beach nourishment. Work included water, sediment, and elutriate sampling for bioassay, bioaccumulation, and chemical analysis.

Project Manager. Managed sediment total maximum daily load studies on eight water bodies in Texas contaminated by refinery, chemical, agriculture, and urban waste. These studies involved extensive sediment sampling for priority pollutant and constituents and fresh water and marine sediment toxicity identification evaluations to identify specific pollutants or class of pollutants causing in-stream sediment toxicity. Projects involved developing extensive and innovative sediment chemical separation protocols for laboratory and statistical modeling to determine specific causes of sediment toxicity.

Head of Toxicity Evaluations Unit. Texas Water Commission, Austin, Texas. Developed Texas mixing zone- and water quality-based toxics permitting approach. Responsible for developing critical conditions and hundreds of mixing zones for permitted discharges for aquatic life and human health protection and participated and gave testimony in contested hearings Responsible for implementing water quality standards relative to water quality-based permit limits. Reviewed

compliance of whole effluent toxicity testing and toxicity reduction evaluations by permittees, wastewater discharges. As member of the Water Quality Standards Unit, developed 61 new standards for protection of human health from water and fish consumption beginning with integrated risk information system data. A total of 35 aquatic life standards were also developed. Represented the state on many national task forces and work groups.

"Bioaccumulation of Polychlorinated Dibenzodioxins and Dibenzofurans in Catfish and Crab Along and Estuarine Salinity and Contamination Gradient," Environmental Toxicology and Chemistry, 28(11): 2307-2317, 2009 (coauthors K.E. Dean, M.P. Suarez, H.S. Rafai, R.M. Palachek, and L. Koenig).

"Development of a Sediment-Water Model for Dioxin in the Houston Ship Channel, Texas," Proceedings of Water Environment Federation, WEFTEC 2007: Session 71 through Session 80, pp. 5736-5750(15), Water Environment Federation, 2007 (coauthors M.P. Suarez, K. Dean, J. Patek, R. Palachek, H. Rifai, A. Izquierdo, and L. Koenig).

"Development of a Dioxin TMDL for the Houston Ship Channel in Texas," Proceedings of the Water Environment Federation, WEFTEC 2006 (coauthors R. Palachek, K. Dean, M.P. Suarez, H.S. Rifai, and L. Koenig).

"Whole Sediment TIEs: A TMDL Case Study," (coauthors J.D. Horne, P.B. Dorn, and L.P. Brzuzy).

"TIE and TMDL Approaches for Legacy Sediment Contaminants: Arsenic and Petrochemcial Case Studies," (coauthors B.W. Brooks, P.K. Turner, W.T. Waller, T.W. La Point, and J.A. Sullivan).

"Reservoir Zonation and Water Quality: Science, Management and Regulations," LakeLine, American Lake Management Society, 28(4): 39-43, 2008 (coauthors B.W. Brooks, J.T. Scott, M.G. Forbes, T.W. Valenti, J.K. Stanley, R.D. Doyle, K.E. Dean, J.M. Patek, R.M. Palachek, R.D. Taylor, and L. Koenig).

"Distribution of Polychlorinated Dibenzo-p-dioxins and Dibenzofurans in Suspended Sediments, Dissolved Phase, and Bottom Sediment in the Houston Ship Channel," Chemosphere 62:417-429, 2006 (coauthors M.P. Suarez, H.S. Rifai, R.P. Palachek, and L. Koenig).

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"Development of Freshwater Water Quality Criteria for Perchlorate," Environmental Toxicology and Chemistry, 23(6): pp. 1441-1451, 2004 (coauthors R.M. Palachek, J.M. Noel, R. Warbritton, J. Aufderheide, and J. Wireman).

"Site-Specific Water Quality Targets for Fish Tissue Contaminants: Application of Sediment, Water, and Tissue Targets Based on Measured Partitioning Relationships," Proceedings of the National TMDL Science and Policy 2003 Specialty Conference, Chicago, Illinois, November 16-

19, 2003 (coauthors R.M. Palachek, H.S. Rifai, M.P. Suarez, S. Hausmann, and L. Koenig).

“Development of a Dioxin TMDL for the Houston Ship Channel in Texas,” Proceedings of the National TMDL Science and Policy 2003 Specialty Conference, Chicago, Illinois, November 16-19, 2003 (coauthors H.S. Rifai, M.P. Suarez, R. Palachek, P. Jensen, M. Bloom, and L. Koenig).

“Third-Party TMDLs,” Water Environment Federation’s Water Environment and Technology (WE&T), June 2003 publication (coauthor M. Vargas).

“Recommended Assessment Protocols for Use With Ambient Toxicity Tests in the 305(b) Reporting and 303(d) Listing Process,” National TMDL Science and Policy Conference (WEF), November 13-16, 2002, Phoenix, Arizona (coauthors A. Sullivan and S. Manning).

“Preparation of Integrated Water Quality Monitoring and Assessment Reports: Recommendations for Clean Water Act § 303(d) and § 303(b) Methodologies and Reporting,” prepared for the Federal Water Quality Coalition, American Farm Bureau Federation, and Association of Metropolitan Sewerage Agencies, March 2002 (coauthors F.P. Andes, E.K. Powers, K.A. Evans, B.A. Harvey, T.M. Richards, M.A. Vargas, K. Dean, and R.M. Palachek).

“Regional Copper WER for Segments of Houston Ship Channel and Clean Metals Sampling Including Mercury,” 74th Annual Water Environment Federation (WEF) Conference, October 17-17, 2001, Atlanta, Georgia (coauthors J. Horne and C. Ryon).

Exhibit B

PARSONS

KIRK E. DEAN, PHD, PE

SENIOR PROJECT MANAGER

Kirk Dean has extensive experience performing quantitative analyses to support environmental decision-making. His specialties include hydrologic and water quality modeling, statistical data analysis, aquatic chemistry, contaminated soil and sediment evaluations and remediation, total maximum daily loads, watershed management, environmental risk assessment, aquatic biology, and water quality standards.

WORK EXPERIENCE

Scientific/Engineering Technical Consultant. Genesee River RI/FS. New York Department of Environmental Conservation. Rochester, New York. 12/2019. Kirk reviewed an EFDC hydrodynamic model of the Genesee River. He designed a sediment cap, including chemical isolation layer, filter, and erosion protection layer.

Engineering Consultant. City of Houston, Texas. Chelford City Diversion Package 3. 8/2019 – 1/2020. Assisted in development of a preliminary engineering report for design of a deep sanitary sewer interceptor for trenchless construction. Kirk's work included analysis and modeling of route alternatives and critical elevations; calculation of velocities under dry and peak flow; analysis potential odor and corrosion issues; identification of required permitting and coordination; and analysis of impacts on traffic and other utilities.

Engineering Consultant. City of Austin, Texas. Vargas Area Water and Wastewater Pipeline Renewal. 10/2019-11/2019. Parsons performed design work to replace 4,780 linear feet of aging wastewater pipelines and 4,430 linear feet of aging water pipelines. Kirk assisted in the design of the replacement sewers by optimizing the manhole positions, pipe slopes, and diameters, and flows and velocities. Ensured that the sewers met city design standards under various flow conditions.

Engineering Consultant. City of Houston, Texas. Sims North Phase 2 Wastewater Treatment Improvements. As part of Parsons design of various plant improvements, Kirk developed the drainage plan for the site.

Principal Scientist. Cumberland Bay OU-3 Remedial Investigation and Feasibility Study. Confidential Private Utility. Plattsburgh, New York. 2/2019-7/2019. Performed a forensic analysis of PAH residues in sediments of Cumberland Bay, Lake Champlain, to discriminate impacts of a former manufactured gas plant. Developed a wind-wave analysis using the US Army Corps of Engineers' ACES model to determine sediment stability and sediment cap armoring requirements for a 100-year event.

Scientific/Engineering Technical Consultant. Oak Hill Parkway Design. Austin, Texas. 3/2019-7/2019. Assisted in the design of water quality control BMPs for a highway expansion project. The BMPs are to include bioretention ponds, sand filtration ponds, batch extended detention ponds, permeable friction course pavement, and vegetated filter strips. The project is in the Barton Springs portion of the Edwards Aquifer Recharge Zone and Contributing Area.

Scientific/Engineering Technical Consultant. Harris County Pollution Control Services Department, Intercontinental Terminals Fire. Houston, Texas. 03/2019-5/2019. During the Intercontinental Terminals Fire and throughout the cleanup period, the Harris County Pollution Control Department requested that Kirk serve as a technical

YEARS OF EXPERIENCE

Total: 29

With Parsons: 19

EDUCATION

- Doctorate/Ph.D., Water Chemistry, University of Wisconsin-Madison, 1994
- Bachelor of Science, Environmental Science, Texas Christian University, 1987

REGISTRATIONS

- Professional Engineer, 138471, Texas

CERTIFICATIONS

- Project Manager Certification, Parsons

PROFESSIONAL AFFILIATIONS

- Society of Environmental Toxicology and Chemistry (SETAC)

COMPUTER/SOFTWARE SKILLS

- EFDC
- SWAT
- PHREEQC
- CE-QUAL-W2
- WASP
- HSPF
- S-Plus
- SPSS
- SAS
- AMOS
- R
- Statistica
- Fortran
- SMS
- HEC-RAS
- XP-SWMM
- RMA
- Bentley SewerGEMS
- BATHTUB
- LOADEST
- ArcGIS
- Microsoft ACCESS
- Geochemist's Workbench
- ProUCL
- PMF
- STEPL
- ACES
- GNOMES

consultant to review monitoring and modeling of petroleum and perfluoroalkyl sulfonate releases to the Houston Ship Channel and Galveston Bay.

Scientific/Engineering Technical Consultant. Confidential Client. Corpus Christi, Texas. 12/2018-2/2019. Kirk performed a technical review of environmental impacts of a deepwater port, including impacts to shallow bay habitat and nearshore oil spill modeling.

Lead Modeler. Oklahoma Department of Environmental Quality, Grand Lake Watershed Modeling, Oklahoma City, Oklahoma, United States. 9/2014-8/2020. Parsons prepared and implemented an updated management plan to improve water quality in Grand Lake with support from watershed stakeholders and water resource management agencies such as the Grand River Dam Authority, the Oklahoma Department of Environmental Quality, the Kansas Department of Health and Environment, the Missouri Department of Natural Resources, the Arkansas Department of Environmental Quality, and the Grand Lake Watershed Alliance Foundation. The interagency work group identified and selected implementation strategies to reduce nutrient loads throughout the 10,000-square-mile Grand Lake Watershed. Innovative techniques were used to allow stakeholders to play a stronger role in evaluating management options and developing an implementation plan to meet their objectives for water quality restoration in the lake. Kirk developed SWAT watershed models for each of three major tributary rivers spanning four states, as well as the local lakefront drainage. Kirk then developed a three-dimensional integrated hydrodynamic/water quality/sediment diagenesis EFDC model of the Grand Lake of the Cherokees, as well as programs to link the outputs of SWAT to EFDC and perform a water balance. He then preformed a sensitivity analysis and calibrated and validated the models. Finally, he applied the models to predict the efficacy of various watershed management measures, including point source and agricultural BMPs, in improving water quality using dozens of different model scenarios.

Principal Scientist. Texas Commission on Environmental Quality, TCEQ Assessment, Investigation, and Remediation Services, Texas, United States. 12/2017-11/2018. Kirk performed simple watershed modeling using ArcGIS and STEPL to assist with prioritizing watersheds for best management practice funding to reduce nutrient loading to coastal waters.

Principal Scientist. Confidential International Chemical Manufacturer. Middleport, New York. 05/2018-1/2020. Kirk assisted in the evaluation of wastewater effluent toxicity via biomonitoring at an active pesticide manufacturing facility. He led a Toxicity Identification Evaluation (TIE) that identified a water treatment chemical as the cause of acute toxicity to Ceriodaphnia. Next, he supervised a Toxicity Reduction Evaluation (TRE) to identify and evaluate water treatment alternatives that eliminated toxicity. Intermittent chronic toxicity to fathead minnows continues to be addressed through a TIE/TRE process.

Modeler. City of Austin, Texas. Walnut Creek Sewer Odor Control Project. 05/2018-5/2019. Kirk developed a model of the sanitary sewer system in the Walnut Creek and Little Walnut Creek sewersheds, which cover a large part of North Austin, using Bentley SewerGEMS. He correlated the model's prediction of sewer pressurization with historical odor complaints and applied the model under high and low flow conditions to predict the impact of various odor control alternatives. He prepared a

report on odor and corrosion impacts in the sewer. He developed information for a bid by the city for fan testing to verify the model and size corrective measures.

Principal Scientist. Confidential International Water Company. Produced Water Merchant Treatment Plant Water Resources Evaluation. Loving County, Texas. 06/2018-09/2018. Parsons supported a company developing a treatment facility for purifying produced water from oil and gas production. Kirk prepared a summary of state and federal permitting requirements, evaluated disposal options for produced water and brine, evaluated market demand and prices for purified water, and identified potential customers in west Texas and southeastern New Mexico for the purified produced water.

Principal Scientist. Confidential International Oil Company, Bayonne Off-Site Support, Bayonne, New Jersey, United States. 10/2017-05/2018. Kirk is serving as a subject matter expert for sediment quality at a former terminal facility. He performed statistical analysis to discern historical site-related impacts from background contamination in a dense industrial port. He also assisted in developing conceptual models and monitoring plans to support sediment remediation and provided support in correspondence and meetings with the state regulatory agency.

Principal Scientist. Confidential Global Chemical Manufacturing Company, USS Lead Homestead Oversight, East Chicago, Indiana, United States. 02/2015-11/2017. Kirk applied statistical source apportionment methods (factor analysis and positive matrix factorization) to soil elemental composition measurements to discern multiple sources of legacy contamination in a residential neighborhood. Stable lead isotopes and a geochemical analysis were also used to provide further insight.

Scientific/Engineering Technical Consultant. Harris County Attorney, San Jacinto Waste Pits Consulting Services, Houston, Texas, United States. 09/2013-7/2019. Parsons provided Harris County attorneys with expert technical opinions on the San Jacinto Waste Pit site cleanup. Work included reviewing and commenting on interim remedial actions and feasibility studies prepared by the potentially responsible parties and the US Environmental Protection Agency. Parsons provided recommendations for using sheet pile walls and berms to protect water quality during dredging and to mitigate post-dredge residual contamination. Kirk reviewed modeling and remediation plans for dioxins, polychlorinated biphenyls, and mercury at a contaminated soil and sediment site impacting the Galveston Bay ecosystem. The review included evaluation of the benefits of dredging, capping, and natural attenuation on bioaccumulation and ecosystem and human health risks. Kirk continues to provide technical support to the County by reviewing data and plans as the remedial action proceeds

Principal Scientist. Confidential International Oil Company, Former Perth Amboy Facility Corrective Measures Implementation-Related Work, Perth Amboy, New Jersey, United States. 01/2015-07/2018. Parsons provided environmental engineering services for implementing selected corrective measures for 92 different solid waste management units and areas of concern. Work included design and implementation of various corrective measures, such as in situ chemical oxidation, thermal treatment, enhanced in situ bioremediation, in situ and ex situ soil stabilization, on-site asphalt caps, and an on-site corrective action management unit to manage waste. Contaminants included light non-aqueous phase liquid, BTEX, chlorinated solvents, lead, benzo(a)pyrene, tetraethyl lead, and arsenic. The cleanup was subject to a Hazardous and Solid Waste Amendment permit. Activities were coordinated with continued operations of a bulk oil product transfer facility and the

other corrective actions occurring at the site. Kirk developed a statistical leak detection monitoring plan for a corrective action management unit and performs ongoing statistical and geochemical evaluations of groundwater quality related to remedial activities and CAMU management.

Statistical Scientist. Los Angeles Unified School District, Site Prioritization Model Validation, Los Angeles, California, United States. 07/2016-02/2017. Kirk developed a decision support model and tool to prioritize sites for renovation based on the client's priorities and an extensive asset management database.

Scientist. New York Department of Environmental Conservation, RCRA Facility Investigation and Corrective Measures Study, Rochester, New York, United States. 07/2014-05/2016. The project involves a 4-mile-long stretch of the Lower Genesee River impacted by silver and other contaminants from operations at the former Kodak Eastman Business Park. The project site includes impacted channel sediments and adjacent wetland areas, and it encompasses an active industrial navigational channel and numerous large marinas and involves multiple stakeholders. Parsons is providing remedial investigation activities, including a bathymetry and side scan sonar survey, a sediment investigation, surface water sampling, adjacent wetland and floodplain assessments, aquatic habitat assessments and tissue sampling, a toxicity study, human health and ecological risk assessments, and sediment transport modeling. Kirk evaluated existing data and developed a sampling and analysis plan to identify and address potential sediment toxicity and toxicants in the Genesee River.

Project Manager. Texas Commission on Environmental Quality, Dissolved Oxygen, pH, and Bacteria Total Maximum Daily Loads - Modeling System Update, Texas, United States. 01/2013-08/2015. Parsons provided technical support to the Texas Institute for Applied Environmental Research at Tarleton State University and the Texas Commission on Environmental Quality for revising and documenting the HSPF watershed models and RMA2/WASP in-stream water quality models used to establish total maximum daily loads for dissolved oxygen in Adams and Cow Bayous and associated tributaries. Updated the models to reflect changes in discharge permits and current land use, population, and sanitary sewer connections. Applied models to determine total maximum daily loads.

Project Scientist. Confidential Global Chemical Manufacturing Company, East Chicago Site Final Corrective Measures Study and Treatability Study, East Chicago, Indiana, United States. 06/2011-02/2015. This project was part of a master services agreement in which Parsons served as an integral part of a collaborative team for the client's corporate remediation group. Parsons provided environmental consulting, project management, and implementation services at more than 50 former and active chemical facilities located in 15 states, Mexico, Puerto Rico, and Brazil. Parsons worked with this client to manage its remediation responsibilities by developing innovative, sustainable solutions that protect people and the environment while complying with applicable laws and regulations. Kirk performed a number of roles related to the cleanup of this site contaminated primarily with lead and arsenic. Applied geochemical modeling using PHREEQC to evaluate remedial alternatives for groundwater contamination. Evaluated the performance of an existing permeable reactive barrier to treat arsenic-contaminated groundwater. Evaluated remediation strategies for metals-contaminated soil and groundwater. Performed statistical and geochemical analysis to evaluate relative influences of

stormwater and groundwater. Developed treatability studies and pilot studies for remediation of contaminated groundwater and soil.

Scientist. Confidential Global Chemical Manufacturing Company, Lonoke Plant Groundwater Monitoring, Lonoke, Arkansas, United States. 12/2009-11/2019. This project was part of a master services agreement in which Parsons served as an integral part of a collaborative team for the client's corporate remediation group. Parsons supported the client by ensuring it remained in compliance with a Resource Conservation and Recovery Act (RCRA) consent order. The scope of services included a RCRA facility investigation (RFI), a corrective measures study, and corrective measures implementation for solid waste management units and areas of concern identified at the facility. Concurrent with the RFI, additional actions were performed, such as a compliance audit, tank and solid waste management unit closures, and other compliance issues related to the consent order and RFI. Following completion of the RFI and one small excavation, closure of all eight areas of concern was negotiated with the Arkansas Department of Environmental Quality requiring no further corrective actions. Kirk performed statistical analysis and risk assessments for this RCRA site. Risk assessment work included data analysis, modeling, and remediation of contaminant migration from soils to surface waterbodies via groundwater. Kirk applied geochemical modeling using PHREEQC to evaluate remedial alternatives for groundwater contamination. Routinely performed statistical analyses for semiannual reporting, including trend analyses, background updating, and significance testing using parametric and nonparametric methods. As part of the 2019 permit renewal, Kirk updated the groundwater monitoring plan to reflect a statistical detection monitoring program compliant with recent statistical monitoring guidance from the State of Arkansas.

Scientist. Oklahoma Department of Environmental Quality, Nutrient Total Maximum Daily Load Development for Lakes, Oklahoma City, Oklahoma, United States. 06/2010-06/2014. Parsons developed total maximum daily loads for Oklahoma sensitive water supply lakes with exceedances of the chlorophyll-a criterion. Kirk developed SWAT and BATHTUB models for watershed nutrient loading and lake trophic response for several Oklahoma reservoirs. Applied models to estimate phosphorus and nitrogen loading reductions necessary to meet water quality standards. Also developed total maximum daily loads for turbidity and metals and expanded the bacteria toolbox application to address turbidity, sediment, and metals impairments. Wrote numerous total maximum daily load support documents.

Principal Scientist. Confidential Global Chemical Manufacturing Company, Oakley Site Groundwater RCRA Facility Investigation, Oakley, California, United States. 3/2010-03/2013. This project was part of a master services agreement in which Parsons served as an integral part of a collaborative team for the client's corporate remediation group. Parsons provided environmental consulting, project management, and implementation services at more than 50 former and active chemical facilities located in 15 states, Mexico, Puerto Rico, and Brazil. Parsons worked with this client to manage its remediation responsibilities by developing innovative, sustainable solutions that protect people and the environment while complying with applicable laws and regulations. Kirk performed statistical analysis and risk assessments for this Resource Conservation and Recovery Act site. Risk assessment work included data analysis, modeling, and remediation of contaminant migration from soils to surface waterbodies via groundwater. Routinely performed

statistical analyses for semiannual reporting, including trend analyses, background updating, and significance testing using parametric and nonparametric methods.

Lead Modeler. City of Boerne, Upper Cibolo Creek Watershed Protection Plan and Decision Support System, Boerne, Texas, United States. 09/2011-01/2013. Parsons assisted stakeholders in and around Boerne, Texas, with identifying and selecting stormwater best management practices to reduce bacteria and total phosphorus loads in the Upper Cibolo Creek Watershed. Kirk developed and applied a SWAT model. Provided the technical support necessary for the City of Boerne and the Texas Commission on Environmental Quality to use the SWAT model and Parsons' decision support system for selecting a practical set of stormwater best management strategies. Provided stakeholders with modeling tools to allow them to determine the most practical suite of best management practices for restoring water quality.

Lead Modeler. Lower Colorado River Authority, Colorado River Environmental Models System Phases 2 and 3, Austin, Texas, United States. 02/2008-01/2013. Parsons developed water quality models for the Highland Lakes of the Lower Colorado River and their watersheds. The models assisted the Lower Colorado River Authority with developing watershed protection ordinances, in planning future development, in permitting decisions, and in reservoir operations. Kirk developed a CE-QUAL-W2 model of Lake Lyndon B. Johnson and a SWAT model of the Lake Buchanan watershed. Assisted with developing CE-QUAL-W2 water quality models of Lake Travis and Inks Lake, and SWAT models of their contributing watersheds. Developed an application to link multiple watershed, water balance, and lake models. Applied models to estimate impacts on water quality of watershed urbanization, changes in upstream loading, additional wastewater discharges, and regulations.

Technical Director. University of Houston and Texas Commission on Environmental Quality, Dioxin and Polychlorinated Biphenyl Total Maximum Daily Loads, Galveston and Houston, Texas, United States. 01/2001-01/2013. The project involved development of total maximum daily loads for dioxins and polychlorinated biphenyls in Galveston Bay and the Houston Ship Channel system, including numerous tributaries. Kirk provided technical guidance and oversight in all phases of the project. Developed a sampling plan that involved water, sediment, fish, crab, runoff, effluent, and air. Using high-volume sampling, quantified dioxins in water and effluent at sub-picogram-per-liter concentrations and polychlorinated biphenyls in the picogram-per-liter range. Trained staff in the operation and maintenance of high-volume samplers and procedures for trace organic sampling. Coordinated the data quality objectives design to support pollutant source identification, the model development strategy that involved use of the WASP model with the RMA2 model for this tidally influenced system, and a simple air model to estimate local atmospheric deposition of dioxins and polychlorinated biphenyls. Developed an RMA2 hydrodynamic model of the Houston Ship Channel system. Developed a bioaccumulation model for fish and crabs using structural equation modeling. Developed sediment and water quality targets for dioxins and polychlorinated biphenyls. Performed an evaluation of remedial measures for contaminated sediment, including dredging, capping, and in situ treatments.

Principal Scientist. North Texas Municipal Water District. Tarrant Integrated Pipeline Project. Henderson and Navarro County, Texas. 01/2012–12/2012. Kirk served as technical advisor and reviewer for a fluvial geomorphic assessment of a pipeline crossing of the Trinity River near Trinidad, Texas. The study included field assessment and data gathering for the geomorphological assessment, development

of an RMA2 2-dimensional hydrodynamic model and potential scour calculations. The project included Acoustic Doppler Current Profiling (ACDP), sonar based bathymetric mapping and an innovative shallow-water application of Acoustic Sub-Bottom Profiling. The resulting study projected potential scour and riverine meander issues for the 100-year design lifecycle of the project.

Principal Scientist. Confidential Global Chemical Manufacturing Company, East Chicago Site Natural Area Evaluation, East Chicago, Indiana, United States. 02/2011-04/2012. Parsons completed a wetland delineation and prepared a report on delineation and a preliminary jurisdictional determination of wetlands and waters of the United States for the East Chicago site interim remedial measures in the buffer zone of the site. Work included submitting Clean Water Act Section 404 and 401 permit applications to the US Army Corps of Engineers and the Indiana Department of Environmental Management. Parsons also conducted vegetation surveys and developed a revegetation management plan after construction was complete. The site included a former manufacturing area (which was demolished, and all structures removed), a landfill, and wetland areas. Parsons produced a comprehensive groundwater report and recommendations for groundwater and soil remedial actions to be carried out as interim remediation measures, pilot and treatability studies, and removal actions. Work included excavating more than 75,000 cubic yards of contaminated soils and revegetating with native plants. Work also included conducting extensive soil and groundwater investigations; performing ecological sampling in the natural area, which contained threatened and endangered species; and working closely with US Environmental Protection Agency Region 5, the Indiana Department of Environmental Management, and the Indiana Department of Natural Resources to preserve and restore the areas adjacent to the natural area. Kirk performed statistical analysis and risk assessments for this Resource Conservation and Recovery Act site. Risk assessment work included data analysis, modeling, and remediation of contaminant migration from soils to surface waterbodies via groundwater. Applied multivariate statistical modeling to quantify impacts of contaminants and environmental factors on species occurrence and abundance. Applied geochemical modeling using PHREEQC to evaluate remedial alternatives for groundwater contamination.

Water Resources Modeler. Kingdom of Saudi Arabia Ministry of Housing, Ministry of Housing Support Services, Riyadh, Saudi Arabia. 10/2011-03/2012. The Kingdom of Saudi Arabia developed a program to build more than 500,000 Saudi homes with a few years. Parsons was awarded the first package released by the Ministry of Housing, which consisted of 11 new communities across the kingdom and around 32 million square m of developed space, ranging from 10 million square m in Dammam to 729,000 square m in Khamis Mushayt. The project scope included master planning, infrastructure and housing design, and construction supervision. Kirk performed hydraulics and hydrology tasks, including developing combined 1D and 2D fully dynamic stormwater runoff, collection, and conveyance models using XP-SWMM for each of the 11 proposed developments. The design phase of the project included evaluating open channels, underground conveyance, ponds, and infiltration and evaporation structures. Major challenges included the flash flood nature of most of Saudi Arabia, the variable natures of the 11 sites, limited availability of data, and the rapid turnaround of the project.

Project Manager. Texas Commission on Environmental Quality, Trinity River Polychlorinated Biphenyls Total Maximum Daily Load Modeling, Dallas-Fort Worth,

Texas, United States. 05/2007-10/2011. Parsons developed total maximum daily loads addressing polychlorinated biphenyl contamination of several segments of the Trinity River in the Dallas-Fort Worth Metroplex. Work included assessing existing data; collecting sediment, water, wastewater, and stormwater samples for analysis to quantify existing levels and sources of polychlorinated biphenyls related to fish consumption advisories and bans; developing a custom watershed and river water quality model simulating sediment-mediated fate and transport of polychlorinated biphenyls in water columns and tissues; preparing total maximum daily load allocations and documentation; and providing public and stakeholder education. High-volume sampling was performed to quantify particulate and dissolved polychlorinated biphenyls down to the picogram-per-liter range. Kirk developed the total maximum daily loads addressing polychlorinated biphenyl contamination of the Trinity River segments in the Dallas-Fort Worth Metroplex.

Technical Director. Texas Commission on Environmental Quality, Texas A&M AgriLife Research, Austin, Texas, United States. 06/2009-09/2011. Parsons provided technical support to the Texas Commission on Environmental Quality's water quality programs for improving field data collection and assessment methods for excess nutrient loading in streams. Kirk performed statistical data analysis to identify key physical and chemical factors influencing periphyton abundance and to compare various periphyton sampling techniques. Substrate size and light were the most important influences on periphyton growth.

Scientist. Confidential Global Chemical Manufacturing Company, Edge Moor Site Phase II RCRA Facility Investigation, Edgemoor, Delaware, United States. 10/2009-04/2011. Parsons performed a Phase II groundwater RCRA Facility Investigation. Kirk performed statistical analysis and risk assessments for this Resource Conservation and Recovery Act site. Risk assessment work included data analysis, modeling, and remediation of contaminant migration from soils to surface waterbodies via groundwater.

Principal Scientist. Confidential Global Chemical Manufacturing Company, Former Agrico Site Remedial Design and Debris Pile Management, Carteret, New Jersey, United States. 02/2011-02/2011. Parsons performed a remedial investigation, design, and implementation for a former phosphate-based fertilizer production plant. Remedies included a cap, a barrier wall, and engineering controls. The site, located along a large river body, contained various contaminants of concern, including phosphorus, arsenic, and radionuclides, and required post-remediation shoreline habitat restoration. Kirk performed statistical analysis and risk assessments for this Resource Conservation and Recovery Act site. Risk assessment work included data analysis, modeling, and remediation of contaminant migration from soils to surface waterbodies via groundwater.

Scientist. Confidential Multinational Conglomerate Corporation, Hudson River Environmental Remediation Project, New York, United States. 01/2009-04/2009. Parsons' scope of work included dredging of more than 2 million cubic yards of sediment, on-river transportation of dredged sediments to a processing area, filter press processing of dredged materials and off-site disposal via a railcar, and mechanical cap placement. Kirk provided technical direction to evaluate and assess plans for monitoring water and air quality impacts.

Task Manager. Lower Colorado River Authority, Colorado River Water Quality Modeling and Assessment, Austin, Texas, United States. 03/2007-04/2009. Parsons evaluated how the Lower Colorado River Authority's San Antonio Water

System Water Project water management policies would affect existing and future water quality of the lower Colorado River below Austin. Kirk served as task manager for water quality modeling to support evaluation of future water quality and management scenarios for a proposed reservoir. Applied the US Army Corps of Engineers BATHTUB model, together with projected future river water quality, to evaluate future water quality in a proposed drinking water supply reservoir. Evaluated the impacts of several sites and reservoir configurations on the occurrence of elevated chlorophyll levels and the frequency of taste and odor problems. Calibrated the model to other off-channel reservoirs in the Colorado River basin. Applied structural equation modeling, a statistical-based modeling method, to evaluate the impacts of water management measures on salinity in the tidal Colorado River in the vicinity of the water intake for the South Texas Project Nuclear Operating Facility. Applied structural equation modeling to evaluate the hydrologic impacts of proposed agricultural water conservation measures on flow in the San Bernard River and Sandy Creek.

Project Manager. Oklahoma Department of Environmental Quality, Total Maximum Daily Load Toolbox Expansion for Turbidity, Oklahoma City, Oklahoma, United States. 12/2008-01/2009. Parsons provided rapid development of more than 150 bacteria and turbidity total maximum daily loads using a Web-based toolbox application (developed as part of the project), which provided load duration curves and pollutant source information on a station-by-station basis. Kirk provided technical direction for developing turbidity total maximum daily loads and for expanding the bacterial toolbox application to address turbidity and sediment.

Scientist. Confidential Multinational Conglomerate Corporation, Onondaga Lake Capping and Dredging, Syracuse, New York, United States. 11/2007-11/2008. Parsons designed a permeable reactive barrier for lake sediments contaminated by metals, BTEX, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls in groundwater migrating from a contaminated site. Work included evaluating activated carbons, organoclays, and sand to confine contaminants and performing extensive testing to evaluate biodegradation. Approximately 450 acres of contaminated sediment were capped with a 3-foot-thick multimedia cap consisting of siderite, activated carbon, sand, gravel, and topsoil. Kirk provided technical direction on design of the permeable reactive barrier. Advised a university subcontractor on laboratory microcosm tests of various caps. Provided technical review of a plan to seed the hypolimnion with nitrate to limit methylation of inorganic mercury in sediments.

Lead Modeler. Dr. Bryan Brooks (Baylor University), Baylor University Transition Zone Index, Waco, Texas, United States. 08/2004-02/2008. Kirk developed EFDC 3D hydrodynamic models of eight Texas reservoirs to aid in determining the location of the transition zone between the tributary streams and lacustrine conditions. This Transition Zone Index project was performed with Baylor University to assist the Texas Commission on Environmental Quality with developing appropriate nutrient and dissolved oxygen criteria for Texas reservoirs and for water quality permitting in reservoirs.

Project Manager. Oklahoma Department of Environmental Quality, Pathogen Source Identification GIS Tool and Total Maximum Daily Load, Oklahoma City, Oklahoma, United States. 10/2004-06/2006. Parsons developed more than 150 bacteria total maximum daily loads developed rapidly using a Web-based bacteria toolbox application (developed as part of the project) that provides load duration curves and

bacteria source information on a station-by-station basis. Kirk served as project manager.

Quality Assurance Manager. Texas Farm Bureau, Lake Waco and Belton Lake Watersheds Bacteria Source Tracking, Waco, Texas, United States. 11/2002-02/2006. Parsons identified sources of fecal contamination in Lake Waco and Belton Lake and incorporated several biological methods (ribotyping, polymerase chain reaction, pulsed-field gel electrophoresis, and antibiotic resistance analysis) to differentiate specific sources of E. coli bacteria in ambient water. Kirk defined the data quality objectives and entire sampling design for conducting bacteria source tracking on the two lakes (19,500 acres) and prepared the quality assurance project plan that was approved by the US Environmental Protection Agency.

Technical Director. USEPA TMDL Program Support. Nationwide. 10/2002–12/2007. Provided technical direction on numerous task orders supporting the USEPA in TMDL development and implementation nationwide. Specific TMDL development projects include: bacteria TMDL development for the Rocky River, Ohio; bacteria TMDL development for Southport Harbor, Connecticut; mercury TMDL development for Louisiana coastal bays and Gulf waters, as well as Catahoula Lake and the Little River; bacteria TMDL development for 60 water bodies in South Carolina; copper, lead, and mercury TMDL development for 17 rivers in Kansas; sediment TMDLs for 12 water bodies in the Pend Oreille River basin, Idaho; a phosphorus TMDL for Black Lake, Idaho; sediment and nutrient TMDLs for 21 water bodies in the American Falls basin, Idaho; chloride and dissolved solids TMDLs for several Louisiana water bodies; dioxin TMDLs in Louisiana. In addition to TMDL development, work included TMDL implementation plan support (including field sampling) to quantify sources of PCBs and other chlorinated organic compounds to the Spokane and Walla Walla Rivers, Washington. Also, developed a load duration application for the States of Oklahoma and Arkansas. The web-based application generates flow and fecal indicator bacteria load duration curves statewide, including ungaged sites, using advanced GIS and statistical algorithms.

Project Manager. Texas Commission on Environmental Quality, Dissolved Oxygen, pH, and Bacteria Total Maximum Daily Loads, Austin, Texas, United States. 07/2002-12/2005. Parsons developed 17 total maximum daily loads that were rapidly adopted by the Texas Commission on Environmental Quality and approved by the US Environmental Protection Agency. The project addressed impairments of aquatic life, contact recreation, and general uses caused by dissolved oxygen, fecal coliform bacteria, and pH in nine water bodies in southeast Texas. Kirk managed all phases of the process, including coordinating with and making presentations to the watershed stakeholder committee, performing a beneficial use impairment assessment, setting water quality targets, preparing data quality objectives and a quality assurance project plan, performing sampling design and instream water quality modeling using WASP with EFDC, performing watershed load modeling using HSPF, identifying pollutant sources, and calculating pollutant loading allocations. Prepared an assessment of historical water quality based on existing data, a model selection memo to identify appropriate models for total maximum daily load development, and a sampling plan and quality assurance project plan for additional data collection required to develop the total maximum daily load models. These deliverables were prepared in a timely manner in logical order, with client reviews, revisions, and approval between each step to ensure the state agency remained in control of the total maximum daily load development process. Developed HSPF models, RMA2

hydrodynamic models, and WASP water quality models for Adams and Cow Bayou Watersheds. Performed four intensive surveys of the systems to provide flow and water and sediment quality data for model calibration and verification. Applied models to determine total maximum daily loads. Made numerous presentations to a stakeholder advisory group.

Quality Assurance Manager. New Mexico Environment Department, Middle Rio Grande Bacteria Source Tracking, Albuquerque, New Mexico, United States. 02/2002-12/2005. Parsons conducted bacteria source tracking using ribotyping and antibiotic resistance analysis for the Middle Rio Grande, which was on New Mexico's Clean Water Act Section 303(d) List. Kirk developed an innovative sampling design, data quality objectives, and quality control metrics for ribotyping analysis and antibiotic resistance analysis of E. coli bacteria. Prepared the quality assurance project plan that was approved by the US Environmental Protection Agency and refined the use of a sanitary survey as an important watershed assessment tool for identifying specific sources of E. coli bacteria.

Technical Director. Texas Institute for Applied Environmental Research, Upper Oyster Creek Bacteria Total Maximum Daily Load, Austin, Texas, United States. 09/2003-07/2005. Parsons provided bacteria source tracking to support total maximum daily load development for the Upper Oyster Creek in Fort Bend County, Texas, for the Texas Commission on Environmental Quality. Ribotyping was used to identify source-specific strains of E. coli. Kirk provided technical direction in support of total maximum daily load development using ribotyping to identify source-specific strains of E. coli as part of a team with the Texas Institute of Applied Environmental Research.

Project Manager. Texas Water Development Board, Seymour Aquifer Groundwater Availability Model, Seymour, Texas, United States. 12/2002-07/2004. Parsons prepared groundwater availability models for the Seymour Aquifer, the Central Gulf Coast Aquifer, the Northern Carrizo-Wilcox Aquifer, and the Southern Carrizo-Wilcox Aquifer. Kirk assisted with the development of groundwater availability models of the Seymour Aquifer for the Texas Water Development Board. Prepared assessment of groundwater quality. Developed standard operating procedures for the spatial, temporal, and lithological distribution of historical groundwater pumpage in the aquifer. Led the application of these procedures to process raw spatial and water use data into model input files.

Project Manager. Air Force Institute for Environmental Risk Assessment. Development of a Water Quality Criterion for Perchlorate. 5/2001-11/2003. I developed a fresh water quality criteria for perchlorate for the acute and chronic protection of aquatic life. I performed a review of existing scientific literature and USEPA requirements for water quality criteria development, identified data gaps, procured and managed commercial laboratory toxicity studies with a variety of freshwater biota to fill those data gaps, and analyzed resulting data. I calculated a water quality criteria in accordance with USEPA guidance and prepared a project report. I also presented at a national SETAC meeting and authored a publication in a peer-reviewed scientific journal.

Task Manager. Shell Oil Company, Patrick Bayou Total Maximum Daily Load, Deer Park, Texas, United States. 01/2001-08/2003. Parsons performed comprehensive tasks for developing four total maximum daily loads for Patrick Bayou, a tributary of the Houston Ship Channel (Segment 1006A), listed on the state's Clean Water Act

Section 303(d) list and later on the US Environmental Protection Agency Superfund list for water quality impairments associated with sediment toxicity, ambient water toxicity, metals, organics, and temperature. Polycyclic aromatic hydrocarbons were a primary chemical of concern because of an upstream fire-training area, a bus barn and lubricants facility, and an oil refinery. Tasks included extensive water, sediment, biological, and toxicity sampling to identify toxicants and their effects on the environment. Multivariant statistical analyses were used to correlate benthic invertebrates, chemistry, and sediment toxicity data. Kirk developed and implemented a sediment quality triad, incorporating simultaneous measurement of sediment chemistry, sediment toxicity, and benthic biological communities to identify the causes of sediment toxicity. Applied advanced statistical methods to relate observed patterns in benthic species abundance to environmental factors such as sediment grain size and chemical contaminant concentrations. Polycyclic aromatic hydrocarbons were a primary chemical of concern because of an upstream fire training area, a bus barn and lubricants facility, and an oil refinery.

Scientist. Duke Engineering and Services Inc., Northeastern Carrizo-Wilcox Aquifer Groundwater Availability Modeling, Texas, United States. 02/2001-01/2003. Kirk assisted with development of a groundwater availability model of the northern portion of the Carrizo-Wilcox aquifer. Prepared a groundwater quality assessment. Developed standard operating procedures for the spatial, temporal, and lithological distribution of historical groundwater pumpage in the aquifer. Led the application of these procedures to process raw spatial and water use data into model input files.

Scientist. Texas Water Development Board, Southwestern Carrizo-Wilcox Aquifer Groundwater Availability Modeling, Texas, United States. 02/2001-01/2003. Kirk assisted with developing a groundwater availability model of the Southern Carrizo-Wilcox aquifer for the Texas Water Development Board. Prepared an assessment of groundwater quality; developed standard operating procedures for the spatial, temporal, and lithological distribution of historical groundwater pumpage in these aquifers; and led the application of these procedures to process raw spatial and water use data into model input files.

Scientist. Texas Water Development Board, Gulf Coast Groundwater Availability Model, Texas, United States. 02/2001-07/2002. Parsons performed groundwater availability modeling for the Gulf Coast Aquifer, the southern and northern portions of the Carrizo-Wilcox Aquifer, and the Seymour Aquifer. Work included developing standard operating procedures for spatial, temporal, and lithological distribution of historical groundwater pumps and evaluating water quality in various areas of the aquifers. Work included evaluating groundwater pumping effects from the Edwards Aquifer from five military installations in San Antonio and the effects on spring flow and endangered species. The Texas Water Development Board's Edwards Model was used to predict groundwater level and spring flow over various years. Kirk assisted with development of a groundwater availability model of the Gulf Coast aquifer for the Texas Water Development Board. Prepared a groundwater quality assessment. Developed standard operating procedures for the spatial, temporal, and lithological distribution of historical groundwater pumpage in the aquifer. Led the application of these procedures to process raw spatial and water use data into model input files.

Project Manager. City of Austin, Sand Hill Energy Center Permit Support, Austin, Texas, United States. 02/2001-03/2002. Parsons provided permit support for the Sand Hill Energy Center, a 480 MW facility with combined-cycle and peaking units. Kirk provided Texas Pollutant Discharge Elimination System permitting assistance.

Project Manager. Clear Creek Total Maximum Daily Loads, Friendswood, Texas, United States. 01/2000-12/2000. The project involved preparing the Clear Creek total maximum loads for volatile organic compounds and chlordane. Kirk managed the project and developed four total maximum daily loads and implementation plans for volatile organic compounds and chlordane.

Project Manager. Texas Natural Resource Conservation Commission, Statewide Low-Level Trace Element Evaluation Project, Texas, United States. 01/1999-01/2000. This project quantified background levels of trace elements for wastewater permitting and total maximum daily load purposes. It involved an intensive survey of trace element levels in water bodies across the state, using state-of-the-art, low-level clean methods. The relative impacts of point and non-point sources of trace elements on instream water quality were examined, as well as the influence of natural watershed factors. Kirk managed the project with the Texas Engineering Experiment Station.

Project Manager. Texas Natural Resource Conservation Commission, Total Maximum Daily Load Program, Texas, United States. 01/1999-01/2000. The program involved preparing total maximum loads for multiple locations within Texas. Kirk assisted with developing and implementing the total maximum daily load program in Texas. Developed and managed federal grants and contracts to support total maximum daily load and water quality assessment projects. Served as a technical resource on water quality, statistical analysis, and quality assurance issues. Led public participation efforts. Led quality assurance and data management activities for the program. Developed a quality assurance project plan “shell” document for use by external contractors working for the Texas Natural Resource Conservation Commission to develop total maximum daily loads. As project manager, managed projects addressing sediment and water toxicity in seven water bodies on the Texas 303(d) List and developed four total maximum daily load studies and implementation plans for volatile organic compounds and chlordane.

Project Manager. Texas Natural Resource Conservation Commission, Toxicity Total Maximum Daily Loads, Texas, United States. 01/1999-01/2000. The project involved addressing sediment and water toxicity in seven Texas water bodies. Kirk managed the project, including federal grants and subcontracts.

Project Manager. Texas Natural Resource Conservation Commission, Buffalo and Whiteoak Bayou Fecal Pathogen Total Maximum Daily Loads, Houston, Texas, United States. 01/1999-01/2000. The project involved developing total maximum daily loads and preparing reports for bacterial indicators of fecal contamination in Buffalo and White Oak Bayous in Houston, Texas. Kirk managed total maximum daily loads for fecal pathogens.

Project Manager. Texas Natural Resource Conservation Commission, Bacterial Source Tracking Project, Corpus Christi, Texas, United States. 01/1998-01/1999. The project involved identifying sources of fecal pathogens in coastal watersheds. Kirk managed an antibiotic resistance analysis to identify the sources of fecal pathogens in coastal watersheds.

Project Manager. Texas Natural Resource Conservation Commission, Statewide Bacterial Indicator Study, Statewide Texas, United States. 01/1998-01/1999. The project involved conducting a statewide bacterial indicator study to develop recommendations for improvements in assessment methods for bacterial indicators of fecal contamination in water. Kirk led the bacterial indicator study and developed

recommendations for improvements in assessment methods for bacterial indicators of fecal contamination in water. Guided development and approval of new water quality standards and monitoring and assessment methodologies. Assembled and coordinated an external group of scientists and stakeholders to provide a peer review for the study.

Project Manager. Texas Natural Resource Conservation Commission, Middle Rio Grande Water Quality Assessment, Laredo, Texas, United States. 01/1998-12/1998. The project involved conducting a biannual assessment of water quality in the middle Rio Grande river. Kirk managed the water quality assessment. Developed a quality assurance project plan and a water quality monitoring plan to integrate the water quality monitoring activities of numerous local, state, and federal agencies. Managed strategic outsourcing of the water quality assessment.

Atmospheric Scientist and Statistician. Texas Natural Resource Conservation Commission. 01/1994-01/1998. As a member of the Air Quality Planning and Assessment Division, Kirk provided chemical, statistical, computer, and other technical and managerial expertise for preparing, managing, and evaluating air quality trends and pollutant transport; developing a sampling and monitoring plan; and implementing a state implementation plan. Served as a primary agency resource for complex multivariate statistical techniques to assist with identifying emission sources. Managed development of an ambient air quality and meteorology database.

Graduate Research Assistant and Graduate Fellow. University of Wisconsin, Madison, Department of Civil and Environmental Engineer. 09/1988-10/1994. Kirk was responsible for performing independent and original research on the ambient levels, phase distribution, transport, and residence times of trace organic and metal contaminants in the environment. Prepared grant proposals. Supervised undergraduate employees. Taught environmental analytical chemistry. Received the 1993 graduate student award from the American Chemical Society and fellowships from the International Association of Great Lakes Research and Wisconsin Alumni Research Federation. Research activities as a graduate student included:

- Coupled field and laboratory studies with models to evaluate the particle-mediated seasonal cycling of PCBs in central Lake Michigan.
- Investigated proposals to remediate PCB- contaminated soils by application of quicklime. Using a complete mass balance, repudiated claims that quicklime degraded PCBs. Showed that the apparent losses were caused by thermally-enhanced volatilization and losses to absorption in Teflon components of the experimental apparatus.
- Applied state-of-the art methods such as continuous flow ultracentrifugation and ultrafiltration to isolate and characterize colloids from diverse aquatic environments, including groundwaters and surface waters. Quantified the colloidal impact on contaminant mobilization in groundwaters using intact soil cores. Quantified the impact of colloids on contaminant settling and volatilization in surface waters.
- Investigated the long-term flux of PCBs, trace metals, and nutrients from intact historically-contaminated sediment cores from the Fox River, Wisconsin back into the overlying water column under various turbulence schemes with and without bioturbation.

Plant Operator. Professional Services Group. Fort Worth, Texas. 05/1987-08/1988. Managed and operated wastewater treatment plants for the Union Pacific Railroad in Fort Worth, Big Spring, and Tyler, Texas.

Graduate Research Assistant. Texas Christian University, Environmental Science Program. 01/1988-08/1988. Kirk designed and executed a study of eutrophication and bacterial contamination in Lake Weatherford, a water supply reservoir in Parker County, Texas.

SPECIAL ASSIGNMENTS

Kingdom of Saudi Arabia Stormwater/ Flood Modeling (2011-2012). Kirk assisted the Saudi Arabia Ministry of Housing in urban development of 11 sites across Saudi Arabia proposed to house approximately a half million residents. The project was a design-build for 11 communities. Hydraulics/hydrology tasks included developing combined 1D/2D fully dynamic stormwater runoff, collection, and conveyance models using XP-SWMM for each of the 11 proposed developments. The design phase of the project included evaluating open channels, underground conveyance, ponds, and infiltration/evaporation structures. Major challenges included the flash flood nature of most of Saudi Arabia, the variable nature of the 11 sites across the country, limited data availability, and the rapid turnaround of the project.

PUBLICATIONS/PRESENTATIONS

Publications

KE Dean, MP Suarez, HS Rafai, RM Palachek, and L Koenig. 2009. Bioaccumulation of Polychlorinated Dibenzodioxins and Dibenzofurans in Catfish and Crabs Along and Estuarine Salinity and Contamination Gradient. *Environmental Toxicology and Chemistry* 28:2307-2317.

BW Brooks, JT Scott, MG Forbes, TW Valenti, JK Stanley, RD Doyle, **KE Dean**, JM Patek, RM Palachek, RD Taylor, and L Koenig. 2008. Reservoir Zonation and Water Quality: Science, Management and Regulations. *LakeLine* 28:39-43.

KE Dean, E Ling, and M Hall. 2007. TMDL Development for Water Quality Impairments of Adams and Cow Bayous. *Texas WET*, 24:10-14.

EA Casarez, SD Pillai, JB Mott, M Vargas, **KE Dean**, and GD Di Giovanni. 2007. Direct Comparison of Four Bacterial Source Tracking Methods and Use of Composite Data Sets. *Journal of Applied Microbiology* 103:350-364.

KE Dean, JM Patek, MA Vargas, M Derichsweiler, and S Webb. 2006. GIS-Based Source Identification and TMDL Development Toolbox for Pathogens. *Texas WET* 23: 17-21.

MP Suarez, HS Rifai, RM Palachek, **KE Dean**, and L Koenig. 2006. Distribution of Polychlorinated Dibenzo-p-dioxins and Dibenzofurans in Suspended Sediments, Dissolved Phase, and Bottom Sediment in the Houston Ship Channel. *Chemosphere* 62:417-429.

MP Suarez, HS Rifai, RM Palachek, **KE Dean**, and L Koenig. 2005. Polychlorinated Dibenzo-p-dioxins and Dibenzofurans in Houston Ship Channel Tissue and Sediment. *Environmental Engineering Science* 22:891-906.

KE Dean, RM Palachek, JM Noel, R Warbritton, J Aufderheide, and J Wireman. 2004. Development of Freshwater Water-Quality Criteria for Perchlorate. *Environmental Toxicology and Chemistry* 23:1441-1451.

FP Andes, EK Powers, KA Evans, BA Harvey, TM Richards, MA Vargas, KE Dean, and RM Palachek. 2002. Preparation of Integrated Water Quality Monitoring and Assessment Reports: Recommendations for Clean Water Act 303(d) and 303(b) Methodologies and Reporting. Federal Water Quality Coalition, American Farm Bureau Federation, and Association of Metropolitan Sewerage Agencies.

Mukerjee, S, DS Shadwick, LA Smith, MC Somerville, KE Dean, and JJ Bowser. 2001. Techniques to Assess Cross-Border Air Pollution and Application to a US-Mexico Border Region. *Science of the Total Environment*, 276: 205-224.

Mukerjee, S, DS Shadwick, KE Dean, LY Carmichael, JJ Bowser, and LJ Purdue. 1999. Lower Rio Grande Valley Transboundary Air Pollution Project. U.S. Environmental Protection Agency, EPA/600/R-99/047.

KE Dean, MM Shafer, and DE Armstrong. 1993. Particle-Mediated Transport and Fate of a Hydrophobic Organic Contaminant in Lake Michigan: The Role of Major Water Column Particle Species. *Journal of Great Lakes Research*, 19:480-496.

DE Armstrong, MM Shafer, and KE Dean. 1992. Role of Mobile Colloids in the Transport of Chemical Pollutants in Ground Waters, Water Resources Center, University of Wisconsin-Madison, Report GI599-02.

Sedlak, DL, KE Dean, DE Armstrong, and AW Andren. 1991. Interaction of Quicklime with Polychlorobiphenyl-Contaminated Solids. *Environmental Science & Technology*, 25:1936-1940.

Hayes, S, L Newland, K Morgan, and K Dean. 1990. Septic Tank and Agricultural Non-Point Source Pollution Within a Rural Watershed. *Toxicological and Environmental Chemistry,* 26: 137-155.

Presentations

"Lower Genesee River RFI Investigation Overview," Ninth International Conference on Remediation and Management of Contaminated Sediments, New Orleans, Louisiana, 2017 (co-presenters L. Thomas, M. Vetter, T. Drachenberg, K. Fields, S. Bupp, K. Dean, M. Rondinelli, C. Kriegner, and T. Towey).

"Development of a Sediment-Water Model for Dioxin in the Houston Ship Channel, Texas," WEFTEC, San Diego, California, 2007 (co-presenters M.P. Suarez, K. Dean, J. Patek, R. Palachek, H. Rifai, A. Izquierdo, and L. Koenig).

"Tools to Assist Identification and Quantification of Indicator Bacterial Sources," WEFTEC, Washington, DC, 2005 (co-presenters K.E. Dean, J.M. Patek, and M.A. Vargas).

"Dioxin Contamination in the Houston Ship Channel," Haden Road Community Advisory Panel, Houston, Texas, 2004 (co-presenters H.S. Rifai, M.P. Suarez, R. Palachek, K. Dean, P. Jensen, M. Bloom, and L. Koenig).

"Groundwater Availability Model for the Seymour Aquifer," Texas Water Development Board, 2004 (co-presenters J.E. Ewing, T.L. Jones, J.F. Pickens, A. Chastain-Howley, K. Dean, and A.A. Spear).

"Dioxin Contamination in the Houston Ship Channel," Galveston Bay Estuary Program Board Meeting, Armand Bayou Nature Center, Texas, 2004 (co-presenters H.S. Rifai, M.P. Suarez, R. Palachek, K. Dean, P. Jensen, M. Bloom, and L. Koenig).

"Use of Bacterial Source Tracking in Support of TMDL Implementation Plan at Middle Rio Grande Watershed," National TMDL Science and Policy Specialty Conference, Chicago, Illinois, 2003 (co-presenters M. Vargas, K. Dean, H. Zhang, D. Hogge, and M. Samadpour).

"Site-Specific Water Quality Targets for Fish Contaminants: Application of Sediment, Water, and Tissue Targets Based on Measured Partitioning Relationships," National TMDL Science and Policy Specialty Conference, Chicago, Illinois, 2003 (co-presenters K.E. Dean, R.M. Palachek, H.S. Rifai, M.P. Suarez, S. Hausman, and L. Koenig).

"Development of a Dioxin TMDL for the Houston Ship Channel in Texas," National TMDL Science and Policy Specialty Conference, Chicago, Illinois, 2003 (co-presenters H.S. Rifai, M.P. Suarez, R. Palachek, K. Dean, P. Jensen, M. Bloom, and L. Koenig).

"Groundwater Availability Model for the Northern Carrizo-Wilcox Aquifer," Texas Water Development Board, 2003 (co-presenters D. Fryar, R. Senger, N. Deeds, J. Pickens, T. Jones, K. Dean, and A.J. Whallon).

"Application of Sanitary Surveys and Other Tools to Optimize Microbial Source Tracking Studies," WEFTEC Microbial Source Tracking Workshop, Los Angeles, California, 2003.

"TMDLs for Bacteria in Houston Bayous," Texas Water, 2001 (co-presenters P.A. Jensen, K. Lee, Y.C. Su, H. Rifai, M. Suarez, and K. Dean).

"Water Quality Standards for Contact Recreation," Texas Water, 2000 (co-presenters K. Dean, P.A. Jensen, and K. Lee).

Exhibit C

April 16, 2020

Lial F. Tischler

Environmental Engineer

Personal Information

Date of Birth: 22 August 42

Education

B.S. in Civil Engineering, Texas Western College, 1964
M.S. in Environmental Health Engineering, University of Texas at Austin, 1966
Ph.D. in Civil Engineering (Environmental), University of Texas at Austin, 1968

Professional Affiliations

Registered Professional Engineer (Texas No. 32768)
Water Environment Federation (past Chairman, Toxic Substances Committee)
American Society of Civil Engineers
Board Certified Environmental Engineer, American Academy of Environmental Engineers
Society of Environmental Toxicology and Chemistry

Honorary Affiliations and Awards

Sigma Xi
Society of American Military Engineers, Outstanding Engineering Student, 1964
Chemical Manufacturers Association Quality and Services Award, 1995

Work Experience

1986 to Present	Tischler/Kocurek, Partner
1976 to 1988	Adjunct Associate Professor, University of Texas at Austin
1973 to 1986	Engineering-Science, Inc. Vice President, Manager of Southwest Operations (1981-1986) Vice President, Deputy Manager of Southwest Region (1977-1981) Associate and Manager, Austin Office (1975-1977) Manager, Austin Office (1973-1975)
1970 to 1973	Texas Water Development Board Director, Systems Engineering Division (1971-1973) Hydrologist, Office of Planning (1971) Systems Engineer (1970)
1968 to 1970	U.S. Army, Medical Service Corps, Captain Sanitary Engineer, Army Environmental Hygiene Agency (1969-1970) Division Sanitary Engineer, 2d Infantry Division (1968-1969)

Qualifications

Wastewater

- Treatability and preliminary engineering studies on industrial wastewaters, including chemical specific reduction studies and waste characterization studies — Includes studies focusing on removal of specific organic chemicals such as polychlorinated dibenzo-p-dioxins and dibenzofurans, all forms of biological treatment, nutrient removal, cyanide removal, oil and grease removal, and heavy metals removal. Direct treatability studies to determine site-specific biodegradation constants for hazardous air pollutants and other volatile organic and inorganic compounds. Types of wastewater evaluated include: organic chemical manufacturing, pharmaceutical manufacturing, plastics and synthetic resins, petroleum refining, petroleum exploration, transportation and storage, pulp and paper, wood products (lumber, plywood, OSB), pesticides manufacturing, electronic equipment and components, synthetic rubber, nuclear weapons manufacturing, cast iron foundries, glass manufacturing, centralized waste treatment facilities, and domestic sewage (POTWs).

- Treatment system operational assistance for biological (e.g., suspended growth and fixed film processes of all types), physical and chemical treatment processes (e.g., oil/solids separation, metals removal, filtration, chemical oxidation) — wastewaters treated by these systems include petroleum refineries, organic chemicals, pharmaceuticals, plastics and synthetic fibers, pulp and paper, wood products, cast iron foundries, synthetic rubber, pesticides, mixed industrial wastewaters (centralized waste treatment), and domestic sewage. Projects included on-site evaluations followed by recommendations for improvements and oversight following implementation of the recommended actions.

- Permit application preparation, negotiation with regulatory agencies, public hearings and administrative hearings on permits — this work includes NPDES permits issued by U.S. Environmental Protection Agency (EPA) regions, state NPDES permits, and state-only permits. Performed wastewater permit support services for clients in over 30 states, Puerto Rico, Virgin Islands and nine EPA regions. Prepare and oversee preparation of permit applications and technical evaluations of technology-based limits and water quality-based effluent limits to support requested permit provisions. Review of draft permits for accuracy and consistency with applicable regulations is a major component of this work. Preparation of comments on draft permits, presentation of comments at public meetings and hearings, and expert testimony at evidentiary hearings on contested permit conditions.

- Toxicity identification evaluations/toxicity reduction evaluations (TIE/TRE) — provided technical oversight, evaluations, and prepared TIE/TRE final reports for POTWs, petroleum refineries, organic chemical plants, synthetic polymer and rubber plants, centralized waste treatment facilities, and a cast iron foundry that failed acute and/or chronic whole effluent toxicity (WET) tests and successfully identified and controlled the toxicant(s). Toxicants identified include organic and inorganic compounds.

- Applications for a fundamentally different factors (FDF) variance from effluent limitations guidelines. — prepared, submitted, and negotiated FDF variances for organic chemical, plastics and synthetic fibers (OCPSF) plants and pharmaceutical manufacturing plants. Two of the clients obtained variances from the U.S. EPA from the effluent guidelines and standards.

Surface Water Quality

- Water quality modeling, mixing zone analyses, and evaluation of effluent diffusers — this work includes planning and implementing field studies of mixing (tracers) and modeling discharges with EPA's Plumes, DKHDEN, and CORMIX models. Conceptual-level evaluation of high-rate diffusers for more than 20 industrial plants and POTWs in six states and Puerto Rico and assisted owners in obtaining NPDES permits for these diffusers. Provided technical direction on several field mixing zone studies. Modeled water quality and directed modeling studies for multiple constituents, including dissolved oxygen, dissolved salts, temperature, nutrients and algal dynamics in streams and estuaries in multiple locations.

- Water quality surveys and studies. — Planned, managed, and prepared final reports on major water quality studies for private and public clients. These studies involved collection of physical, hydrologic, chemical, and biological data necessary to document existing water quality and to develop calibrated and verified water quality models. Most of the studies also included development of a calibrated water quality model and use of the model to predict future treatment and non-point source control requirements. Example projects include: City of Austin — Nationwide Urban Runoff Program, Republic of Korea Han River Master Plan, Fox River Industrial Rivers Study Committee — Fox River waste load allocation, City of Phoenix, Beijing Municipal Environmental Protection Bureau, and the Thailand Pollution Control Department.

- Site-specific water quality standards development and use attainability analyses — planning, management, report preparation, negotiation, and testimony in public hearings for development and approval of site-specific use designations and chemical-specific criteria. Clients include POTWs, stakeholder groups, and industrial plants. This work includes development and state approval of site-specific metals criteria (e.g., aluminum, copper, nickel, zinc) for over 15 clients using the water effects ratio (WER), biotic ligand model (BLL) and/or partitioning coefficient methods.

- Total maximum daily loading (TMDL) analyses/technical support/guidance — projects include preparing technical guidance manuals, comments, and technical evaluations, and participating as a member of TMDL stakeholder groups. Clients include trade associations (e.g., American Chemistry Council, American Petroleum Institute, East Harris County Manufacturers Association, Texas Association of Dairymen), stakeholder groups (Delaware Estuary Municipal-Industrial Coalition, Texas Commission on Environmental Quality TMDL guidance stakeholders group), and individual companies and cities. Types of pollutants addressed in the TMDLs include polychlorinated dibenzo-p-dioxins and dibenzofurans, nutrients, heavy metals, pesticides, polynuclear aromatic hydrocarbons and dissolved oxygen.

- Thermal plume characterization modeling — clients include chemicals and plastics plants, electric power stations, petroleum refineries and industrial POTWs.

- Peer review of Clean Water Act Section 316(b) reports on cooling water intake system entrainment, controls, and environmental and economic impacts — clients include electric power stations (conventional and nuclear) and chemical plants.

Hazardous and Solid Wastes

- Remedial investigations of existing and closed treatment and disposal sites. — work included technical direction, development and implementation of work plans, preparation of final reports, and negotiation with regulatory authorities. Types of sites include chemical plants, petroleum refineries, nuclear weapons manufacture, lead mines, aerospace manufacturing, glass manufacturing, and cast iron foundries.

- Ground water monitoring programs and ground water modeling — work included planning, management, oversight and evaluation of ground water quality data from monitoring programs. This work included development of groundwater monitoring plans and location and design of monitoring wells. Development and application of ground water hydrologic models to evaluate transport of pollutants. Clients include chemical plants, aerospace manufacturing plants, petroleum refineries, cast iron foundries, nuclear weapons plants and a major municipal government (Beijing Municipal Environmental Protection Bureau).

- Feasibility studies for corrective action. — evaluation and costs of alternatives for remediation of past contamination. Types of sites include nuclear weapons manufacturing, chemical plants, lead mines and petroleum refineries. Clients include private firms, government, and trade associations.

- Treatability studies and preliminary engineering of waste management systems. — technical oversight and report preparation of studies on solid waste management systems for petroleum refineries, POTWs, cities, and chemical plants.

- Site selection for treatment/disposal operations— planned, managed, and prepared the final report for two environmental site selection studies for planned hazardous waste management facilities.

- Closure plans and closure certification. — performed closure evaluations, prepared closure plans, and certified closure of hazardous and solid waste sites for chemical plants, synthetic rubber plants, aerospace manufacturing plant, and cast iron foundry.

- Permit application preparation and negotiation with regulatory agencies. — prepared permit applications and negotiated hazardous and solid waste permit provisions with regulatory agencies for petroleum refineries, chemical and plastic plants, cast iron foundries.

- Waste analysis plans — prepared hazardous waste analysis plans for refineries, chemical plants, foundries, and POTWs.

Water Supply

- Assessment of water availability — evaluated availability of surface and ground water for government and private clients at two sites.

- Assessment of suitability of treated water for human and/or process use — collected and evaluated chemical and biological data for government and industrial clients to determine acceptability as a drinking water supply.

- Performed audits of drinking water system compliance with state and federal regulations at multiple industrial treatment facilities.

Regulatory Advocacy

- Technical assistance and preparation of comments on industrial effluent limitations guidelines, storm water permitting, water quality-based permitting regulations, water quality criteria, surface water quality evaluation methods, hazardous and solid waste regulations, drinking water regulations, NPDES permitting regulations, impaired waters listing and TMDL regulations, cooling water intake structures, ocean acidification, hazardous air pollutant emissions regulations, and analytical methods — clients include the American Petroleum Institute, American Chemistry Council, Pharmaceutical Research and Manufacturers of America, New Jersey Business and Industry Association, Western States Petroleum Association, Texas Paper Industry Environmental Committee, East Harris County Manufacturers Association, Industry Water Coalition of New Jersey, National Mining Association, Texas Association of Dairymen, and numerous private companies.

- Preparation/presentation of technical comments and provide public testimony on water quality standards — clients include trade associations (e.g., Texas Chemical Council, Texas Forestry Association, Louisiana Chemical Council, Great Lakes Water Quality Coalition, American Chemistry Council, Utilities Water Act Group, Industry Joint Water Coalition of New Jersey, American Petroleum Institute, Pharmaceutical Research and Manufacturers of America), Barceloneta Wastewater Treatment Corporation (Puerto Rico), Port of Corpus Christi Authority and individual public and private clients.

- Preparation of petroleum refining industry BAT review for the Ontario Petroleum Association and the Petroleum Association for the Conservation of the Canadian Environment. Technical assistance to Ontario Ministry of the Environment for scoping petroleum refining industry study. Presented discussion of BAT standards development to Ministry staff working on their development of industrial standards (Municipal Industrial Strategy for Abatement).

- Expert Testimony in public hearings, agency actions. — testimony given on water quality issues and proposed projects for chemical plants, petroleum refineries, electric utilities, cities, state agencies and trade associations.

Litigation

- Expert witness — qualified as an expert and testified on ground water hydrology and contamination, surface water hydrology and surface water quality, biological and physical-chemical treatment of municipal and industrial wastewater, federal and state water quality regulations, and federal and state hazardous and solid waste regulations. Testimony has been provided on behalf of government and private clients.

- Technical brief preparation — prepared technical briefs to support challenges of federal regulations. Clients included trade associations and a POTW.

Environmental Audits

Audits include wastewater, hazardous/solid waste, oil and hazardous material handling, polychlorinated biphenyls, asbestos, air emissions and potable water.

- In-depth evaluation of wastewater treatment at an organic chemicals manufacturing plant including collection and analysis of samples.

- Audits of two semiconductor manufacturing plants, eight organic chemicals manufacturing plants, six synthetic polymer plants, four tire plants, two cast iron foundries, one defense products plant, one petroleum refinery, one calcium carbide manufacturing plant and one glass plant.

Air

- Permit assistance and negotiations with regulatory agencies — planning, permit application preparation, and assistance in the negotiation of new source review (NSR) construction permits, prevention of significant deterioration (PSD) permits, and state operating permits (including Clean Air Act Title V permits) for industrial and government clients. Industries include petroleum refining, chemicals, synthetic rubber and pulp and paper. Government clients include POTWs and a port authority.

- Estimation of volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions from wastewater collection systems and treatment units — use of WATER9 and TOXCHEM models to estimate air emissions for annual emissions inventories, permit applications, and to demonstrate compliance with National Emission Standards for Hazardous Air Pollutants. Provided technical assistance and prepared comments on EPA rules for HAPs and VOCs for trade associations including the American Chemistry Council, American Petroleum Institute, and Pharmaceutical Research and Manufacturers of America. Industrial facilities for which emissions have been estimated include organic chemical and resins plants, industrial POTWs, petroleum refineries, pharmaceutical manufacturing plants, pesticide manufacturing plants, and centralized waste treatment facilities.

- Technical assistance for maximum available control technology (MACT) wastewater compliance — assist clients in planning, provide technical support, and conduct studies to support multiple companies efforts to comply with the EPA MACT rules including the SOCMI HON, pharmaceutical MACT, pesticide manufacturing MACT, polymers manufacturing MACT, OSWRO MACT, miscellaneous organic chemicals (MON) MACT and related rules. Directed studies for development of site-specific biodegradation rates for HAPs at over 18 manufacturing sites (organic chemical plants, petroleum refineries, pharmaceutical plants, centralized waste treatment facilities, and pesticide plants).

LIAL F. TISCHLER
Environmental Engineer

PUBLICATIONS

"Linear Substrate Removal in the Activated Sludge Process," with W. W. Eckenfelder, *Advances in Water Pollution Research*, Jenkins, S.H., ed., Pergamon Press, London, 1967.

"Simulation of Water Quality in Streams and Canals," with W. A. White and F. D. Masch, Texas Water Development Board, Report 128, 1971.

"The Effect of Water Resources Development on Estuarine Environments," with J. C. Nelson and D. G. Rauschuber, Water Resources Bulletin, Vol. 9, No. 6, 1973.

"Integrated Surface-Ground Water Development on a Regional Basis - The San Antonio, Texas Study," *Proceedings, First World Congress on Water Resources*, International Water Resources Association, 1973.

"Water Quality Prediction Within an Interbasin Transfer System," with W. A. White and T. A. Austin, *Water Resources Bulletin*, Vol. 8, No. 3, 1972.

"Simulation Techniques for Water Project Analysis," with M. L. Holloway, *Journal of the Irrigation and Drainage Division*, American Society of Civil Engineers, September 1974.

"Multibasin Simulation and Optimization Model, SIMYLD-II," with C. D. Puentes, Texas Water Development Board, 1972.

"Economic Optimization and Simulation Techniques for Management of Regional Water Resource Systems," with D. E. Salcedo, Texas Water Development Board, Report 179, 1974.

"Analytical Techniques for Planning Complex Water Resource Systems," with J. O. Williams and H. W. Grubb, Texas Water Development Board, Report 183, 1974.

"Inherent Variability in Wastewater Treatment," *Proceedings of the Open Forum on Management of Petroleum Refinery Wastewaters*, U.S. E.P.A., A.P.I., N.P.R.I., and University of Tulsa, Tulsa, Oklahoma, January 1976.

"Measurement and Treatment of Oil and Grease in Petroleum and Petrochemical Industrial Wastewaters," with R. L. Elton and D. L. Ford, *Progress in Water Technology*, Vol. 9, Pergamon Press, London, 1977.

"Report on the Conservation of Water Quality in Beaches and Ports of the Republic of Mexico," Pan American World Health Organization, World Health Organization, Washington, D.C., February 1975.

"Recent Developments in Biological Treatment of Industrial Wastes," with D. L. Ford, *Chemical Engineering*, May 1977.

"Meeting BPT Standards for Refinery Wastewater Treatment," with D. L. Ford, *Industrial Wastes*, July/August 1977.

"Treatment Cost-effectiveness as a Function of Effluent Quality," *Proceedings of the Second Open Forum on Management of Petroleum Refinery Wastewaters*, U.S. Environmental Protection Agency, EPA 600/2-78-078, Ada, Oklahoma, 1978.

"Recommendations for Regulatory Modifications: the Use of Waste Stabilization Pond Systems," with E. F. Gloyna, *Journal Water Pollution Control Federation*, Vol. 53, No. 11, 1981.

"Biological Removal of Toxic Organic Pollutants," with D. S. Kocurek, *Toxic Materials - Methods for Control*, Armstrong, N. E. and Kudo, A., eds., Water Resources Symposium No. 10, The University of Texas at Austin, 1983.

"Process and Economic Considerations of Ponds for the Treatment of Industrial Wastewaters," with D. L. Ford, *Ponds as a Wastewater Treatment Alternative*, Gloyna, E.F., Malina, E.F., and Davis, E.M., eds., Water Resources Symposium No. 9, The University of Texas at Austin, 1976.

"The CMA/EPA Five Plant Study: Biological Treatment of Toxic Organic Pollutants," with D.S. Kocurek, *Proceedings of the Industrial Waste Symposium*, 55th Annual Conference, Water Pollution Control Federation, Detroit, 1982.

"Waste Stabilization Pond Systems," with E. F. Gloyna, *Performance and Upgrading of Wastewater Stabilization Ponds*, Middlebrooks, E.J., Falkenborg, D.H., Lewis, R.F., eds., Municipal Environmental Research Laboratory, U.S. Environmental Protection Agency, EPA 600/9-79-011, 1979.

"Fate of Recalcitrant Organics," *Proceedings of the Second National Water Conference*, The Academy of Natural Sciences, Philadelphia, 1984.

"Historical Perspective — Biomonitoring Requirements in Industrial Wastewater Discharge Permits," with D.S. Kocurek, *Proceedings of the Industrial Waste Symposium*, 57th Annual Conference, Water Pollution Control Federation, New Orleans, 1984.

"Water Quality Modeling of the Lower Han River," with Bradley, R.M., Park, S.J., Rhee, D.G., *Proceedings of the 12th International Conference on Water Pollution Control*, Pergamon Press, London, 1984.

"Technologies for Remediation of Contaminated Ground Water," with D. Kocurek, *Proceedings of the 79th Annual Meeting and Exhibition*, Air Pollution Control Association, Minneapolis, 1986.

"Comparison of SW-846 and 304(H) Methods for Analysis of Appendix VIII Organic Compounds," with D.S. Kocurek, *9th Annual U.S. Environmental Protection Agency Symposium on the Analysis of Pollutants in the Environment*, Environmental Protection Agency, March 1986, Norfolk, Virginia.

"State-of-the-Art Statistical Verification of a Water Quality Model of the Lower Fox River," with D. S. Kocurek, *Proceedings of the 1987 TAPPI Environmental Conference*, Portland, 1987.

"Measurement Error in the Chemical Manufacturing Industry," *National Research Council Committee to Evaluate Mass Balance Information for Facilities Handling Toxic Substances Workshop*, National Academy of Sciences, Washington, 1988.

"Evaluation of the Biodegradation Predictive Equations in EPA's CHEMDAT6 Model," American Petroleum Institute, Health and Environmental Science Department, API Publication No. 4487, March 1989.

"Dioxins and Furans — A Primer," with D. Kocurek, American Petroleum Institute, Health and Environmental Sciences, API Publication No. 4506, March 1990.

"Effluent Variability Considerations and EPA's OCPSF Flow Guidance," with D. Kocurek, *Proceedings of the 67th Annual Water Environment Federation Conference*, Chicago, October 1994.

"Development of Metals Partitioning Relationships for the Salt River," with R Hollander, *Proceedings of the 67th Annual Water Environment Federation Conference*, Chicago, October 1994.

"Waste Load Allocations for Metals," *Metals in Surface Waters*, Allen, H.E., Garrison, A.W. and Luther, G.W, III, eds., Ann Arbor Press, 1998.

"Development of Fluoride Limits to Prevent Whole Effluent Toxicity," with L. Levine and T. Strachan, *Proceedings of the 69th Annual Water Environment Federation Conference*, Dallas, Texas, October 1996.

"Development of Site-Specific Water Quality Standards for Enterococci," with L. Levine, *Proceedings of the 69th Annual Water Environment Federation Conference*, Dallas, Texas, October 1996.

"Testing EPA's Method 304: Biodegradation Rates for Methanol and Other Oxygenated Solvents in a Pharmaceutical Wastewater," with H. Monteith, *Proceedings of the 69th Annual Water Environment Federation Conference*, Dallas, Texas, October 1996.

"Activated Sludge as an Air Pollution Control Device: Field Measured Removal Efficiency and Model Predictions," with M. Oppelt and L. Levine, *Proceedings of the 71st Annual Water Environment Federation Conference*, Orlando, Florida, October 1998.

"An Evaluation of Protective Concentrations for Hydrogen Sulfide in Produced Water Discharged in California Outer Continental Shelf Ocean Waters," with A. H. Glickman and W.H. Ford, *Proceedings of the 1999 SPE/EPA Exploration and Production Environmental Conference*, Society of Petroleum Engineers, Austin, Texas, March 1999.

"Evaluation of the Fate of Oxygenated Solvents in a POTW's Primary Clarifiers," with M. Buzby, *Proceedings of the 72nd Annual Water Environment Federation Conference*, New Orleans, October 1999.

"Refinement of the EPA's POTW Pass-Through Analysis Method for Application to the Pharmaceutical Manufacturing Industry," with M. Buzby, K. Mahsman, M. Willett, F. Hund, *Proceedings of the 72nd Annual Water Environment Federation Conference*, New Orleans, October 1999.

"Laboratory Analysis of Petroleum Industry Wastewaters," with D. Kocurek, American Petroleum Institute, Regulatory and Scientific Affairs, Publication Number 4694, December 1999.

"Understanding and Preparing Applications for Petroleum Facility NPDES Discharge Permits," with D. Kocurek, American Petroleum Institute, Regulatory and Scientific Affairs, Publication Number 4695, December 1999.

"Clearing the Air," with Michael Oppelt, Leonard Levine, Jim Kowalik, *Water Environment and Technology*, November 1999.

"Hydraulic and Oxygen Transfer Characteristics of an Industrial Roughing Filter," with R. Watts and H. Monteith, *Proceedings of the 74th Annual Water Environment Federation Conference*, Orlando, October 2001.

"Achieving Compliance with Wastewater Provisions of the Pharmaceutical MACT ," with S. Dave, V. Venkatasubbiah, G. Gibbons, S. Charbonneau, J. Greiner, D. Wozniak, R. Patel, *Proceedings of the 74th Annual Water Environment Federation Conference*, Orlando, October 2001.

"Understanding Setting of Pass-through Criteria for Setting Acetone Pretreatment Standards Under Federal Effluent Guidelines," with N. Parke and V. Parker, *Proceedings of the 75th Annual Water Environment Federation Conference*, Chicago, October 2002.

"Calibration of Biodegradation Rate Coefficients for Hazardous Air Pollutants in an Industrial Roughing Filter," with R. Watts and H. Monteith, *Proceedings of the 75th Annual Water Environment Federation Conference*, Chicago, October 2002.

"Monte Carlo Analysis of Point Source Loadings of Oxygen Demanding Substances to the Houston Ship Channel," with P. Jensen and K. Lee, *Proceedings of the National TMDL Science and Policy Conference, Water Environment Federation*, Phoenix, November 2002.

"Treatment Alternatives for MON Wastewater Compliance: When Will Biological Treatment be the Answer," *Proceedings, 10th Industrial Waste and Regulatory Conference*, Water Environment Federation, Philadelphia, August 2004.

"Landfill Disposal of Medicines," *Proceedings of Compounds of Emerging Concern*, WEF Specialty Conference, Providence, R.I., July 2007.

"Potential Contribution of Unused Medicines to Environmental Concentrations of Pharmaceuticals," prepared for Pharmaceutical Research Manufacturers of America, September 2007.

"Landfill Disposal as an Approach to Reduce Discharges of Medicines from POTWs," with M. Buzby, V. Cunningham, D. Finan and N. Parke, *Proceedings of WEFTEC 2008,* Chicago, October 2008.

"Cyanide Discharges in the Petroleum Industry: Sources and Analysis," American Petroleum Institute, Regulatory and Scientific Affairs, Publication Number 4750, November 2008.

"Treatment of Active Pharmaceutical Ingredients at Publicly Owned Treatment Works," with M. Buzby, V. D'Aco and J. Jahnke, *Proceedings of WEFTEC 2009*, Orlando, October 2009.

"Approved Alternative Control Device: VOC BioTreat Technology As Required by NESHAPs [BWON, HON, MON, MACT] and Other Regulations," with C. Adams, A. Edwards, *Proceedings of WEFTEC 2011*, Los Angeles, October 2011.

"Landfill disposal of unused medicines reduces surface water releases," with Buzby M, Finan DS, Cunningham VL, *Integr Environ Assess Manag*, 2013 Jan; 9(1):142-54.

"Experiences in Toxicity Reduction Evaluations for Petroleum Refineries," *Proceedings of WEFTEC 2013*, Chicago, October 2013.

"PERF Study of Modeling Hazardous Air Pollutant Emissions from Refinery Effluent Treatment Plants," with Jim Russell, Carl Adams, and Dianna Kocurek, *Proceedings of WEFTEC 2014*, New Orleans, October 2014.

"The Petroleum Refining Effluent Limitations Guidelines, Past, Present and Future" with Andy Edwards, 2015 AFPM Environmental Conference, Salt Lake City, October 2016.

Exhibit D

JORDAN E. FURNANS, PhD, PE, PG
Hydraulic Engineer

PROFESSIONAL SUMMARY

Jordan Furnans leads LRE Water, LLC in Round Rock, Texas. His 19 years of professional experience encompasses both field hydrologic data collection and analysis of data through the development and application of numerical models. He specializes in large project management & coordination, water availability modeling, water rights analysis & acquisition, groundwater management, surface water hydrology & hydraulics, water supply planning/evaluation, climate change analysis and modeling, water right accounting; optimization, coupled field and model hydrodynamic investigations of estuaries, lakes, and rivers; watershed hydrology planning and management; flood plain management; hydrographic and sedimentation surveying. He regularly provides expert testimony and interacts with regulators at the Texas Commission on Environmental Quality.

EDUCATION

PhD, 2005, Civil Engineering
The University of Texas at Austin

MSE, 2001, Environmental & Water Resources Engineering
The University of Texas at Austin

BSE, 1999, Civil/Geological Engineering, Princeton University

US Fulbright Fellowship, 2002-2003, Centre for Water Research
The University of Western Australia

PROFESSIONAL REGISTRATION

Professional Engineer

TX	(2006)	No. 97316
CO	(2010)	No. 44217
NM	(2010)	No. 19880
OK	(2012)	No. 26095
AZ	(2015)	No. 61061
KS	(2019)	No. 26856

Professional Geoscientist

TX	(2011)	No. 11002

NSPS Certified Hydrographer**

USA	(2011)	No. 268

***National Society of Professional Surveyors*

EMPLOYMENT & GENERAL EXPERIENCE

- **LRE Water, LLC**, Round Rock, TX 2015-present

Senior Project Manager, Vice President and Manager of the Leonard Rice Engineers, Inc. Texas office

Conducts and supervises water resource investigations, including watershed hydrology, surface water supply/analyses, groundwater availability assessments/modeling, support and review of environmental impact statement modeling, stormwater management planning, water availability modeling, reservoir and river operations modeling, water rights accounting, and hydrographic surveys of reservoir volumes and sedimentation.

- **The University of Texas at Austin**, Austin TX 2016-present

Adjunct Faculty – Department of Civil, Architectural, and Environmental Engineering.

Teaching CE 356 – Fundamentals of Hydraulic Engineering

- **INTERA, Inc.** Austin, TX 2009-2015

Senior Water Resources Engineer & Team Manager

Provided water availability modeling (WAM) services for various clients in the Brazos River, Concho River, Colorado River and Guadalupe River Basins in Texas. Developed detailed daily models for assessing individual client needs and for aquifer storage and recovery (ASR) development efforts. Developed HEC-RAS models of client canal systems to assist in bridge re-design, culvert sizing, and operational methods review. Planned, executed, and completed hydrodynamic modeling for projects in WA, CO, TX, NM and OK.

EMPLOYMENT & GENERAL EXPERIENCE, Continued.

- **Texas Water Development Board.** Austin, TX 2003-2009

Water Resources Engineer

Served as an engineering specialist assisting in State of Texas programs related to Instream Flow evaluation, Bays & Estuaries modeling, Water Availability Analyses, and Hydrographic Surveying.

Served as part of a team working toward developing the methodology used to determine instream flow requirements for Texas. Lead data collection efforts on the San Antonio, Colorado, Sabine, Brazos and Trinity Rivers. Data collection involved high precision elevation surveying using GPS, bathymetric data collection, ADCP usage, spot velocity measurements, and fish collection/identification. Developed hydrodynamic models linking flows to habitat availability for selected fish/invertebrate species in the Brazos, Sabine, and San Antonio River Basins.

Overhauled the surveying and data processing methodology of the hydrosurvey program in order to improve the accuracy of reservoir volume and sediment accumulation rate estimates. Developed a multi-function software package (HydroEdit) which processes, edits, interpolates and extrapolates survey data collected using various depth sounders and surveying equipment. Lead the program assessment project which involved a detailed survey of Lake Lyndon Baines Johnson, developed recommendations for improvements in study design, surveying methodology, data processing techniques and methods for comparing the results of repeated surveys. Performed field data collection on 12 hydrographic surveys in Texas, oversaw the completion of 23 survey reports, and developed methods for incorporating LiDAR and multibeam datasets into reservoir volumetric computations.

Planned and directed a field and modeling exercise aimed at determining the impact of a potential desalination brine discharge into the Corpus Christi Bay system. Lead 2-15 professionals on 4 field data collection trips, sampling water quality parameters and bathymetry in the Corpus Christi Bay system. Processed data to determine the cause of existing seasonal hypoxia and to determine the extent of the existing high-density underflow plumes affecting water quality. Directed the development of an EFDC model of the exchange flows between Oso Bay and Corpus Christi Bay.

- **Norwich University.** Northfield, VT 2008-2011

Adjunct Professor – Civil Engineering

Developed online courses for graduate level classes in groundwater hydraulics, waste water engineering, and landfill design. Taught online courses in groundwater hydraulics and waste water engineering.

- **The University of Texas at Austin**, Austin TX 1999-2005

Graduate Student – Department of Civil, Architectural, and Environmental Engineering.

Developed hydrodynamic models of Marmion Marine Park (Western Australia) and Lake Kinneret (Israel). Tracked GPS drifters and compared motion to model-predicted motion using ELCOM and customized drifter-modeling program. Developed ArcGIS tools for water resources research, implemented the Pfafstetter coding system into ArcGIS for watershed connectivity management.

FEATURED PROGRAM & PROJECT EXPERIENCE

Desalination Brine Discharge Modeling – Corpus Christi Bay, Port of Corpus Christi, 2019. Project Manager/Engineer. Developing a 3-Dimensional SUNTANS hydrodynamic model of Corpus Christi Bay to determine the long-term cumulative effect of a high-saline discharge into the Corpus Christi Bay ship channel. Modeling will determine the extent to which the proposed discharge will alter benthic and water column salinity, oxygen transfer through the water column, and will suggest impacts to local biota.

Evaluation Rainfall-Runoff Trends in the Upper Colorado River Basin, Phase II, TWDB, 2018-2019. Project Manager/Engineer. Leading the ongoing investigation to determine the cause of diminished rainfall/runoff response in the Upper Colorado River Basin, and to quantify the reduction in streamflow resulting from determined causes. This investigation involves quantifying the impact of small detention structures of runoff-based streamflow, assessing the impact of continued groundwater production on springs and baseflow, correlating trends in precipitation, temperature, and soil moisture to streamflow production, and compiling statistical analyses to suggest streamflow impacts and potential mitigation measures. This work will be completed by August, 2019.. TWDB Contract Number 1800012283.

Camp Ozark Water Right Application Development – Bandera, TX, 2019-Present. Project Manager/Engineer. Developing a TCEQ water right permit application in support of planned summer camp operations in Bandera, TX. Efforts included surveying site impoundments, developing an accounting plan for water usage (subject to TCEQ and watermaster jurisdiction), and quantifying water needs, availability, and environmental flow concerns.

City of Goldthwaite Water Right Amendment Application Development – Goldthwaite, TX, 2019-Present. Project Manager/Engineer. Developing a TCEQ water right amendment to combine the City of Goldthwaite's two existing water right permits, revise the diversion location, and increase the permitted off-channel storage capacity. Effort involves completing required TCEQ forms and documentation, performing WAM modeling (to assess non-impact clauses), and working with TCEQ to ensure application completeness in concordance with the Texas Water Code.

Public Water Supply Well – Design & Application Development, Wise Water Corporation, 2019. *Project Engineer.* Designed a public water supply well in Wise County, TX, including developing bid specifications and all material required for TCEQ design approval. Will oversee drilling, well construction, and testing per TCEQ regulations.

Water Conservation & Drought Contingency Plan Update – City of Galveston, TX. 2018-2019. Project Manager/Engineer. Served as project manager and engineer for effort update the water conservation plan, drought contingency plan, and utility profile for the City of Galveston, to meet requirements of the TWDB and TCEQ. Worked directly with city staff, council, and public to implement improved water conservation measures for the City.

State of Texas Subsidence Risk Identification due to Groundwater Pumping, TWDB, 2017-2018. Project Manager/Engineer. Served as project manager for effort to assess subsidence risk in all major and minor aquifers across Texas, quantifying relative risk and developing mathematical tools to incorporate subsidence risk in groundwater permitting decisions. TWDB Contract Number 1648302062.

Surface water- groundwater linkage along the San Saba River, TX, TK Cattle Co., LLC, 2018. Project Engineer. Measured water levels in the San Saba River and adjacent groundwater wells to determine the likelihood that wells are pumping surface water without proper surface water permits. Performed evaluation in response to a TCEQ notice of violation. Working with landowners and attorneys at Terrill & Waldrop to ensure water usage conforms to all applicable laws.

Water Supply Options Assessment, City of Manvel, TX. 2015-2019. Project Engineer. Serving as lead engineer in providing technical expertise to the City of Manvel regarding future development options for a 105-acre sand pit which receives groundwater inflows. Responsible for quantifying water availability, water quality, water treatment options, and land-use options to support growth in the local area. Revised Brazos River Basin WAM model for a potential new water right application, developed local MODFLOW model of the sand pit replenishment. Developed rating curve using HEC-RAS for Mustang Bayou adjacent to the sand pit, and quantified bayou flows from 7/2017 to 7/2018 to assess viability of a water right application.

Water Rights Analyses and Litigation Support, Gulf Coast Water Authority, TX. 2010 – Present. Project Engineer. Serving as lead engineer in providing technical expertise to the Gulf Coast Water Authority (GCWA) to improve GCWA's ability to reliably supply water to clients within the Brazos River Basin, with specific focus on Fort Bend, Brazoria, and Galveston counties, TX. Supported GCWA in contested-case hearings and mediation efforts against the Brazos River Authority (TX), the City of Sugarland (TX), and Dow Chemical (TX). Ongoing work includes analyzing water usage patterns of GCWA customers, evaluating potential short-term water supply sources, developing a revised and more effective Drought Contingency Plan (through a WaterSMART grant from the US Bureau of Reclamation), developing a water accounting plan for GCWA Brazos River water rights, development of a canal-system conveyance model (water balance & HEC-RAS) for water operations planning, developing Version 7 of the GCWA Daily-Hydro Water Availability Model, and representing GCWA in public meetings regarding GCWA water reliability and supply commitments. Past tasks include: 1) Modeling support in the Brazos Basin watermaster contested case hearing, 2) development of the GCWA Daily-Hydro water accounting model (Versions 1-6), currently the only available daily model capable of assessing water availability in Texas, 3) quantifying GCWA's expected water shortages during 2011 (a year worse than the current Brazos Basin drought of record), 4) evaluating water availability modeling (WAM) in support of proposed and desired future water right permits in the Brazos basin, 5) identifying errors in WAM modeling efforts and the implications of such errors with respect to water availability resulting from the "granting" of pending water right permits applications, 6) review of the Lake Houston Water Accounting Plan, 7) performing a sedimentation survey of TX City Reservoir, 8) analysis of water availability from GCWA's Juliff Canal system & Chocolate Bayou water rights, 9) evaluating the impacts to GCWA of the proposed Brazos River Authority Water Management Plan, 10) performing hydrographic surveys of GCWA's Mustang Reservoir and Canal A1 system, and 11) conducting a flow gain-loss study of the GCWA canal system,.

Hydrologic and Engineering Support Services, Central Texas Water Coalition (CTWC), TX. 2012 – Present. Project Engineer. The CTWC is an organization representing the interests of land owners and businesses dependent on the recreational activities associated with the highland lakes of Central Texas. In developing the basin Water Management Plan, the Lower Colorado River Authority (LCRA) brought together stakeholder groups, including CTWC, to help determine the appropriate management of water in the basin, including conditions under which water for agricultural uses would be curtailed. Have and continue to provide hydrologic and engineering support services to assist the CTWC in evaluating proposed water management strategies for the LCRA Highland Lakes system in the Colorado River Basin (TX). Ongoing activities include developing alternative water accounting models (other than the TCEQ-approved WAM model) to simulate water ability through 2016 according to the Texas prior-appropriation system. Past activities have included: 1) investigating potential reasons for historically low lake inflows which are out-of-proportion to the relatively low rainfall totals in the watershed, 2) review of LCRA- and TCEQ-produced water availability models and results, 3) review of historical inflow data to the Highland Lakes, 4) assessing the impact of the Lake Buchanan-O.H. Ivie subordination agreement on Highland Lake water levels, 5) quantifying how recent TCEQ emergency orders have prevented drought-worse-than-drought-of-record (DWDOR) declarations, and 6) developed a forward-looking water balance model to demonstrate the impact of low lake inflows on water supply reliability.

Water Rights Litigation Support – South Texas Project Nuclear Operating Company, 2016-Present. Lead Engineer, Project Manager. Utilized WAM and Non-WAM based analysis techniques to advise client on the impact to their water supply of proposed changes to senior water rights ("Garwood" and "Gulf Coast") owned by the Lower Colorado River Authority. Provided engineering technical support to STPNOC staff and outside counsel. Developed the Wharton Water Balance model to quantify water availability for STPNOC both before and after LCRA completes construction of Arbuckle Reservoir.

Waller Creek Tunnel Hydraulic Review – SJ Louis Company, 2016-Present. Lead Engineer. Performed hydraulic calculations and reviewed expert documents provided by the City of Austin regarding the Waller Creek Tunnel. Demonstrated how calculations were initially improperly performed, and how when corrected they indicate that design objectives are maintained by the current state of tunnel construction.

Water Management Plan Review and Litigation Support, NRG Texas Power LLC. 2014 Lead Engineer, Project Manager. Provided litigation support and review services regarding the Brazos River Authority's pending permit 5851 water right application, water management plan, and accompanying accounting plan. Assisted counsel in negotiations and analyses regarding NRG Texas Power LLC water rights and the impact of permit 5851 on those rights.

Creek Flow Measurements for Permitting Support, TX. 2014 Lead Engineer, Project Manager. On behalf of a confidential client, measured flow within an unclassified receiving waterbody for use in a pending Texas Pollutant Discharge Elimination System (TPDES) water discharge permit. Aided client in interpreting the impact of the flow measurements and computing the harmonic mean flow used in assessing surface water quality maintenance efforts. Will continue to support client in negotiations with the TCEQ regarding the pending discharge permit.

Water Availability Assessment: City of Houston, TX . 2014 Lead Engineer, Project Manager. On behalf of a confidential client, detailed the water availability and reliability for a potential new water customer relying upon supplies to be made available by the City of Houston. Analysis involved assessing City of Houston water rights using the WAM models, GIS analysis, review of water right permits and certificates of adjudication, and review of the Texas State Water Plan and Region H Regional Water Plan.

Water Reuse-Supply Feasibility Study, Houston Ship Channel, Confidential Client, TX. 2012 – 2013. Lead Technical Engineer. For a confidential client, reviewed water supplies and demands for Harris County, TX, and the neighboring region to assess the potential for tertiary water reuse projects in supporting industrial water needs. Analyses involved reviewing the state water plan and Region H water plans, City of Houston accounting plans, Texas Water Availability Models (WAMs), and existing water reuse applications and permits.

Review of Brazos River Authority Water Availability Modeling and Water-Management Plan for Pending Permit 5851, Possum Kingdom Lake Association, Graford, TX. 2013. Lead Technical Engineer. For the Possum Kingdom Lake Association (PKLA), reviewed water availability modeling (WAM) and water-management plan (WMP) documents submitted to the Texas Commission on Environmental Quality (TCEQ) in support of the Brazos River Authority's (BRA) pending water right permit 5851. Verified modeling claims made by BRA and concluded that the Brazos Basin WAM model does suggest sufficient water is available to meet the current permitted and pending permitted water needs in the Brazos Basin. Also identified areas of potential miscommunication of facts in BRA document regarding the pending 5851 permit and WMP, and clarified these points for PKLA.

Expert Peer Review – Hunting Bayou Flood Risk Management Study, Harris County Flood Control District, TX. 2013. Expert Panel Reviewer – Hydrology & Hydraulics. Was selected to participate in the independent external peer review panel for Hunting Bayou Flood Risk Management Study as a subcontractor to Battelle.

Expert Peer Review – Little Colorado River EIS Review, Winslow, AZ, 2017-2018. *Expert Panel Reviewer – Hydrology & Hydraulics*. Served as the Hydrology and Hydraulics expert for the in the independent external peer review panel for Little Colorado River EIS review as a subcontractor to Battelle.

Stormwater Pond Evaluation Survey – Brushy Creek Municipal Utility District, Round Rock, TX. 2017. *Lead Engineer*. Performed a multi-frequency hydrographic survey 24 stormwater ponds (wet & dry) to assess as-built/operated conditions and determine if ponds need rehabilitation to continue providing the level of stormwater runoff protection services expected by residents.

Northern Integrated Supply Project, City of Fort Collins, CO. 2015. *Project Engineer*. Serving as expert reviewer for issues regarding treatment of total organic carbon (TOC) and trichloroethylene (TCE) as discussed in the Supplemental Draft Environmental Impact Statement (SDEIS) developed by the US Army Corps of Engineers. Reviewed CE-QUAL-W2 model of Horsetooth Reservoir, water quality modeling of the Cache de la Poudre River.

Watermaster Compliance Review & Evaluation: CILI, 2015. *Lead Engineer, Project Manager*. Performed hydraulic modeling to develop a reference device for a water right holder to properly divert water from the North Bosque River according to permit conditions. Evaluated owner's water pump for compliance with Brazos River Watermaster regulations, recommended water management and operation alternatives to optimize water usage for client's pecan orchard.

Sedimentation Assessment on Morris Shepard Dam, Graford TX. 2014 *Lead Engineer*. For the Brazos River Authority, as a subcontractor to ARCADIS, performed a multi-frequency hydrographic survey of the area immediately upstream of Morris Sheppard Dam on Lake Possum Kingdom. Quantified the amount of sediment accumulation on the face of the dam, based on acoustic measurements of current water depths/bathymetry and sediment accumulation. Collected sediment core samples using a Vibracore system, and had samples analyzed for chemical content and density.

Review of Brazos River Authority Water Availability Modeling and Water-Management Plan for Pending Permit 5851, Possum Kingdom Lake Association, Graford, TX. 2013. *Lead Technical Engineer*. For the Possum Kingdom Lake Association (PKLA), reviewed water availability modeling (WAM) and water-management plan (WMP) documents submitted to the Texas Commission on Environmental Quality (TCEQ) in support of the Brazos River Authority's (BRA) pending water right permit 5851. Verified modeling claims made by BRA and concluded that the Brazos Basin WAM model does suggest sufficient water is available to meet the current permitted and pending permitted water needs in the Brazos Basin. Also identified areas of potential miscommunication of facts in BRA document regarding the pending 5851 permit and WMP, and clarified these points for PKLA.

Water Supply Assessment, Barton Creek Lakeside Property Owners Association, TX. 2013. *Lead Engineer, Project Manager*. The Barton Creek Lakeside Property Owners Association (POA) is concerned about the future water supply for irrigation of their properties considering the low level of the Pedernales River during the central Texas drought. Oversaw the evaluation of the water supply systems for the POA, including the evaluation of existing infrastructure and the needs for improvement where the existing infrastructure was inadequate. Insured that the existing potable water supply company was meeting all Texas Commission on Environmental Quality (TCEQ) regulations. Oversaw compilation and analysis of water quality and water level data in the vicinity of wells serving the Barton Creek Lakeside community. Due to the proximity of the wells to nearby Lake Travis and water system failures in nearby communities, the POA was concerned about the reliability of their water supply. Available hydrologic data was evaluated to determine the source of water to the wells – whether groundwater from the Hosston unit of the Trinity Aquifer or intercepted surface water from Lake Travis – and the expected impacts to the water supply in an ongoing drought.

Waurika-Ellsworth System Evaporation Study, Waurika Lake Master Conservancy District, OK. 2013. *Lead Engineer*. Developed scientifically justified rules based on historical hydrology and climate

to determine when water should be conveyed via pipeline to minimize combined storage losses due to evaporation. This was done to assist the Waurika Lake Master Conservancy District in managing its municipal water supply between its three reservoirs in Oklahoma. A daily decision making tool was developed in Microsoft Excel for water managers to evaluate the benefits/determents of transferring water given current conditions. Assessed the full range of possible relative conditions (using MATLAB) and developed guidelines for when transfers would most often yield water savings.

Water Availability Assessment, Aquifer Storage and Recovery Applications, Naismith Engineering, Victoria, TX. 2013. *Principal Engineer*. Used the monthly WAM model to determine water availability for a proposed Aquifer Storage and Recovery (ASR) project. Developed a daily model which allocates water to water right holders in the Guadalupe River Basin (TX) and San Antonio River Basin (TX) in order to better quantify ASR water availability. The model determined the quantity and likelihood of water being available for ASR projects in the vicinity of Victoria, TX, and near facilities managed by the Guadalupe-Blanco River Authority near Port Lavaca, TX. The model simulates water allocation based on daily gauged flows, and follows the Texas prior-appropriation doctrine. The model also includes pumping limitations and treatment limitations dictated by the ASR-design constraints, and any special provisions dictated in existing Guadalupe and San Antonio Basin water right permits.

Bathymetric & Sedimentation Surveys - Gulf Coast Water Authority, TX. 2013. *Project Engineer*. Served as lead engineer in determining reservoir capacities and sediment accumulations rates in water supply reservoirs owned and managed by the Gulf Coast Water Authority (GCWA). Surveyed waterbodies include Mustang Reservoir (650 acres), TX City Reservoir (800 acres), and the A1 canal (35 miles), including lakes within the City of Sugarland. Demonstrated that sediment influx into the A1 canal has increased due to land management/construction practices within the ETJ of the City of Sugarland.

Baker-Martin Lake Impoundment Study, the Terrill Firm P.C., Menard County, TX. 2013. *Lead Technical Engineer*. Reviewed impoundment calculations for the Baker-Martin dam on the San Saba River, Menard County, TX, for the Terrill Firm P.C. Reviewed the data and volume calculations from TCEQ, and developed revised volume estimates using traditional hydrographic survey data processing techniques. Performed a detailed bathymetric survey of Baker-Martin lake to definitively quantify the impounded water volume and upstream boundary of the water body.

Expert Model Review – HEC-EFM and HEC-GeoEFM, U.S. Army Corps of Engineers (USACE). 2012. *Expert Model Reviewer – Hydrology & Hydraulics*. *Was selected to participate in the independent external peer review panel for the planning model quality assurance review of the* USACE Hydrologic Engineering Center Ecosystem Functions Model (HEC-EFM) and HEC-GeoEFM Spatial Accessory to HEC-EFM *as a subcontractor to Battelle.*

Water Availability Analysis, Bentwood County Club, San Angelo, TX. 2012. *Project Engineer*. Performed Water Availability Model (WAM) analyses to support water supply negotiations between the Bentwood County Club and the City of San Angelo. Reviewed all (135+) local Certificates of Adjudication, confirmed their representation in the state's WAM model, reviewed the water accounting plan for the Concho River system reservoirs, and assessed benefits to all parties resulting from numerous potential water supply agreements. Will provide as-needed support for ongoing negotiations and/or legal proceedings.

Water Availability Analysis and Salinity Study, Brazosport Water Authority, Brazoria County, TX. 2012. *Project Engineer*. Performed Water Availability Model (WAM) analyses for the Brazosport Water Authority (BWA), and assessed reliability of water rights within Brazoria County, TX. Compared the WAM-based reliability results to those generated by the INTERA-created GCWA Daily-Hydro model, which uses data from 2011 (a a year worse than the current Brazos River Basin drought-of-

record). Developed a relationship between Brazos River flow and salinity at the BWA intake location using measured field data, WRAP-SALT, and the TxBLEND and SELFE hydrodynamic models.

Water Availability Model-Based Hydrologic Analyses of Strategies to Meet SB3 Environmental Flow Standards for the Guadalupe Estuary, National Wildlife Federation, Austin, TX. 2011. *Lead Engineer*. Performed WAM-based hydrologic analyses to assess environmental flow strategies for the Guadalupe Estuary. Modified the Region L WAM to include increases in flow to the estuary due to 1) wastewater return flow dedications, 2) temporary dry year irrigation right transfers, and 3) the conversion of unused portions of senior firm water rights into permanent environmental flow water rights. Evaluated the effectiveness of each strategy to address environmental flow needs of the estuary. Reported modeling results to the National Wildlife Federation and the Guadalupe, San Antonio, Mission, and Aransas Rivers, and Mission, Copano, Aranasas, and San Antonio Bays Expert Science Team (GSA BBEST).

Bathymetric and Sedimentation Survey of Sunshine Lake, City of Weatherford, TX. 2011. *Lead Engineer, Project Manager*. To aid the City of Weatherford, TX, in assessing their surface water availability, planned and executed a multi-frequency bathymetric and sedimentation survey of Sunshine Lake. Data collection occurred along pre-planned survey lines spaced at 100-ft intervals covering the extent of the approximately 43 acre lake, with lines oriented in a grid pattern to achieve spatial coverage adequate per U.S. Army Corps of Engineers hydrographic standards. Interpreted multi-frequency acoustic sounding data and spud-bar measurements to estimate and map the thickness of the accumulated sediment layer along the lake bottom. Determined the lake has lost approximately 1/6th of its original capacity due to sediment accumulation.

Hydrodynamic Model Development, Mid-Columbia Fisheries Enhancement Group, WA. 2011 – 2014. *Lead Engineer,* Developed a hydrodynamic (EFDC) model to determine the likely impact of the removal of the Bateman Island Causeway on salmonid migration, dissolved oxygen (DO) levels, and water temperatures at the confluence between the Columbia and Yakima rivers in Richland, WA. Performed a bathymetric and sedimentation survey of the confluence area using multi-frequency depth sounders and survey-grade GPS equipment. Developed and validated EFDC models to describe both current water circulation patterns and those expected under four alternative causeway-breaching scenarios

Hydrologic Analysis of Climate Change Impacts on Water Availability, Albuquerque Bernalillo County Water Utility Authority (ABCWUA), NM, 2010 – 2012. *Project Engineer*. Served as technical lead in assisting the ABCWUA to understand how climate change may affect its future water supplies from the Rio Grande. Developed a statistical analysis algorithm/program to assess the impact of potential streamflow reductions and alterations to historical snowmelt runoff patterns in the Rio Grande Basin. Evaluated historical USGS gage records to determine whether any statistically significant changes to the timing, magnitude, and duration of snowmelt runoff have occurred over the period of record. Developed a graphically-based hydrograph-shifting program to assess the impact on water availability models if (due to climate change) snowmelt runoff were to occur earlier or later in the year and result in reduced (or increased) flow volumes. Implemented the hydrograph-shifting program into a Goldsim model provided to the ABCWUA.

Model Analysis and Litigation Support, Hays Caldwell Public Utility Agency, TX. 2011. *Project Engineer*. Assisted in preparation of engineering material for use in potential litigation hearings regarding groundwater availability and pending groundwater permit applications in Gonzalez County, TX. Analyzed MODFLOW model input and output files to assess consistency with material presented in permit applications and engineering reports by opposing parties.

Hydrographic Survey and Data Analysis, City of Santa Fe, NM. 2011. *Lead Engineer, Project Manager*. To assess available water supplies for the City of Santa Fe, planned & executed detailed bathymetric and sedimentation surveys of McClure and Nichols Reservoir, including review and

analysis of previous survey data collected in 1995. Results from the current survey (undertaken in May 2011) were used to determine the current capacity of each reservoir, the original (pre-impoundment) capacity of each reservoir, and the amount of sediment/debris accumulated in the reservoir since impoundment. Based on the accumulated sediment/debris volumes, capacity loss rates due to reservoir infill were extremely small (<0.1% per year), with capacity lost both due to soft sediment influx and influx of hard sediment (rocks, trees, etc) due to mass wasting and erosional processes in the immediate vicinity of each reservoir. Project involved extensive field data collection and analysis using multi-frequency depth sounders and survey-grade GPS equipment (Trimble R6-R8 system and VX Scanner).

Stormwater Management Plan Update and Water Quality Analysis, City of Bonita Springs, FL. 2010 – 2011. *Project Engineer*. Served as technical lead in updating the stormwater management plan for the City of Bonita Springs, FL. Completed tasks include the development, calibration and validation of an ICPR model of runoff response to storm events, use of Florida State Emergency Response Team (SERT) LiDAR data in determining stormwater system watersheds, and creation of GIS data describing city stormwater infrastructure. Using ICPR, performed numerical modeling of flooding extent, channel conveyance, and detention basin performance under assumed design storm conditions. Revised Imperial River bathymetric survey data to improve model calibration results. Assisted in the identification and prioritization of potential stormwater system improvement projects. Aided in data collection and analysis for assessing stormwater quality concerns within the city limits, and developing an HSPF water quality model of the City of Bonita Springs watersheds. The HSPF model was used to determine the water quality impacts of proposed future land use and to identify needed water quality improvement projects.

PlumeCalc Model Review, Los Alamos National Laboratories, NM. 2010 – 2011. *Project Engineer*. Developed numerical models of groundwater flow and contaminant transport for use in assessing accuracy and numerical performance of the PlumeCalc program developed by the Los Alamos National Laboratory. Models were developed using Groundwater Vistas, MODFLOW, and MT3DMS, with statistical and visual comparisons made with customized MATLAB scripts. Identified numerical instabilities and physical inconsistencies in the PlumeCalc code, leading to code revisions and program re-distribution.

Regional Water Plan, Choctaw and Chickasaw Indian Tribes, Southeast OK. 2010 – 2014. *Project Engineer*. The Choctaw and Chickasaw Nations are involved in a federal lawsuit over water rights within their jurisdictional boundaries. Provided expert modeling support for this effort, including hydrologic analyses of stream flow records, development of a Kiamichi Basin RiverWare accounting model, and development of the larger Red River Basin RiverWare accounting model. Development of the Red River Basin RiverWare model required detailed understanding of the Red River Compact dictating water management between Texas, Oklahoma, Arkansas, and Louisiana. Also developed innovative means for using RiverWare to assess prioritized diversions from subbasins, subject to applicable water management methods in each subbasin and state.

Water Availability Modeling and Irrigation Supply Assessment, Colorado Water Issues Committee, Wharton, TX. 2010. *Project Engineer*. Provided expert model review services for the Colorado Water Issues Committee (CWIC), an organization of rice farmers in the Lower Colorado River basin, in their effort to understand the modeling performed by the Lower Colorado River Authority (LCRA) as part of their 2010-2011 water management plan revision. Reviewed and assessed the LCRA's water availability model (WAM) for accuracy and conformity with established legal water priorities, and recommended policy initiatives CWIC should suggest to better ensure sufficient water supplies for irrigation purposes.

Water Use and Availability Analysis, Confidential Client, NM. 2009 – 2010. *Project Engineer*. Employed extensive numerical and analytical modeling techniques to assess water right allocations and water availability in New Mexico. Served as technical lead assessing alternative water usage

scenarios for developing expert testimony (Confidential Clients). Using GIS techniques and MATLAB scripts, assessed the possibility of inter-basin transfers within New Mexico, considering both surface water and groundwater simulations. Reviewed the impact that climate change may have on future water availability, and assessed how groundwater use practices may alter historical streamflow patterns.

Developing Uncertainty Analysis Methodologies for the MikeSHE/Mike11 Modeling System, U.S. Army Corps of Engineers, Jacksonville, FL. 2009. *Project Engineer*. Organized the automatic modification of a coupled MikeSHE/Mike11 groundwater/surface water model of the Kissimmee Basin (FL) developed by the U.S. Army Corps of Engineers, using the mCalc Monte Carlo simulation program developed by INTERA. Developed the linkages between mCalc and the MikeSHE/Mike 11 model and extracted output metrics for use in a simplified, "proof of concept" uncertainty analysis of the Kissimmee Basin model. Developed the proof-of-concept analysis report for the U.S. Army Corps of Engineers.

Hydrographic Survey Program, Texas Water Development Board, TX. 2003 – 2009. *Project Engineer*. Overhauled the surveying and data processing methodology of the hydrosurvey program in order to improve the accuracy of reservoir volume and sediment accumulation rate estimates. Developed a multi-function software package (HydroEdit) which processes, edits, interpolates and extrapolates survey data collected using various depth sounders and surveying equipment. Lead the program assessment project which involved a detailed survey of Lake Lyndon Baines Johnson, developed recommendations for improvements in study design, surveying methodology, data processing techniques and methods for comparing the results of repeated surveys. Performed field data collection on 12 hydrographic surveys in Texas, oversaw the completion of 23 survey reports, and developed methods for incorporating LiDAR and multibeam datasets into reservoir volumetric computations. Work performed while employed by the Texas Water Development Board.

RiverWare Model Development for Water Accounting, CADSWES, CO. 2009 – Present. *Technical Lead*. Developed extensive expertise in developing both "simulation" and "rule-based simulations" within the RiverWare modeling system developed by CADSWES (University of Colorado). Completed the CADSWES RiverWare training courses "Introduction to Simulation Modeling in RiverWare," "Rulebased Simulation Modeling in RiverWare," and "Water Accounting In RiverWare." Currently LRE's lead technical engineer actively involved with applications of the RiverWare model on the Kiamichi River (OK), Pecos River (NM), the Upper Rio Grande River (NM), the Lower Colorado River (TX), the Red River Basin (TX/OK) and the Brazos River Basin (TX).

Instream Flow Program Development, Texas Water Development Board, TX. 2003 – 2006. *Project Engineer*. Served as part of a team working toward developing the methodology used to determine instream flow requirements for Texas. Lead data collection efforts on the Colorado, Sabine, Brazos and Trinity Rivers. Data collection involved high precision elevation surveying using GPS, bathymetric data collection, ADCP usage, spot velocity measurements, and fish collection/identification. Work performed while employed by the Texas Water Development Board.

Corpus Christi Bay Data Collection and Modeling, Texas Water Development Board, TX. 2005 – 2006. *Project Engineer/Team Leader*. Planned and directed a field and modeling exercise aimed at determining the impact of a potential desalination brine discharge into the Corpus Christi Bay system. Lead 2-15 professionals on 4 field data collection trips, sampling water quality parameters and bathymetry in the Corpus Christi Bay system. Processed data to determine the cause of existing seasonal hypoxia and to determine the extent of the existing high-density underflow plumes affecting water quality. Directed the development of an EFDC model of the exchange flows between Oso Bay and Corpus Christi Bay. Work performed while employed by the Texas Water Development Board.

Hydrodynamic Modeling of Water Currents, The University of Western Australia, Marmion Marine Park, Australia, and Lake Kinneret, Israel. 2002 – 2003. ***Project Engineer***. While on a U.S.

Fulbright Fellowship to Australia, studied at the Centre for Water Research under Stockholm Water Laureate Jörg Imberger. Performed field data collection and numerical modeling of observed surface currents near a wastewater treatment plant outfall within Marmion Marine Park, Australia. Circulation was predicted using the three-dimensional ELCOM model and validated using current data observed with GPS-tracked drifters. Developed advanced numerical methods to simulated the Lagrangian movement of drivers within the Eulerian velocity field predicted by ELCOM. Developed statistical techniques to assess ELCOM's ability to reproduce the observed drifter motion. Used the ELCOM model to predict surface circulation patterns in Lake Kinneret, Israel, with the circulation validated using drifters. Lake Kinneret experienced zones of low-dissolved oxygen interspersed with seasonal zones of high biological productivity. The numerical modeling indicated that internal waves produced the observed water quality conditions and were due to the diurnally and seasonally varying wind forcing from the eastern Mediterranean Sea.

EXPERT TESTIMONY & LITIGATION SUPPORT EXPERIENCE

Brazos River Authority Permit 5851 Contested Case Hearing, NRG Texas Power, LLC, 2014. - *Project Engineer.* Provided expert witness support to counsel for NRG Texas Power LLC (Joe Freeland, Freeland & Mathews). Reviewed permit 5851 and its associated accounting and water management plans, and detailed how Brazos River Authority operations could be detrimental to NRG Texas Power LLC. Suggested adjustments to Permit 5851 that would reduce the risk of harm to NRG Texas Power LLC should permit be issued and should Brazos Basin streamflows continue to be low based on the historical record. Legal action still being considered by NRG Texas Power, LLC.

Lower Colorado River Authority Emergency Order Hearing, Central Texas Water Coalition, TX. 2014. *Project Engineer*. Provided expert witness testimony to support the desire of the Central Texas Water Coalition (CTWC) to have the Texas Commission on Environmental Quality (TCEQ) grant an emergency order to the Lower Colorado River Authority (LCRA) to allow deviations from the 2010 LCRA water management plan (Texas State Office of Administrative Hearings (SOAH) Docket No. 582-14-2123; TCEQ Docket No. 2014-0124-WR Application of The Lower Colorado River Authority For Emergency Authorization). Services performed included: 1) development of litigation support material regarding the need for an emergency order and the appropriate "trigger" level at which to allow stored water releases for interruptible users, and 2) providing oral expert-witness testimony (direct and cross-examination by opposing counsel). The provided testimony led to the Proposal for Decision from the Administrative Law Judges favoring issuance of the emergency order at the 1.4 M acre-ft combined storage trigger level favored by CTWC. Assisted Legal Counsel (Cindy Smiley & Shana Horton, Smiley Law Firm PC; Frank Cooley, Independent) in developing all technical testimony.

Brazos River Watermaster Hearing, Gulf Coast Water Authority, TX. 2013. *Project Engineer*. Provided expert witness testimony to support the desire of the Gulf Coast Water Authority (GCWA) to have a watermaster control water diversions in the entire Brazos River Basin (Texas State Office of Administrative Hearings (SOAH) Docket No. 582-13-3040; TCEQ Docket No. 2013-0174-WR Petition for the Appointment of a Watermater in the Brazos River Basin). Services performed included: 1) development of litigation support material regarding the need for a watermaster and the appropriate jurisdiction for a watermaster in the Brazos Basin, 2) providing an oral deposition, 3) developing and providing written pre-file testimony, and 4) providing oral expert-witness testimony during cross-examination by opposing counsel. The provided testimony led to the Proposal for Decision from the Administrative Law Judges favoring creation of a Brazos Basin watermaster with jurisdiction over the entire river basin. Assisted Legal Counsel (Molly Cagle, Baker Botts LLC) in developing all technical testimony.

Brazos River Systems Operations Permit #4851, Gulf Coast Water Authority (GCWA), TX. 2012. *Project Engineer*. Provided engineering support to GCWA in negotiations and mediation efforts with the Brazos River Authority (BRA) in regard to pending permit #4851. Assisted Legal Counsel (Molly Cagle, Vinson & Elkins) in developing all technical material for negotiations.

City of Sugarland Mediation Efforts, Gulf Coast Water Authority, TX. 2012. *Project Engineer*. Provided engineering support to GCWA in negotiations and mediation efforts with the City of Sugarland in regard to water management issues in Fort Bend County, including water accounting concerns related to Certificate of Adjudication 11-5169. Assisted Legal Counsel (Molly Cagle, Vinson & Elkins) in developing all technical material for negotiations.

Streamflow Losses on the Concho River, Glenn Jarvis (Attorney), TX. 2010. *Project Engineer.* Assisted in providing technical support and developing expert testimony for the plaintiffs in a water right contested case. Calculated the conveyance losses involved in moving a point of diversion several miles downstream and through a large reservoir situated in semi-arid central Texas.

EXPERT REPORTS & PUBLICATIONS

- Furnans, J., 2019. "**Gulf Coast Water Authority Drought Contingency Plan Update**." For US Bureau of Reclamation WaterSMART Grant #R16AC00114, March.
- Furnans, J. Keester, M., Danielson, V., Khorzad, K., Snyder, G. 2017 "**Final Report: Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping**." Texas Water Development Board Contract Report #1648302062.
- Furnans, J., 2015. "**Gulf Coast Water Authority Water Reliability Assessment for Long-Term Planning**." Gulf Coast Water Authority, July.
- Furnans, J., 2015. "**Managing Water Supplies in the Lower Colorado River Basin**." EWRI World Congress, Austin, TX May 2015.
- Furnans, J., 2015. "**Hydrologic Studies of the Highland Lakes Watershed – Part 1 – Why are the recent inflows so low**?" Central Texas Water Coalition. January
- Furnans, J., 2013. "**Evidence for the Need to Change the Approach to Water Planning in the Lower Colorado Basin." Parts 1, 2, and 3**. Central Texas Water Coalition. May, June.
- Chowdhury, A., T. Osting, J. Furnans, and R. Mathews, 2010. Groundwater-Surface Water Interaction in the Brazos River Basin: Evidence from Lake Connection History and Chemical and Isotopic Compositions. Texas Water Development Board Report #375.
- Furnans, J., D. Pothina, T. McEwen, and B. Austin, 2010. Hydrographic Survey Program Assessment. Final Report for the U.S. Army Corps of Engineers, Texas Water Development Board.
- Hodges, B., J. Furnans, and P. Kulis, 2010. Case Study: Thin Layer Gravity Current with Implications for Desalination Brine Disposal. Journal of Hydraulic Engineering, Vol. 137, Issue 3. http://dx.doi.org/10.1061/(ASCE)HY.1943-7900.0000310
- Furnans, J., and B. Austin, 2008. Hydrographic Survey Methods for Determining Reservoir Volume. Environmental Modeling & Software, Volume 23, Issue 2 doi:10.1016/j.envsoft.2007.05.011
- Furnans, J., J. Imberger, and B. Hodges, 2008. Including drag and inertia in drifter modelling. Environmental Modelling & Software, Volume 23, Issue 6. doi:10.1016/j.envsoft.2007.09.010
- Furnans, J., B. Hodges, J. Imberger, 2005. Drifter Modeling and Error Assessment in Wind Driven Currents. PhD Dissertation, The University of Texas at Austin. http://www.crwr.utexas.edu/reports/pdf/2005/rtp05-05.pdf
- Furnans, J., D. Maidment, and B. Hodges, 2002. Integrated Geospatial Database for Total Maximum Daily Load Modeling, Lavaca Bay – Matagorda Bay Coastal Area. The University of Texas at Austin. http://www.crwr.utexas.edu/reports/2002/rpt02-1.shtml

EXPERT REPORTS & PUBLICATIONS, Continued

- Maidment, D., S. Morehouse, S. Grise, F. Olivera, D. Honeycutt, J. Furnans, D. Djokic, Z. Ye, N. Noman, J. Nelson, K. Davis, V. Samuels, K. Schneider, V. Merwade, T. Whiteaker, M. Blongewicz, D. Arctur, and B. Booth, 2002. Arc Hydro: GIS for Water Resources. ESRI, Inc. Press. ISBN: 978158940346
- Furnans, J., and D. Maidment, 2001. Topologic Navigation and the Pfafstetter System. The University of Texas at Austin. http://www.crwr.utexas.edu/reports/2001/rpt01-5.shtml

LRE Water Hydrographic Survey Project Reports: Volumetric and/or Sedimentation Survey Reports (Served as Primary Co-Author)

2017: Brushy Creek Municipal Utility District – 24 Stormwater ponds, Round Rock (TX)

INTERA Hydrographic Survey Project Reports: Volumetric and/or Sedimentation Survey Reports (Served as Primary Co-Author)

2014: Morris Sheppard Dam, Lake Possum Kingdom (TX)
2013: Baker-Martin Lake (TX), Mustang Reservoir (TX), TX City Reservoir (TX), Monsanto Reservoir (TX),
GCWA Canal A1 (TX), Bonito Lake (NM)
2012: Yakima & Columbia River Confluence (WA)
2011: McClure Reservoir (NM), Nichols Reservoir (NM), Sunshine Lake (TX)

Texas Water Development Board Hydrographic Survey Project Reports: Volumetric and/or Sedimentation Survey Reports (Served as Primary Co-Author)

2010: Ray Roberts Lake (TX), Lake Bob Sandlin (TX), Lake Austin (TX)
2009: Richland-Chambers Reservoir (TX), Eagle Mountain Reservoir (TX), Gibbons Creek Reservoir (TX), Lake Mexia (TX), Navarro Mills Lake (TX), Lake Travis (TX), Lake Weatherford (TX), Granger Lake (TX), Lady Bird Lake (TX)
2008: Jim Chapman Lake (TX), Lake Palo Pinto (TX), Lake Cypress Springs (TX), Lake Lewisville (TX),
Squaw Creek Reservoir (TX), Lake Arlington (TX), Lake Pat Cleburne (TX), Pat Mayse Lake (TX)
2007: Lake Buchanan (TX), Lake Marble Falls (TX), Inks Lake (TX), Lake LBJ (TX)
2006: Alan Henry Reservoir (TX), Eufaula Lake (OK), Sam Rayburn Reservoir (TX)
2005: GCWA Reservoirs A and B (TX), Possum Kingdom Reservoir (TX)

Exhibit E

George J. Guillen, Ph.D.
University of Houston Clear Lake
Environmental Institute of Houston and College of Science and Engineering
2700 Bay Area Blvd, MC 540, 281-283-3950 guillen@uhcl.edu
https://www.uhcl.edu/science-engineering/faculty/guillen-george
https://www.uhcl.edu/environmental-institute/people/staff/guillen

EDUCATION

1996	University of Texas - School of Public Health (Houston, TX). Ph.D. Environmental Science Option. Dec. 1996.
1983	Texas A&M University (College Station, TX). M.S. Wildlife and Fisheries Sciences. Dec. 1983.
1979	Texas A&M University (Galveston, TX). B.S. Marine Biology. Dec. 1979.

EXPERIENCE

2004- Present	University of Houston Clear Lake City. Houston, Texas. Executive Director of the Environmental Institute of Houston. Responsible for overall management of the Environmental Institute of Houston.
2017 – Present	University of Houston Clear Lake City. Houston, Texas. Professor of Biology and Environmental Science. Teach courses in Marine Biology, Ichthyology, Limnology, Wetland Ecology and Population Dynamics, and Seminar.
2004 – 2017	University of Houston Clear Lake City. Houston, Texas. Associate Professor of Biology and Environmental Science. Teach courses in Marine Biology, Ichthyology, Limnology, Wetland Ecology and Population Dynamics.
2005- 2018	Texas A&M University. Galveston, Texas. Lecturer: Teach undergraduate fisheries population dynamics course and graduate marine biology courses. Appointed to the Graduate faculty 2015-present.
2000-2004	U.S. Department of Interior. Fish and Wildlife Service. Arcata, CA. Chief of the Fisheries and Contaminant Programs
1999-2000	U.S. Department of Interior. BOEM (previously Minerals Management Service), New Orleans, LA. Gulf of Mexico Office. Toxicology and Risk Assessment Unit Chief
1998-99	U.S. Department of Interior. BOEM (Previously Minerals Management Service), New Orleans, LA. Gulf of Mexico Office. Oceanographer
1997-98	Texas Natural Resource Conservation Commission. Water Program Manager
1993-97	Texas Natural Resource Conservation Commission Environmental Assessment Program Manager
1998	University of Houston - Main Campus. Houston, Texas. Adjunct Faculty: Taught upper level undergraduate courses in ecology (2 semesters).
1995-96	San Jacinto College - Houston, Texas. Adjunct Faculty: Taught undergraduate course in zoology.
1993-98	University of Houston Clear Lake. Houston, Texas. Adjunct Faculty: Upper level undergraduate courses in zoology, ecology, fisheries science, marine biology, environmental biology

1991-94	Texas A&M University. Galveston, Texas. Lecturer: Taught undergraduate fisheries management course.
1992-93	Texas Water Commission. District Manager.
1988-92	Texas Water Commission. Environmental Monitoring Program Manager.
1984-88	Texas Parks and Wildlife Department. Environmental Contaminants Biologist
1983-84	LGL Environmental Consultants. Laboratory Technician
1982-83	Texas A&M University/Biology Department. Laboratory Teaching Assistant
1980-82	TERECO Corporation Environmental Consultants. Environmental Assessment Technician
1981	Texas A&M University/Wildlife and Fisheries Sciences Department. Lab Technician
1980	Texas A&M University/ Dr. A.M. Landry. Field Team Leader
1979-80	Human Sciences Research. Creel Survey Interviewer
1979	Texas A&M at Galveston. Research Diver

RECENT FUNDED RESEARCH AND PROJECTS EXPERIENCE (PI or Co-PI, Source, Amount):

2021	National Wetland Assessment of Texas– Co-PI, $300K
2019-21	Assessment of Water Quality in Galveston Bay watersheds. Clean Rivers Monitoring Program. PI, Houston Galveston Area Council, $110K
2019-21	Development and Assessment of Floating Wetland Treatment Systems. PI, Harris County Flood Control District. $130K
2020	National Coastal Condition Assessment of Louisiana– PI, Great Lakes Environmental Quality, $400K
2019-20	National Coastal Condition Assessment of Texas– PI, TCEQ/EPA, $300K
2019-20	Texas Western Chicken Turtle Status Assessment – PI, TXCPA, $133K
2019-20	Texas Dwarf Seahorse Status Assessment – PI, TPWD, $62K.
2018-19	Brazos River Freshwater Inflow Study. Phase 3. PI, TWDB, $75K
2018	Coastal Texas Protection and Restoration Study, Environmental Impacts on Marine Mammal Populations. Texas General Land Office. $138K
2018-20	National Rivers and Streams Assessment of Texas – PI, TCEQ/EPA, $484K
2017-20	American Eel Population Status Assessment – PI, TPWD, $109K
2017-20	Characterization of the Influence of Freshwater Inflow on the Trinity River Delta Salinity, Rangia and Submerged Aquatic Vegetation. Galveston Bay Estuary Program. $64K.

2017-18	Characterization of microbial community structure and fecal contamination of floodwaters generated by Hurricane Harvey. NSF-Rapid Co-PI. PI Michael LaMontagne. $9.3K
2017	National Lakes Assessment of Texas – PI, TCEQ/EPA, $248K
2016-17	Brazos Rivers Instream Flow and Freshwater Inflow Study. Phase 2. Co-PI, TWDB, $75K.
2016-18	Coast-wide Characterization of Saltmarsh Topminnow – *Fundulus jenkinsi* populations within the Texas coast. - PI, TPWD/USFWS. $107K.
2016-17	Assessment of Salinity Regime at the Anahuac NWR and Trinity River Delta. – PI, NWF. $64K.
2016	Distribution of *Rangia cuneata* in relation to salinity and freshwater inflow along the Trinity River delta, Galveston Texas. – PI, NWF. $34K
2016-18	Assessment of Water Quality in Galveston Bay watersheds. Clean Rivers Monitoring Program. PI, Houston Galveston Area Council, $77.9K
2015- 17	Assessment of Water Quality in Galveston Bay watersheds. Clean Rivers Monitoring Program. PI, Houston Galveston Area Council, $89K
2015-16	National Wetlands Condition Assessment – PI, TCEQ/EPA, $245K
2015-16	Mapping Shallow Oyster Reefs using Low-Cost Side Scanning Sonar and Drone Photography Systems. – Co-PI, Gulf Coast Prairie LCC Grant, Wildlife Management Institute, Inc. (WMI). $48K
2014-15	National Coastal Condition Assessment – PI, TCEQ/EPA, $290K
2014-15	Brazos Rivers Instream Flow and Freshwater Inflow Study. Co-PI, TWDB, $88K
2014-15	Distribution, Abundance and Habitat Use by the Saltmarsh topminnow, *Fundulus jenkinsi*. PI, TPWD, $48.7K
2014	Population Survey of the Texas Diamondback Terrapin, *Malaclemys terrapin littoralis* in San Antonio Bay, Matagorda Bay, and Sabine Lake. PI, TPWD, $42.3K
2013-14	Statistical analysis of the National Lakes Assessment Data for the State of Texas. PI, TCEQ, $50K
2013-14	Tracking the Incidence of the Fibropapilloma Virus in Texas' Green Sea Turtle Population. Co-PI with Dr. Tasha Metz. WCCR. Texas State Aquarium. - $20K
2013-17	Instream Flow Study of Endangered Texas Wild Rice and Associated Biota on the San Marcos River. Co-PI with Dr. Thom Hardy. City of San Marcos, TX, $1.2M/yr.
2012-14	Piping Plover Survey – Upper Texas Coast. Coastal Bend Bays and Estuaries Program and Co-PI with CBBEP, USFWS, $71K.
2012-14	American Oystercatcher Stewardship in Texas. Gulf Coast Bird Observatory. Co-PI with Susan Heath, GCBO $82K.
2013-14	National Rivers and Stream Assessment – PI, TCEQ/EPA, $270K.

2011-13	Assessment of Water Quality in Galveston Bay watersheds. Clean Rivers Monitoring Program. PI, Houston Galveston Area Council, $300K
2011-13	Effects of the Texas Blue Crab Fishery on Diamondback Terrapin Populations. PI, Texas Parks and Wildlife Department State Wildlife Grant, $60K
2011-12	Diamondback Terrapin Population Assessment. PI, Texas Sea Grant, $70K
2011	National Wetland Condition Assessment – PI, TCEQ/EPA, $170K
2011	Estimation of Blue Crab growth and movement in Galveston Bay tributaries – PI, TPWD, $9K
2010-11	Evaluation of water quality in coastal basins – PI, Texas AgriLife, $52K
2010-11	Sedimentation Study of Dickinson Bayou Tidal (Segment 1103) – PI, TCEQ, $40K
2010-11	Development of Nutrient Criteria Support Document – Technical Support. PI, TCEQ, $170K
2010-11	National Coastal Condition Assessment – PI, TCEQ/EPA, $220K
2010-11	Evaluation of the influence of stream substrate of fish communities in Harris County. PI, Harris County Flood Control District. $60K
2010-11	Assessment of Water Quality in Galveston Bay watersheds. Clean Rivers Monitoring Program. PI, Houston Galveston Area Council, $80K
2010-11	Evaluation of wetland hydrology and time of transport estimates in relation to indicator bacteria removal at the constructed Mason Park wetland. PI, Harris County Flood Control District, $40K
2010-12	Characterization of turbidity in Harris County streams based on watershed characteristics and hydrology. PI, Harris County Flood Control District, $70K
2009-13	Development of Wetland Treatment System for the Armand Bayou Watershed. PI, TCEQ – GBEP, $500K
2009-10	Development of an Ecosystem Model for Galveston Bay. PI, TCEQ – GBEP, $35K
2009-11	Recreational and Aquatic Life Use Attainability Analysis – South Texas Streams. PI, TCEQ, $200K
2009-10	Evaluation of Diamondback Terrapin population dynamics in Brazoria San Bernard National Wildlife Refuge System Complex. PI, USFWS, $20K
2009-11	Evaluation of Diamondback Terrapin population dynamics in West Bay. PI, USFWS. Ecological Services, $32K
2009	Development of Ecological Overlay Information and Data for Support of Senate Bill 3 Environmental Flow Recommendations. PI, Trinity River Authority and Texas Water Development Board, $70K
2008-10	Evaluation of Fish as sources of *E. coli* bacteria. PI, TWRI Harris County Public Infrastructure (HCPID), $70K

2008-10	Evaluation of Bats as sources of *E. coli* bacteria. PI, TWRI Harris County Public Infrastructure (HCPID), $60K
2008-09	Compilation and evaluation of existing environmental information on the Trinity River, Texas. Trinity River Authority, $60K
2007-08	Evaluation of Diamondback Terrapin population dynamics in Galveston Bay. PI, Houston Zoo and Texas Parks and Wildlife Department, $30K
2008-09	Population density, movement and habitat utilization of the Diamondback Terrapin. PI, Faculty Research and Support Fund Proposal, $6K
2008-09	Phase II. A bacteriological survey of Lake Madeline, Texas. PI, City of Galveston. $20K
2007-09	Assessment of Water Quality in Galveston Bay watersheds. Clean Rivers Monitoring Program. PI, Houston Galveston Area Council. $80K
2008-10	Armand Bayou TMDL and Recreational Use Attainability Analysis – Bacteria Above Tidal. PI, TCEQ. $80K
2008	Use of Stable Isotopes to evaluate food webs in support of development of Mass Balanced ECOPATH Model for Galveston Bay (Modeling losses to blue crab populations from reduced fresh water inflow and overfishing using EwE software). Co-PI, TPWD. Collaborative Project with TPWD P.I. Glen Sutton. $30K
2007-10	Greens Bayou Wetlands Mitigation Bank Assessment Project: Development of a GIS model to evaluate site hydrology. PI, Harris County Soil and Water Conservation District, $120K
2007	Evaluation of Historical Trends in Trinity River Fish Communities, Phase II. PI, Trinity River Authority. $25K
2007	Evaluation of Historical Trends in Trinity River Fish Communities. PI, Trinity River Authority. $20K
2007	Development of Mass Balanced ECOPATH Model for Galveston Bay (Modeling losses to blue crab populations from reduced fresh water inflow and overfishing using EwE software). Co-PI, TPWD. Collaborative Project with TPWD P.I. Glen Sutton. $20K
2007	Air Quality Monitoring and Education Gift. PI, Houston Endowment. $300K
2007-09	Evaluation of the influence of stream substrate of fish communities in Harris County. PI, Harris County Flood Control District. $60K
2006-07	Revision of the Galveston Bay Habitat Blueprint. PI, Galveston Bay Estuary Program. $20K
2006	A bacteriological survey of Lake Madeline, Galveston, Texas. PI, City of Galveston. $30K
2006	An Evaluation of the Hydrology of the Greens Bayou Wetland Mitigation Bank: Subdivision A Phase 1. Co-principal investigators Dr. Brad Wilcox – TAMU, and Heather Biggs - EIH, Harris County Flood Control District. $25K
2005-06	Assessing the Effects of Community-based restoration on stewardship in communities. Restore America's Estuaries. Co-principal investigator. Principal Investigator: Dr. Sharon Hall – School of HSH Galveston Bay Foundation. . $18K

2005-07	Assessment of Water Quality in Galveston Bay watersheds. Clean Rivers Monitoring Program. PI, Houston Galveston Area Council, $85K
2005-06	Growth of Ichthyoplankton in Relation to Environmental Conditions within Galveston Bay. PI, University of Houston Faculty Research Development Grant. $6K
2005-06	Growth of Larval Fish in Relation to Water Quality within Galveston Bay. PI, University of Houston Faculty Research Development Grant. $6K
2005	Rapid Bioassessment of benthic invertebrates in Goose Creek, Texas. PI, Crouch Environmental Subcontract. $20K
2004	Assessment of Water Quality in Galveston Bay watersheds. Clean Rivers Monitoring Program. PI, Houston Galveston Area Council. $40K
2004	Evaluation of the Distribution of Exotic Fish Species in first and second order tidal streams of the Galveston Bay watershed. PI, University of Houston Faculty Research Development Grant. $6K

INDEPENDENT EXTERNAL SERVICE, CONSULTING AND INSTRUCTION

2019-2020	Statewide Synthesis of Environmental Flow Studies (2014-2017). Co-PI. Client: Texas Water Development Board. TWDB Contract # 1900012284. Subcontractor to Texas State University, PI Dr. Thom Hardy.
2019	Instructor of portion of *Investigation and Valuation of Fish Kills*. Workshop. Client: Southern Division of the American Fisheries Society. Primary Instructor: Greg Conley.
2017-18	Review of the Southeast Climate Science Center. American Fisheries Society review team. Client: USGS, Oklahoma State and AFS.
2015	Instructor of *Investigation and Valuation of Fish Kills*. Workshop. Client: State of Alabama.
2014-16	Independent external peer review panel. Technical Review of the Puget Sound Nearshore Ecosystem Restoration Draft Integrated Feasibility Study/Environmental Impact Statement (PSNER DFS/EIS). Client: Battelle Corporation.
2014	Review of HCFCD Stream Restoration Project – Memorial Park Buffalo Bayou Project. Client: Sierra Club of Houston.
2012	Instructor of *Investigation and Valuation of Fish Kills*. U.S. Fish and Wildlife Service. National Conservation Training Course. Arcata, CA.
2011-18	Member of the Brazos River Bays and Basins Expert Scientific Team (BBEST). Preparation of technical support documents.
2008-18	Member of the Trinity and San Jacinto River Bays and Basins Expert Scientific Team (BBEST). Preparation of technical support documents.
2008-09	Peer Reviewer - Exxon Valdez Oil Spill Trustee Council. Partial reimbursement for review of proposed research projects dealing with restoration of previously impacted ecosystems in Arctic ecosystems.

2008	Consultant. Client Anadarko. Subcontract with Weston Solutions. Preliminary Recreational Fishing and Hydrology of the Tule Lake Complex Brine Service Company Superfund Site.
2008	Consultant. Client U.S. Army Corp of Engineers. Subcontract with Battelle Corporation. Technical Peer Review of Freeport Harbor COE Project.
2008	Evaluation of Bacteria Levels and Water Quality in Harris County Bayous. Consultant. Client Harris County Public Infrastructure Department. Subcontract with Turner Collie and Braden. $35K.
2007-08.	Galveston Airport Study Client: City of Galveston, subcontracted under Klotz and Associates.
2006	Instructor. Pond culture short course. Client: U.S. Fish and Wildlife Service. National Conservation Training Course.
2005	Instructor. Investigation and Valuation of Fish Kills. U.S. Fish and Wildlife Service. National Conservation Training Course.

EXPERT WITNESS AND LITIGATION SUPPORT EXPERIENCE

2016-17	Deposition and testimony in support of San Leon MUD opposition to Clean Harbors San Leon, Inc.'s application with SOAH and/or TCEQ for a Major Amendment to its Texas Pollutant Discharge Elimination System Permit. Contact: Stephanie S. Potter: Naman, Howell, Smith and Lee, PLLC.
2015-16	Review of Water Quality Impacts associated with the proposed CLCWA Authority wastewater facility: permit amendment. Clients: Coats | Rose, Dallas, TX and CLCWA. Contact: Angela Stepherson.
2014-16	Analysis of impacts associated with superfund site on coastal fisheries of Texas. Local Fishermans Group and State of Texas vs. Private Company. Clients: Bracewell & Giuliani LLP and Morgan, Lewis and Bockius LLP. Houston, TX. Contact: Attorney Jason Muriby.
2013-14	Characterization of Galveston Bay Commercial Fisheries. Houston, TX. Bracewell & Giuliani LLP and Morgan, Lewis and Bockius LLP. Houston, TX. Contact: Attorney Jason Muriby.
2011-13	Deposition on the methodology used to derive estimates of dead endangered darter populations. Alabama Fish Kill Case. City of Birmingham vs. USFWS. Client: Balch and Bingham, LLP. And City of Birmingham. Contact: P. Stephen Gidiere, III.
2004.	Deposition as to the scientific evidence and causes of the Klamath River Fish Kill Case investigated by the USFWS. Arcata, California. U.S. Government v. Yurok Tribe. Client: USDOJ. Role: Agency Biologist.
1990.	Oral testimony on impacts of proposed wastewater discharge on Christmas Bay. Texas Water Commission Proposed Permit Hearing. Role: Agency Biologist.

PRESENTATIONS

Hansen, J. and G. Guillen. 2020. Speckled Worm Eel (*Myrophis punctatus*) in Texas, a common, not so common species. Texas Academy of Science Annual Meeting. Tyler, TX.

McDaniel, S. and G. Guillen. 2020. Foraging Ecology of Bottlenose Dolphins (*Tursiops truncatus*) in Galveston Bay. Texas Academy of Science Annual Meeting. Tyler, TX.

Omar, M., J. Oakley and G. Guillen. 2020. Atlantic Rangia, Rangia cuneata, in Trinity Bay (Upper Galveston Bay): Ecology and growth in response to freshwater inflow. Texas Academy of Science Annual Meeting. Tyler, TX.

Fazioli, K., V. Mintzer, and G. Guillen. 2019. *In the path of floodwaters*: Short-term effects of Hurricane Harvey on bottlenose dolphins (*Tursiops truncatus*) in upper Galveston Bay, Texas. World Marine Mammal Conference: Barcelona, Spain 2019.

Guillen, G.J. Oakley, C. Scanes and M. Gordon. 2019. Coast-Wide Characterization of Saltmarsh Topminnow – *Fundulus jenkinsi* Populations in Texas. Meeting of the Southern Division of the American Fisheries Society. Galveston, TX. Jan. 2019

Oakley, J., F. Gelwick, M. Lawing, A. Armitage and G. Guillen. 2019. A Coastal Health Index for The Northern Gulf Of Mexico; How Fisheries Contribute To Measuring Ecosystem Health. Meeting of the Southern Division of the American Fisheries Society. Galveston, TX. Jan. 2019

Scanes, C., Guillen, G., J. Oakley, and M. Gordon. 2019. Using National Surveys to Evaluate the Condition of Texas State-Wide Fish Communities. Meeting of the Southern Division of the American Fisheries Society. Galveston, TX. Jan. 2019.

Hansen, J.R., J. Oakley, S. Curtis and G. Guillen. 2019. The Hunt for the Elusive American Eel in Texas: A Story about Eels and Blue Crab. Meeting of the Southern Division of the American Fisheries Society. Galveston, TX. Jan. 2019.

Guillen, G., J. Oakley, C. Scanes, and M. Gordon. 2018. Characterization of Saltmarsh Topminnow - *Fundulus jenkinsi* populations along the Texas coast. Gulf Estuarine Research Society. Galveston, Texas. November 2018.

Oakley, J., F. Gelwick, M. Lawing, A. Armitage and G. Guillen. 2018. Developing a coastal health index for the northern Gulf of Mexico. Gulf Estuarine Research Society. Galveston, Texas. November 2018.

Guillen, G. and M. Mokrech. 2018. Mapping intertidal oyster reefs using side-scanning sonar and drone systems. Gulf Estuarine Research Society. Galveston, Texas. November 2018.

Hansen, J.R., J. Oakley, S. Curtis and G. Guillen. 2018. Hunting for the elusive American Eel along the Texas coast. Gulf Estuarine Research Society. Galveston, Texas. November 2018.

Guillen, G., C. Scanes, M. Gordon, T. Swanson, and J. Oakley. 2018. The influence of freshwater inflow on the estuarine nekton of a tidal river. Texas Chapter of the American Fisheries Society. College Station, Texas. January 2018.

Warner, K.J., G. Guillen and T. Hardy. 2018. Instream habitat use of invasive armored catfishes in the Upper San Marcos River. Texas Chapter of the American Fisheries Society. College Station, Texas. January 2018.

Oakley, J., C. Scanes, M. Gordon, and G. Guillen. 2018. Recovery of Galveston Bay saltmarsh nekton communities after Hurricane Harvey. Texas Chapter of the American Fisheries Society. College Station, Texas. January 2018.

Buhler, K., and G. Guillen. 2018. Comparing habitat types and fish assemblages in the Flower Garden Banks mesophotic zone. Texas Chapter of the American Fisheries Society. College Station, Texas. January 2018.

Vallery, A., M. Mokrech, and G. Guillen. 2017. Assessment of shorebird and wading bird populations in Galveston Bay using Unmanned Aerial Vehicles. Texas Colonial Waterbird Conference. Kingsville, TX. November 2017.

Guillen, G. 2017. Harvey, Ike and the Future: What can be done? Houston Bay Area Storm Water Flood Forum. Houston, Texas. November 2017.

Guillen, G. 2017. Fish, Shrimp, Crabs and Freshwater – Life in a Dynamic Estuary. H-GAC Clean Water Initiative Series – Freshwater Inflow November 2017. Houston, TX.

Guillen, G., Oakley, J, Gordon, M., and C. Scanes. 2017. The Influence of Freshwater Inflow on the Nekton Community of a Riverine Estuary. November 2017. Coastal and Estuarine Research Federation Conference. Providence, RI.

Johns, N., K. Garmany, G. Guillen, R. Feagin, E. White, Y. Want, K. Fritz-Gammond and P. Walther. 2017. Bringing the freshwater – the Anahuac Wetlands Restoration Project, TX. November 2017. Coastal and Estuarine Research Federation Conference. Providence, RI.

Guillen, G. 2017. UHCL-EIH Activities. Hurricane Harvey: Lighting Talks. Galveston Bay Council of the GBEP. October 18, 2017. Houston, TX.

Fazioli, K., V. Mintzer, V. and G. Guillen. 2017. Site fidelity of bottlenose dolphins (*Tursiops truncatus)* in a highly-industrialized estuary. The Society for Marine Mammalogy, 22nd Biennial Conference on the Biology of Marine Mammals, Halifax, NS, Canada. Poster.

Guillen, G. 2017. Keynote Address to Session: Emerging Anthropogenic Pollution and its Effects on our Aquatic Resources. Title: Recent Advances in Fish Kill and Pollution Event Investigations. American Fisheries Society Conference. Tampa, FL. August 2017.

Guillen, G., J. Oakley, C. Scanes, M. Gordon, and T. Swanson. 2017. The Relationship of Freshwater Inflow Regime and the Spatial Ecology of the Nekton of the Brazos River Estuary, Texas. Tampa, FL. August 2017.

Guillen, G., Oakley, J., M. Gordon, C. Scanes. N. Johns. 2017. Influence of freshwater inflow on the distribution of Atlantic Rangia and Water Celery within the Trinity River delta, Galveston Bay. Texas Chapter of the American Fisheries Society. Corpus Christi, TX.

Guillen, G. Oakley, J. M. Gordon, C. Scanes, and N. Johns. 2017. The influence of freshwater inflow on the Occurrence of Atlantic Rangia and Water Celery. Texas Academy of Science. Belton, TX.

Vallery, A., G. Guillen and M. Mokrech. 2017. Spatial distribution of bird communities were analyzed using cluster analysis within the ESRI ArcGIS 10.4 software package. Texas Academy of Science. Belton, TX.

Guillen G., M. Gordon, J.W. Oakley and N. Johns. 2016. Recent Observations on Trinity River Delta *Rangia cuneata* and *Vallisneria americana* in relation to Freshwater Inflow. Trinity and San Jacinto River Basins and Galveston Bay BBASC Meeting: November 2, 2016. Conroe, TX.

Guillen, G., J.W. Oakley and M. Gordon. 2016. Factors Associated with Historical Trends in the Occurrence of Texas Diamond-backed Terrapin (*Malaclemys terrapin*). Diamond-backed Terrapin Working Group Conference. October 29, 2016. Fairhope, Alabama

Guillen G., M. Gordon, J.W. Oakley and N. Johns. 2016. Relationship of the Trinity River Delta *Rangia cuneata* population and Freshwater inflow. Texas Mollusk Symposium. August 8-11, Dallas, TX.

Guillen, G. and J.W. Oakley. 2016. Water Quality Improvements Associated with Creation of a Multipurpose Coastal Wetland on a University Campus. Society of Wetland Scientists. Corpus Christi, TX.

Oakley, J.W., M. Gordon, and G. Guillen. 2016. National aquatic resources surveys: application for wetland condition monitoring and assessment in Texas. Society of Wetland Scientists. Corpus Christi, TX.

Guillen, G. and J. Oakley. 2016. The Influence of Hydrology, Habitat and Water Quality on stream fishes inhabiting coastal urban streams: implications for restoration. Advancing Stream Restoration in the Southwest. San Antonio, TX.

Robertson, J., S. Curtis, J. Oakley and G. Guillen. 2016. Growth and reproduction of the saltmarsh topminnow (*Fundulus jenkinsi*). Texas Academy of Science. Junction, TX.

Guillen, G., J. Oakley, and S. Curtis. 2016. Influence of Freshwater Inflow on Aquatic Biota of the Lower Brazos River, Texas. Texas Academy of Science. Junction, TX.

Loe, S., K. Fazioli, and G. Guillen. 2016. Foraging ecology of common bottlenose dolphins (*Tursiops truncatus*) in the Galveston bay ecosystem. Texas Academy of Science. Junction, TX.

Curtis, S., J. Oakley, M. Gordon, and G. Guillen. 2016. Development of methodology to validate freshwater needs of the Brazos River estuary. Texas Chapter of the American Fisheries Society. Kerrville, TX.

Silvy, E., F. Gelwick, G. Guillen, and R. Lopez. 2016. Determining factors affecting Dermo Disease (*Perkinsus marinus*) in populations of Eastern Oysters (*Crassostrea virginica*) in Galveston Bay, Texas. Texas Chapter of the American Fisheries Society. Kerrville, TX.

Guillen, G., S. Curtis, J. Oakley, and M. Gordon. 2016. Influence of freshwater inflow on nekton of the Brazos River estuary. Texas Chapter of the American Fisheries Society. Kerrville, TX.

Robertson, J. J., S. Curtis, J. Oakley, and G. Guillen.2016.Growth and reproduction of the Saltmarsh Topminnow (*Fundulus jenkinsi)* in Texas. Texas Chapter of the American Fisheries Society. Kerrville, TX.

Morris, N.S. and G. Guillen. 2016. Mercury monitoring in Texas waters of the Gulf of Mexico: a concurrent Study with the national coastal condition assessment. Texas Chapter of the American Fisheries Society. Kerrville, TX.

Silvy, E., G. Guillen, and F. Gelwick. 2016. Determining Factors Affecting Dermo Disease of Oysters in Galveston Bay. State of Galveston Bay Symposium. Galveston, TX.

Robertson, J. and G. Guillen. 2016. Where Them Fish At? An Overview of the Population and Habitat Characteristics of the Saltmarsh Topminnow (*Fundulus jenkinsi*) in Galveston Bay and Sabine Lake. State of Galveston Bay Symposium. Galveston, TX.

Guillen, G., B. Alleman, J. Oakley, and A. Moss. 2016. Trends in the Abundance of Texas Diamond-Backed Terrapin, *Malaclemys terrapin littoralis*, in Galveston Bay. State of Galveston Bay Symposium. Galveston, TX.

Morris, N. and G. Guillen. 2016. Mercury Monitoring in Texas Waters of the Gulf of Mexico: A concurrent study with the National Coastal Condition Assessment. State of Galveston Bay Symposium. Galveston, TX.

Zarnstoff, N. and G. Guillen. 2016. Characterization of ambient water quality and influencing characteristics in natural and created wetlands of the Texas coast. Poster Presented at State of Galveston Bay Symposium. Galveston, TX.

Loe, S., K. Fazioli, and G. Guillen. 2016. Foraging ecology of common bottlenose dolphins (*Tursiops truncatus)* in upper Galveston Bay. Poster Presented at State of Galveston Bay Symposium. Galveston, TX.

Fazioli, K., V. Mintzer and G. Guillen. 2015. Bottlenose dolphin activity in a highly industrialized region of Galveston Bay, Texas. Poster Presented at Society for Marine Mammalogy. San Francisco, CA.

Vale, K.., G. Guillen and D. Newstead. 2015. Southeast Partners in Flight Investigation of Factors Influencing Piping Plover Distribution on the Upper Texas Coast Conference. Lafayette, LA.

Guillen, G., J. Oakley, M. Moss, and S. Curtis. 2015. The Response of Nekton Communities of the Lower Brazos River Estuary, Texas to Varying Freshwater Inflow. Coastal and Estuarine Research Federation Conference. Portland, OR.

Curtis, S., J. Oakley, M. Moss and G. Guillen. 2015. Effects of Freshwater Inflow and Tides on Water Quality of the Brazos River Estuary. American Fisheries Society Conference. Portland, OR.

Zarnstoff, N. and G. Guillen. 2015. Characterization of annual ambient water quality in natural and created wetlands of the Texas coast. Texas Bays and Estuaries Meeting, Corpus Christi, TX.

Metz, T., M. Gordon, G. Guillen, and J.D. Anderson. 2015. Current documentation of fibropapillomatosis in Green Turtles (*Chelonia mydas*) captured from Texas inshore waters. Texas Bays and Estuaries Meeting, Corpus Christi, TX.

Alleman, B. and G. Guillen. 2015. Assessment of Habitat and Prey Availability Associated with the Distribution of Texas Diamond-backed Terrapin (*Malaclemys terrapin littoralis*). Texas Bays and Estuaries Meeting, Corpus Christi, TX.

Robertson, J., S. Curtis, J. Oakley, G. Guillen. 2015. Distribution, Abundance, and Habitat Use of the Saltmarsh Topminnow (*Fundulus jenkinsi*). Texas Bays and Estuaries Meeting, Corpus Christi, TX.

Curtis, S., J. Oakley, M. Gordon, and G. Guillen. 2015. Effects of Freshwater Inflow and Tides on Water Quality of the Brazos River Estuary. Texas Bays and Estuaries Meeting, Corpus Christi, TX.

Guillen, G., J. Oakley, B. Alleman, M. Gordon. 2015. Historical Occurrence and Trends in the Distribution of the Texas Diamond-backed Terrapin, *Malaclemys terrapin littoralis*. Texas Bays and Estuaries Meeting, Corpus Christi, TX.

Loe, S., Fazioli, K., Guillen, G. 2015. Observations on the occurrence and distribution of bottlenose dolphins (*Tursiops truncatus*) in upper Galveston Bay. Texas Bays and Estuaries Meeting, Corpus Christi, TX.

Metz, T. Gordon and G. Guillen. 2015. Documentation of Fibropapillomatosis in Green Turtles (*Chelonia mydas*) captured from Texas inshore waters. Southeast Regional Sea turtle Meeting. Port Aransas, Texas.

Gordon, M., T. Metz and G. Guillen. 2015. Relative Abundance & Distribution of Juvenile Sea Turtles Along the Mid-Lower Texas Coast Based on Directed Capture. Southeast Regional Sea turtle Meeting. Port Aransas, Texas.

Fazioli, K., Mintzer, V. and G. Guillen. 2015. An apparent increase in bottlenose dolphins in upper Galveston Bay: 7-8 April, 2015. Marine Mammal Monitoring Conference. New Orleans, LA.

Lane, M., M. Mokrech, S. Curtis, J. Oakley, and G. Guillen. 2015. Trends in land use and Texas lotic fish communities. Texas Academy of Science Annual Meeting. San Antonio, TX. May 6-8, 2015.

Byrne, R. and G. Guillen. 2015. Influence of Recreation on Water Quality in the San Marcos River. Texas Academy of Science Annual Meeting. San Antonio, TX. May 6-8, 2015.

Alleman, B. and G. Guillen. 2015. Diet analysis of Texas diamondback terrapin (*Malaclemys terrapin littoralis*). Texas Academy of Science Annual Meeting. San Antonio, TX. May 6-8, 2015.

Robertson, J. and G. Guillen. 2015. Distribution, Abundance, and Habitat Use of the Saltmarsh Topminnow (*Fundulus jenkinsi*). Texas Academy of Science Annual Meeting. San Antonio, TX. May 6-8, 2015.

Zarnstoff, N. and G. Guillen. 2015. Characterization of ambient water quality in natural and created wetlands of the Texas coast. Texas Academy of Science Annual Meeting. San Antonio, TX. May 6-8, 2015.

Lane, M., S. Curtis, J. Oakley, M. Mokrech and G. Guillen. 2015. Spatial patterns in Texas lotic fish communities. Texas Chapter of the American Fisheries Society Meeting. Tyler, TX.

Robertson, J., S. Curtis, J. Oakley, and G. Guillen. 2015. Distribution, abundance, and habitat use of the Saltmarsh Topminnow (*Fundulus jenkinsi*). Texas Chapter of the American Fisheries Society Meeting. Tyler, TX.

Anderson, A., G. Guillen and S. Heath. 2014. The effect of laughing gulls (*Leucophaeus atricilla)* on American oystercatcher (*Haematopus palliates*) reproductive success and parental behavior along the upper Texas Coast. International Waterbird Society 2014 meeting. Baja, Mexico.

Alleman, B. and G. Guillen. 2014. Feeding ecology of Texas diamondback terrapin (*Malaclemys terrapin littoralis*). Texas Diamondback Terrapin Workgroup Meeting. October 2014. Corpus Christi, Texas.

Anderson, A., G. Guillen, and S. Heath. 2014.A time activity budget of American oystercatchers and investigation of factors affecting breeding adult behavior during the incubation and chick rearing periods. 2014 Atlantic and Gulf Coast American Oystercatcher Working Group Annual Meeting. Lake Jackson, TX.

Anderson, A., G. Guillen, and S. Heath. 2014. A time activity budget for American oystercatchers (Haematopus palliatus) and the factors affecting parental behavior during the incubation and chick rearing periods. Gulf Estuarine Research Society Annual 2014 Meeting. Port Aransas, TX.

Vale, K., G. Guillen and D. Newstead. 2014. Investigation of potential factors that influence piping plover distribution along the upper Texas coast. Gulf Estuarine Research Society Annual 2014 Meeting. Port Aransas, TX.

George, R. and G. Guillen. 2014. The nesting ecology of the Texas diamondback terrapin (*Malaclemys terrapin littoralis*). Gulf Estuarine Research Society Annual 2014 Meeting. Port Aransas, TX.

Guillen, G. 2014. Terrapin Research in Texas: Past, Present and Future? Texas Terrapin Conference and Workshop. University of Texas Port Aransas. Port Aransas, TX.

Clarkson, E. and G. Guillen. 2014. Movement and Behavior of Texas Terrapin in West Bay Texas. Texas Terrapin Conference and Workshop. University of Texas Port Aransas. Port Aransas, TX.

Clarkson, E. and G. Guillen 2014. Short term temporal trends in activity and habitat selection of the Texas Diamondback Terrapin. Texas Bays and Estuaries Meeting. University of Texas Port Aransas. Port Aransas, TX.

Alleman, B. and G. Guillen. 2014. Characterization of prey availability between Texas diamondback terrapin (*Malaclemys terrapin littoralis*) capture sites and background wetland densities. Texas Academy of Science. March 7, 2014. Galveston, Texas.

Guillen, G. 2014. Examination of potential factors influencing the commercial fisheries of Galveston Bay. Texas Academy of Science. March 7, 2014. Galveston, Texas.

Lane, M. and G. Guillen. 2014. Texas lotic fish communities: preliminary analysis of spatial patterns. Texas Academy of Science. March 7, 2014. Galveston, Texas.

Guillen, G. and J. Oakley. 2014. Effects of Bycatch Reduction Devices on Commercial Blue Crab Catch Rates. Joint Annual Meeting of the Oklahoma and Texas Chapter of American Fisheries Society. Pottsboro, Texas. Feb 15, 2014.

Lane, M., S. Curtis, J. Oakley, and G. Guillen. 2014. Preliminary Analysis of Spatial Patterns in Texas Lotic Fish Communities. . Joint Annual Meeting of the Oklahoma and Texas Chapter of American Fisheries Society. Pottsboro, Texas. Feb 15, 2014.

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Haskett, K. and G. Guillen. 2008. Population Characteristics of Diamondback Terrapin at the Deer Island Complex: Galveston, Texas during 2008. EIH Technical Report to the Houston Zoo and Texas Parks and Wildlife Department. UHCL, TX.

Guillen, G. and H. Biggs. 2007. Greens Bayou Wetlands Mitigation Bank Assessment Project Phase 1 of 3: Topographic Survey for Evaluation of Site Hydrology January 1, 2007 through July 30, 2007. Environmental Institute of Houston. Houston, Texas.

Guillen, G., B. Wilcox and H. Biggs. 2006. An Evaluation of the Hydrology of the Greens Bayou Wetland Mitigation Bank: Subdivision A Phase 1 - Final Report. EIH-01-06. Environmental Institute of Houston. Houston, Texas.

Guillen, G. and S. Moore. 2006. Lake Madeline Bacteria Study Final Report. EIH-02-06. Environmental Institute of Houston. Houston, Texas.

Guillen, G. 2003a. Klamath River Fish Die-off: September 2002. AFWO-01-03. USFWS. Arcata, California.

Guillen, G. 2003b. Klamath River Fish Die-off: September 2002: Report on Causative Factors. AFWO 03-03. USFWS. Arcata, California

Klamath River Technical Advisory Team. 2003. Klamath River Fall Chinook Age-Specific Escapement, 2002 Run. Yreka, California. Coauthor.

Klamath River Technical Advisory Team. 2003. Ocean Abundance Projections and Prospective Harvest Levels for Klamath River Fall Chinook, 2003 Season

Minerals Management Service. 2000. Environmental Assessment of Chevron/OECD Joint Venture Destin Dome 1 and 2 Development Plan. Coauthor of discharge/water quality section. MMS. New Orleans, Louisiana.

Minerals Management Service. 2000. Environmental Impact Statement: Offshore Lease Sale 181 - Eastern Gulf of Mexico Planning Area. Coauthor of water quality characterization section. MMS. New Orleans, Louisiana

Guillen, G.J., L. Whaylen, L. Broach and S. Smith. 1999. Evaluation of sediment quality in the vicinity of permitted discharges and selected land-use practices: Galveston Bay. TNRCC. Austin, Texas.

Marks, L.M. and G. Guillen. 1999. Characterization of water quality, macrobenthos, and nekton at Gulf of Mexico Beaches: Bolivar Peninsula, Galveston Island, and Surfside. AS-178/SR. TNRCC. Austin, Texas.

Guillen, G.J. 1996. Development of a Rapid Bioassessment method and index of biotic integrity for tidal streams and bayous located along the northwest Gulf of Mexico. Final Report to EPA. TNRCC. Houston, Texas.

Guillen, G.J. and D. Phillips. 1996. Overflows and Bypasses in the Harris and Galveston Counties Area. Final Report. TNRCC. Houston, Texas.

Guillen, G.J. 1995. Texas Coastal Natural Resources Inventory: Water and Sediment Quality - Historical Data Compilation. User's Manual. TNRCC. Houston, Texas

Guillen, G.J. 1994. Development of Rapid Bioassessment and Index of Biotic Integrity for coastal ecosystems in Southeast Texas. Special Report to EPA Region 6. TNRCC.

Guillen, G.J., D. Phillips, J.A. Harper and J.R. Larson. 1994. Estimated loadings of partially treated domestic wastewater on Galveston Bay. GBNEP-41. Galveston Bay National Estuaries Program. Webster, Texas

Guillen, G.J. 1994. Ecological risks effecting freshwater streams and bayous within the Houston-Galveston watershed. Special Report to HARC ecosystem committee.

Guillen, G.J., M. Ruckman, S. Smith, and L. Broach. 1993. Marina Impacts in Clear Lake and Galveston Bay. Special Report D7-001. Texas Water Commission. Houston, Texas 77015

Guillen, G.J. 1993. Evaluation of dissolved oxygen trends in the Houston Ship Channel from historical statewide monitoring data. AS-09. Texas Natural Resource Conservation Commission.

Guillen, G.J. 1993. APEX Oil Spill: Natural Resource Damage Assessment. Special Report. Texas Water Commission.

Albrecht, C.A. and G. J. Guillen. 1991. A biological site assessment of an unnamed tributary in Chambers County: City of Anahuac permit renewal. TWC Technical Report.

Guillen, G.J. and M. Luedke. 1991. Fish kill investigation of Buffalo Bayou. TWC Technical Report. Texas Water Commission.

Guillen, G.J. 1991. An ecological survey of Jarbo Bayou. TWC Technical Report. Austin, Texas.

Guillen, G.J. and R. Kiesling. 1989. A biological site assessment of an unnamed receiving stream (TWC segment no. 1107) downstream of the proposed discharge (permit number 03116) from the NAIAD Corporation facility in Brazoria County. TWC Technical Report. Austin, Texas.

Guillen, G.J. and C.A. Albrecht. 1989. Site assessment of Linnville Bayou, with special reference to renewal of TWC Permit 00721 (Phillips 66 Company) TWC Technical Report. Austin, Texas.

Guillen, G.J. and R. Kiesling. 1989. Preliminary Type-A Natural Resource Damage Assessment of the June 23, 1989 oil spill from the Coastal Towing T/B 2514 barge collision. TWC Technical Report. Austin, Texas.

Guillen, G.J. 1988. Goose Creek Water Quality and Biological Survey conducted on 10-10-88. Texas Water Commission (TWC) Technical Report. Field Operations Deer Park Office. Austin, Texas. 11pp.

Guillen, G.J. 1988. Natural resource survey of Christmas Bay surrounding the proposed Continental Savings discharge (proposed permit no. 13402-01). TWC Technical Report. Austin, Texas.

Guillen, G.J. 1988. Preliminary assessment of the effects of the Phillips 66 discharge (Permit No. 00721) on Linnville Bayou, Matagorda County. TWC Technical Report. Austin, Texas.

Guillen, G.J. 1993. APEX Oil Spill: Natural Resource Damage Assessment. Special Report. Texas Water Commission.

Guillen, G.J. 1987. A review of Chemical Waste Management's application to amend permit no. 39037 for disposal of Class I hazardous wastes in Jefferson County at the Bayou Farms site. TPWD Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1986. Shell Pipeline Corporation- oil spill. TPWD Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1986. Farmland Fertilizer Spill- Calhoun County, 30 December 1985. TPWD Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1986. Biological impact of underwater explosive removal of Tenneco rig on 21 June 1986. TPWD Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1993. APEX Oil Spill: Natural Resource Damage Assessment. Special Report. Texas Water Commission.

Guillen, G.J. 1985. Fish kill at Lake Nassau in Harris County, 15 September 1985. TPWD Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1985. Oil pollution of lower Galveston Bay by Mitchell Energy Corporation- Mitchell Fee lease #11808. Violation of RRC permit. TPWD Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1985. APAC of Texas oil spill in Dickinson Bayou, December 13-16, 1985. TPWD Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1985. Red tide in Refuge Harbor, Calhoun County, 18 September 1985. TPWD Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1984. Reid Vacuum and Mud X site maintenance- 5 December 1985. Texas Parks and Wildlife Department (TPWD) Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1984. Essenjay Drilling Mud Spill in Lavaca County, May 16, 1984. TPWD Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1984. Natural Resource of Texas Oil Spill at Lake Texana- November 18, 1984. TPWD Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1984. Fish kill in Cedar Bayou, Harris and Chambers counties. TPWD Resource Protection Technical Report. Austin, Texas.

Guillen, G.J. 1984. Fish kill in Canoe Bayou. TPWD Resource Technical Report. Austin, Texas.

Graduate Student Theses and Research Projects Supervised

Mahmoud Omar. 2020. Modelling the Growth of Atlantic Rangia, *Rangia cuneata*, in response to freshwater inflow, Trinity River Delta, Galveston Bay. M.S. Thesis. University of Houston Clear Lake, Houston, TX.

Justin Hansen. 2020. Speckled Worm Eel (*Myrophis punctatus*) in the Estuarine Waters of Texas: a “Dove Tale” of the Elusive American Eel (*Anguilla rostrata*). M.S. Thesis. University of Houston Clear Lake, Houston, TX.

Tyler Swanson. 2019. Nekton community characterization of the lower Brazos River with an emphasis on Atlantic croaker, *Micropogonias undulatus*, trophic dynamics. M.S. Thesis. University of Houston Clear Lake, Houston, TX.

Kaitlin McGraw. 2019. Qualitative Characterization of Habitat Types and Fish assemblages of the Flower Garden Banks Mesophotic Zone. M.S. Thesis. University of Houston Clear Lake, Houston, TX.

Kris Warner. 2018. Instream habitat use and management of invasive armored catfishes in the upper San Marcos River. M.S. Thesis. University of Houston Clear Lake, Houston, TX.

Anna Vallery. 2018. Assessment of shorebirds and wading birds in Galveston Bay using conventional and UAV technologies. M.S. Thesis. University of Houston Clear Lake, Houston, TX.

Allison Norris. 2017. A Mesocosm Study of the Impact of Invasive Armored catfish (*Pterygoplichthys* sp.) on endangered Texas Wild Rice (*Zizania texana*) in the San Marcos River. M.S. Thesis. University of Houston Clear Lake, Houston, TX.

Nicole Morris. 2016. Mercury monitoring in Texas estuaries: A concurrent study with the National Coastal Condition Assessment. M.S. Thesis. University of Houston Clear Lake, Houston, TX

Kristin Vale. 2016. Investigation of factors influencing Piping Plover distribution along the upper Texas Coast. M.S. Thesis. University of Houston Clear Lake, Houston, TX

Michael Lane. 2016. Spatial patterns in Texas lotic fish communities. M.S. Thesis. University of Houston Clear Lake, Houston, TX.

Josi Robertson. 2016. Distribution, habitat, and life history characteristics of the saltmarsh topminnow (*Fundulus jenkinsi*). M.S. Thesis. University of Houston Clear Lake, Houston, TX.

Bryan Alleman. 2015. The Influence of Prey Availability and Habitat on the Distribution and Food Habits of Diamondback Terrapin *(Malaclemys terrapin littoralis)* in Texas. M.S. Thesis. University of Houston Clear Lake, Houston, TX. December 2015.

Laila Melendez Pronker. 2014. Growth Parameterization for Blue Crabs, Callinectes sapidus, of Galveston Bay, Texas. M.S. Thesis. University of Houston Clear Lake, Houston, TX

Rachel George. 2014. Nesting ecology of the Texas Diamondback Terrapin (*Malaclemys terrapin littoralis*). M.S. Thesis. University of Houston Clear Lake, Houston, TX

Amanda Anderson. 2014. The factors affecting productivity and parental behavior of American Oystercatchers in Texas. M.S. Thesis. University of Houston Clear Lake, Houston, TX

Alex Miller. 2014. Characterization of the Brazos River Estuary. M.S. Thesis. University of Houston Clear Lake, Houston, TX

Sybil Glenos. 2013. A comparative assessment of the genetic variation of diamondback terrapin (*Malaclemys terrapin littoralis*) in Galveston Bay, Texas in relation to other northern Gulf Coast populations. M.S. Thesis. University of Houston Clear Lake, Houston, TX

Daniel Barcenas. 2013. Use of Stable Isotope Analyses to describe Trophic Dynamics of Aquatic Ecosystems in Galveston Bay, Texas. M.S. Thesis. University of Houston Clear Lake, Houston, TX

Emma Clarkson. 2012. The Diamondback Terrapin – a comparison of nocturnal and diurnal activity, range, habitat selection, and behavior. M.S. Thesis. University of Houston Clear Lake, Houston, TX

Greg Knothe. 2012. The influence of urbanization on streams: the use of GIS spatial analysis to study land use influence on fish communities, water quality and physical habitats in Southeast Texas. M.S. Thesis. University of Houston Clear Lake, Houston, TX

Michael Franks. 2012. Determination of Spatial Patterns of Total Mercury Concentrations in Recreationally Important Offshore Fishes of the Gulf of Mexico. *M.S. Graduate Project*. University of Houston Clear Lake, Houston, TX

Kelli Haskett. 2011. Abundance and movement of the Texas Diamondback Terrapin in the Deer Island complex, Galveston, Texas**.** M.S. Thesis. University of Houston Clear Lake, Houston, TX

Diana Ramirez. 2008. The relationship between environmental characteristics and invasive fish species in selected tributaries within the Clear Lake watershed during summer months. *M.S. Graduate Project Report*. University of Houston Clear Lake, Houston, TX

Julie Sandefur. 2008. Evaluation of the influence of various stream substrates on fish communities within Harris County. *M.S. Graduate Project Report*. University of Houston Clear Lake, Houston, TX

Thesis and Dissertation Committee Member:

J.W. Kennedy. 1999. Stratigraphic evidence for the occurrence of flooding on the Brazos River, Old River Ranch Meander Bend, Burleson County, Texas. M.S. Thesis. University of Houston, Houston, TX

Beth Silvy. 2015. Determining factors affecting Dermo disease (*Perkinsus marinus*) in populations of Eastern oysters (*Crassostrea virginica*) in Galveston Bay, Texas (Co-chair with Dr. Fran Gelwick). M.S. Thesis. Texas A&M University, College Station.

Jenny Oakley. 2019. Coastal Health Index for the Northern Gulf of Mexico: Moving towards Meaningful Ecosystem Based Management. (Co-chair with Dr. Fran Gelwick) Ph.D. Dissertation. Texas A&M University, College Station.

Current Graduate Student Research Supervision

University of Houston Clear Lake - 11

Natasha Zarnstorff – Thesis Title: *Characterization of Wetland Water Quality in the Galveston Bay System*

Sherah McDaniel – Thesis Title: *Trophic Interactions of Bottlenose Dolphin, Tursiops truncatus, in Galveston Bay as determined with Mark Recapture and Stable Isotope studies.*

Joshua Yeager – Thesis Title: Influence of Freshwater Inflow on Estuarine and Marine Organisms in the Brazos River Estuary

Mackenzie A. Farrell – Tentative Thesis Title: Dolphin Ecology of Upper Galveston Bay.

Emily Cox – New Student Fall 2020 – Microplastics in Galveston Bay.

Grey Dennis – New Student Fall 2019 – Dwarf Seahorse Genetics

Story Lesher – New Student Fall 2019 – Dwarf Seahorse Ecology

Kaylei Chau – New Student Fall 2019. Constructed Floating Wetland Treatment Systems.

Tito Bryant – New Student Spring 2020. Analysis of juvenile eel populations along the Texas coast.

Jason Nagro – New Student Summer 2020. Assessment of Western Chicken Turtle using Drone Technology

Danielle DeChellis – New Student Fall 2020. Analysis of population status of Western Chicken Turtle in Texas

Academic Courses Taught – UHCL (1993-98 and 2004-Present)
Graduate:
Research Project and Seminar in Biology - BIOL 6838. 3hrs.
Wetlands – GEOL/ENSC 5333. 3hrs.
Coastal and Estuarine Ecology – BIOL 5532. 3hrs.
Limnology and Freshwater Biology – BIOL 5537. 3hrs.
Population and Community Dynamics – BIOL 5234. 3 hrs.
Ichthyology – BIOL 5235. 3 hrs.
Ichthyology Lab – BIOL 5215. 3 hrs.
Water Management – ENVR 5532. 3 hrs
Undergraduate: (1993-98 and 2004-Present)
Marine Biology – BIOL 3311. 3 hrs.
Biology of Fishes – BIOL 4313. 3 hrs.
Biology of Fishes Lab – BIOL 4113. 3 hrs.
Seminar in Biology – BIOL 4728. 3 hrs
Ecology – BIOL 4311. 3 hrs.

Courses Taught – Texas A&M University (Galveston Campus - 1991-94 and 2005-2018)

Undergraduate:
Marine Fisheries Management – MARB 445. 3 hrs
Fisheries Population Dynamics– MARB 460. 4 hrs (3 lect/3 lab)

Graduate:
Marine Biological Resources MARB 620. 3 hrs.

Courses Taught – University of Houston (1998 – 2 semesters)

Undergraduate:
Ecology – BIOL 4311. 3 hrs.

Courses Taught – San Jacinto College South (1995-96; – 3 semesters)

Undergraduate:
Zoology – 3hrs

Courses Taught – Texas A&M University (1982-1983) Lab TA
Undergraduate:
Freshmen Biology Laboratory – 1hrs (2 session per semester – 3 semesters)

Faculty Service: University Committees

IACUC member 2005-present
Environmental Science Program Committee – 2005-present
Biology Program Committee – 2005 – present

SCE Dean's Search Committee - 2012
Geology Faculty Search Committee – 2010-14
Biology Faculty Search Committee – 2010
ENSC Instructor Search Committee – 2016
ENSC Faculty Promotion Committee - 2017
ENSC Faculty Promotion and Tenure Committee – 2019
Provost Search Committee - 2018

Service: Recent External Reviewer Experience - Journals

Texas Academy of Science
Journal of Coastal Research
American Fisheries Society
Coastal and Estuarine Research Federation

Service: Recent External Agency Experience - Project Review Panel

Texas Water Development Board – Galveston Bay Studies
TCEQ Galveston Bay Estuary Program – Galveston Bay Studies

Service: Recent External Reviewer Experience - Research Project Proposals

NOAA MARFIN
NOAA Salston-Kennedy Competitive Research Program
Galveston Bay Estuary Program

Service: Recent Program Reviewer Experience

USGS/Oklahoma State University – Southeaster Central Climate Center – AFS Committee

Service: Professional Affiliations

Chair of Local Arrangements – Southern Division of the American Fisheries Society – January 2019 Meeting, Galveston, TX.
Chair of the Galveston Bay Estuary Program- Monitoring and Research Committee
Member of the Galveston Bay Estuary Program – Water Quality Committee
Member of the Galveston Bay Estuary Program – Natural Resource Committee
Past Chair: Freshwater Science Section of the Texas Academy of Science – 2015-2016.
Past Chair: Marine Science Section of the Texas Academy of Science – 2016 - present
Past President – Texas Chapter of the American Fisheries Society – 2011-2013.
Past President - Humboldt Chapter of the American Fisheries Society – 2001-2002
Past Member of the Gulf of Mexico Fishery Management Council - Interagency Scientific and Statistical Advisory Committee 1993-1997 and 2005-2009.
Past Member of the Interagency Klamath River Technical Advisory Team (stock assessment and harvest management advisory committee). 2000-2004
Member of the American Institute of Fishery Research Biologists
Member of the American Fisheries Society (AFS)
Member of the Education, Water Quality and Early Life History Sections of AFS.
Member of the Pollution Committee of the Southern Division of the AFS - (Chairman 1988-1991; 2015-19)
Member of the Ecological Society of America
Member of the Society of Environmental Toxicologists and Analytical Chemists
Member of the American Society of Ichthyologists and Herpetologists
Member of the American Water Resources Association

Member of the Society of Wetland Scientists
Member of the Association of Limnologists and Oceanographers
Member of the Coastal and Estuarine Research Federation
Member of the Texas Academy of Science
Member of Interagency HGAC Clean Rivers Program Advisory Committee
Past Member of the Joint MMS/Industry Deep-Water Spill Modeling Group
Past Co-chair of the Interagency Klamath River Instream Flow Study Technical Advisory Group.
Past Member of the Dioxin TMDL Stakeholder Group
Member of the Trinity and San Jacinto Rivers and Galveston Bay Basin and Bay Expert Science Team (BBEST) – Environmental Flows Committee: 2008-present.
Member of the Brazos River (BBEST) – Environmental Flows Committee: 2011-present.
Past Member of the Gulf of Mexico Alliance Nutrients Task Force
Past Member of the Gulf of Mexico Alliance Water Quality Task Force
Member of the Gulf of Mexico Alliance Wildlife and Fisheries Work Group
Member of the Gulf of Mexico Alliance Water Resources Work Group
Member of the Gulf of Mexico Alliance Monitoring and Data Work Group
Member of the American Fisheries Society Continuing Education Committee
Member of the SETAC Continuing Education Committee
Member of the Houston-Galveston Area Riparian Restoration Expert Panel – Houston Galveston Area Council

Professional Certifications and Recognition: Year Awarded

AFS Certified Fisheries Scientist- 1988
ESA Certified Senior Ecologist - 1997
Award of Special Recognition – Western Division of the American Fisheries Society. 2004.
Who's Who among Americas Teachers. 1998. ID# 1753928-5C1-0-11711
Award of Special Recognition – Fisheries Educator – Texas Chapter of the AFS -2013
Award of Recognition – President TCAFS – Texas Chapter of the AFS – 2013
Faculty Research Million Dollar Club – UHCL – 2014
Nominated for the UHCL Piper award for teaching by students – 2013.
Faculty Research 5 Million Dollar Club – UHCL – 2018

Professional Development: Courses and Year Completed.

YMCA Scuba diving course- Basic Certification: 1976.
Water Pollution Abatement from Oil field wastes. Workshop- Texas Railroad Commission: 1984.
Oil Spill Control Course- Texas A&M Extension Service: 1984.
Hazardous Material Control Course- Texas A&M Extension Service: 1986.
State of Texas Governors - First-line Management School: 1986. Austin, Texas.
S.L. Ross - MIRG Dispersant Use Workshop. Austin, Texas 1986.
Hazardous Waste Management Course - Texas A&M Extension Service. 1987. Houston, Texas.
Boating Safety Course. USPS. 1988. Houston, Texas.
U.S. Dept. of Interior. 1988. Natural Resource Damage Assessment Training Session- Austin, Texas 1988.
EPA Rapid Bioassessment Workshop- Denton, Texas 1989.
University of North Texas Effluent Biomonitoring Workshop- Denton, Texas 1989.
EPA Rapid Bioassessment Seminar- Bandera, Texas 1989.
USFWS HEP Certified Training Course - Fort Collins, CO 1990.
Wetlands Training Institute - Wetland Delineation Training Course - Houston, TX 1991.
EPA Water Quality Standards Academy - Minneapolis, MN 1995
Design of Water Quality Monitoring Systems - CSU, CO 1995
Fish Disease Short course: USFWS. Va. Tech. Blacksburg, Va. 1997.
Field Methods for Physical Habitat Simulation System: IFIM Course National Biological Survey. CSU. 1997.
Basics of Ecological Risk Assessment - SETAC Conference 1998. Hartford, CT.
Fish Histology Short Course: USFWS. Shepherdstown, WV 1998

Scientific Training for Oil and Chemical Spills. 1999. NOAA HAZMAT. Seattle, WA.
Ecological Risk Assessments of Oil Spills Workshop 1999 - NOAA. International Oil Spill Conf. Seattle, WA.
Instream flow modeling using RHABSIM. 2000. FWS. Sacramento.
Multivariate Statistical Analysis. 2000. FWS-NCTC. Sacramento.
Stream Habitat Assessment - 2001. FWS-NCTC Shepherdstown, WV
2D Instream Flow Assessment Models - 2001. USGS, Fort Collins, CO.
Assessment of Fish Health 2001. USFWS Contaminants Workshop. FWS. Yosemite, CA.
Otolith Evaluation Techniques. USFWS Contaminants Workshop. 2001. FWS. Yosemite, CA.
Applied Fluvial Geomorphology - 2002. FWS-NCTC. Shepherdstown, WV.
Geostatistics for environmental, ecological, and site characterization studies. SETAC Conference. 2002.
Analysis of Telemetry Data - 2002. FWS-NCTC Shepherdstown, WV
EcoPath Modeling Workshop. National Marine Fisheries Service. December 2004. Galveston, Texas.
Index of Hydrological Alteration. November 2005. Nature Conservancy. San Marcos, Texas.
Early Life History of Marine Fishes. (3 week workshop). August 2006. University of New England, Maine.
Larval Fish Sampling and Identification Workshop. September 2006. AFS. Paul Smith College, NY.
Introduction to Aquatox. SETAC. 2008. Tampa, Florida.
HEP Procedures. USFWS. 2008. Houston, Texas
Introduction to MesoHabSim. Instream Flow Council Meeting. 2008 San Antonio, Texas.
EcoPath with EcoSim Modeling Workshop. 2009. University of British Columbia, Vancouver, B.C., Canada.
Introduction to the R programming for fisheries scientists. 2009. Annual Meeting of the American Fisheries Society, Nashville, TN.
Introduction to Instream Flow Analysis using IHA and HEFR. TPWD. 2009. Austin, Texas
Use of Non-destructive methods for sampling contaminants in Wildlife. 2009. SETAC Workshop. N.O., La.
EcoPath with EcoSim Modeling Workshop. 2009. University of British Columbia, Vancouver, B.C., Canada.
Taxonomy and Ecology of Freshwater Algae. 2009, Part 1: Green Algae. San Marcos, Texas.
Taxonomy and Ecology of Freshwater Algae. 2010, Part 2: Diatoms and Dinoflagellates. San Marcos, Texas.
Taxonomy and Ecology of Freshwater Algae. 2011, Part 3: Algal Ecology. San Marcos, Texas.
Surgical Techniques for Fishes. 2011. American Fisheries Society Meeting. Pittsburgh, PA.
Multivariate Analysis of Community Data with PC-ORD training workshop. 2012. J.E. Peck. Oregon.
PRIMER multivariate analysis training workshop. 2012. Jacksonville, FL
Fish Population Dynamics – 2013. USFWS NCTC. Stockton, CA
Non-destructive Genetic Analysis Methods – 2013. Smithsonian-Mason School of Conservation. Front Royal, VA
Freshwater Mussel Identification and Ecology Workshop – 2014. 3rd Annual Mussel Symposium, Kerrville, TX
Applied Environmental Statistics – 2014. Practical Stats. College Station, TX
Foundational Workshop on Critical Thinking and Teaching for Critical Thinking – 2014. UHCL. Houston, TX.
Chemical Immobilization of Animals (16 hrs.) March 15, 2015, Safe Capture International Inc. Brenham, TX.
Estimating Animal Abundance and Occupancy MCCS 0511 (April 27-May 8, 2015). Smithsonian-Mason School of Conservation. Front Royal, VA.
Bayesian Methods in Fisheries Science - I and II. Portland, Oregon. AFS Annual Meeting. August 2015.
PRIMER v7 multivariate analysis training workshop. 2015. Seattle, WA
Advanced PRIMER v7 multivariate analysis training workshop. 2016. Corpus Christi, TX.
UAV Workshop – Southwest Stream Restoration Conference. 2016. San Antonio, TX.
PERMANOVA Training workshop. College of William and Mary. 2017.
PC-ORD. Training Webinar (5 days). 2017.
Mental Health First Aid for Students (1 day). UHCL. 2019.

Exhibit F

Dr Nathan A. Knott

Senior Research Scientist - Marine Ecologist, Fisheries NSW, NSW Dept. of Primary Industries
E-mail Nathan.Knott@dpi.nsw.gov.au; Phone +61244283009, 0438496201

Education

***PhD - Marine Biology* 1997- 2002 PhD thesis "Epibiota on natural reefs and on artificial structures"** Centre for Research on Ecological Impacts of Coastal Cities, University of Sydney. Supervisors: Prof. AJ Underwood, Dr MG Chapman and Dr TM Glasby.

Bachelor of Science (Biology) Honours Class I 1992-1996 University of Wollongong (Thesis title: Evidence of orientation and external morphology inducing passive flow through the intertidal ascidian, *Pyura stolonifera*) Department of Biological Sciences, University of Wollongong. Supervisors: Assoc. Prof. AR Davis and Assoc. Prof. W Buttemer.

Grants, Contracts, Scholarships and Awards

2015 Australian Research Council Linkage Grant *Improving prediction of rocky reef ecosystem responses to human impacts.* $1,352,100.
2014 Californian Government *Review of the scientific basis for amendments to the Water Quality Control Plan for Ocean Waters of California.*
(http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/).
2014 Australian Research Council Linkage Grant *Movement,migration and social networks in wild shark populations.* $267,000.
2011 The National Climate Change Adaptation Research Facility Grant (NCCARF) *Adaptive management of temperate reefs to minimise effects of climate change: Developing new effective approaches for ecological monitoring and predictive modelling.* $330,000.
2009 Australian Research Council Linkage Grant Assessing the ecological health of Australian estuaries and ports. University of NSW (UNSW) $690,000.
2008 BlueScope Steel Contract Research Port Kembla Harbour Study. UNSW $480,000.
2008 Sydeny Water Contract Research Marine Environment Monitoring Program - Sydney's Desalination Plant. UNSW $469,135.
2007 Port Kembla Port Corporation Contract Research Assessing the ecological effects of dredging activities in Port Kembla Harbour. UNSW $75,000.
2006 Australian Research Council Linkage Grant Ecological effects of resuspending contaminated sediments on marine invertebrates within Port Kembla Harbour. UNSW $240,000.
2006 BlueScope Steel Contract Research Assessment of the ecological impacts associated with the cooling water intake and discharge from the BlueScope Steel Co-generation Plant and its proposed salt water cooling. UNSW $25,000.
2005 Parks Victoria Contract Research Ecological performance measures for Victorian Marine Protected Areas: Review of the existing biological sampling program. University of Melbourne $45,000.
1997 Special Research Centre on the Ecological Impacts of Coastal Cities PhD Scholarship University of Sydney $63,000.

Summary of Employment

2015 - Senior Research Scientist, Fisheries NSW
2009 - 2015 Research Scientist, Fisheries NSW
2006 - 2009 Research Fellow, Biological, Earth and Environmental Sciences, University of NSW
2002 - 2005 Research FellowDepartment of Zoology, University of Melbourne
2001 - 2002 Marine Ecology Consultant, The Ecology Lab Pty Ltd
1997- 2002 PhD Student, University of Sydney
1996 - 1997 Research Assistant, Biological Sciences, University of Wollongong

Publications

- Bass, N. C., J. Day, T. L. Guttridge, N. A. Knott, and C. Brown. 2021. Intraspecific variation in diel patterns of rocky reef use suggests temporal partitioning in Port Jackson sharks. Marine and Freshwater Research.

- Day, J. K., N. A. Knott, D. S. Swadling, and D. J. Ayre. 2021. Dietary analysis and mesocosm feeding trials confirm the eastern rock lobster (*Sagmariasus verreauxi*) as a generalist predator that can avoid ingesting urchin spines during feeding. Marine and Freshwater Research.
- Goetze, J. S., S. Wilson, B. Radford, R. Fisher, T. J. Langlois, J. Monk, N. A. Knott, H. Malcolm, L. M. Currey-Randall, D. Ierodiaconou *et al.* 2021. Increased connectivity and depth improve the effectiveness of marine reserves. Global Change Biology.
- Harvey, E. S., D. L. McLean, J. S. Goetze, B. J. Saunders, T. J. Langlois, J. Monk, N. Barrett, S. K. Wilson, T. H. Holmes, D. Ierodiaconou. N. A. Knott *et al.* 2021. The BRUVs workshop-An Australia-wide synthesis of baited remote underwater video data to answer broad-scale ecological questions about fish, sharks and rays. Marine Policy 127:104430.
- Knott, N., J. Williams, D. Harasti, H. Malcolm, M. Coleman, B. Kelaher, M. Rees, A. Schultz, and A. Jordan. 2021. A coherent, representative, and bioregional marine reserve network shows consistent change in rocky reef fish assemblages. Ecosphere 12:e03447.
- Lédée, E. J., M. R. Heupel, M. D. Taylor, R. G. Harcourt, F. R. Jaine, C. Huveneers, V. Udyawer, H. A. Campbell, R. C. Babcock, X. Hoenner, N. A. Knott *et al.* 2021. Continental-scale acoustic telemetry and network analysis reveal new insights into stock structure. Fish and Fisheries.
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- Knott, NA, I Osterloh, M Fackerell and P Davies (2014) Jervis Bay Catchment Study: Background on drift algae and algal blooms and an assessment of the possible causes of the 2009 bloomReport for Shoalhaven City Council.
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- Roberts, D, NA Knott and EL Johnston (2008) Conceptual models of potential ecological impacts of plankton entrainment in the Port Kembla Steelworks Cogeneration PlantUNSW Global report prepared for BlueScope Steel, Port Kembla.
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- Knott, NA and EL Johnston (2007) Assessment of the effects of desalination discharge on the recruitment of subtidal reef sessile invertebrates: sampling methodology, design and analysisPrepared for Sydney Water Corporation.
- Keough, MJ, NA Knott and DJ Ross (2006) Ecological performance measures for Victorian Marine Protected Areas: Review of the existing biological sampling program Parks Victoria Technical Series.
- Johston, EL, J Carey and NA Knott (2006) Ecological issues in relation to BlueScope Steel SCP proposed salt water cooling NewSouth Global Report prepared for BlueScope Steel, Port Kembla.
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- The Ecology Lab (2003) Twofold Bay Study Prepared for the Department of Defence(Associate author)
- The Ecology Lab (2002) Review of the ecological effects of the upgrade of the Swansea-Belmont waste water treatment works Prepared for the Hunter Water Corporation(Primary author)
- The Ecology Lab (2002) Manly Lagoon fish kill Prepared for the Manly Council(Joint Primary author)
- The Ecology Lab (2002) Spatial variation in macroinvertebrate assemblages in sediments on the drop-overs of sandy shoals in Port Hacking Prepared for the Department of Land and Water Conservation(Primary author)
- The Ecology Lab (2001) Effects of environmental flows on macroinvertebrate assemblages in freshwater streams Prepared for Sydney Water(Primary author)
- The Ecology Lab (2001) Hunter Estuary Process Study: Review of Aquatic Ecology Prepared for Newcastle Council (Second author)
- The Ecology Lab (2001) Ecological effects of dumping dredged material: Newcastle Port Prepared for Newcastle Port Corporation(Primary author)
- The Ecology Lab (2001) Oxleyan Pygmy Perch Study Stage 1: Yelgun to Chinderah Pacific Highway Upgrade Prepared for the Roads and Traffic Authority(Primary author)

Membership of Associations

1997 - current Member of the Australian Marine Science Association
1997 - current Member of the Ecological Society of Australia
2015 - current Member of the Australian Society of Fish Biology

Exhibit G

Craig A. Jones, Ph.D.
Managing Principal

Education and Credentials

Ph.D., Mechanical and Environmental Engineering, University of California, Santa Barbara, California, 2000

M.S., Fluid Mechanics (minors: Environmental Ocean and Environmental Engineering) University of California, Santa Barbara, California, 1996

B.S., Coastal Engineering, Texas A&M University, Galveston, Texas, 1994

Professional Affiliations

American Society of Civil Engineers

Marine Technology Society

American Geophysical Union

American Shore and Beach Preservation Association

Achievements and Awards

United States Utility Patent No. 61/857,057 (provisional). A device and method for measuring wave motion.

Recipient of J.C. Stevens Award, recognizing excellence in a paper published by the American Society of Civil Engineers. The paper is in the field of hydraulics, including fluid mechanics and hydrology. See Jones and Gailani (2009) below.

Professional Profile

Dr. Craig Jones is a principal ocean and environmental engineer with 20 years of experience in developing and executing engineering and science projects for government agencies and the private sector to characterize offshore environmental sites. His experience includes riverine, lacustrine, estuarine, and coastal processes involving hydrodynamics, waves, sediment, and contaminant transport. Dr. Jones' expertise includes the application of state-of-the-science field measurements and modeling analysis to characterize and quantify processes in all aquatic systems. He actively participates in the design of field activities and instrumentation to develop data sets in support of clients' needs. Dr. Jones is adept at incorporating these data into the most effective levels of analysis, from empirical to numerical modeling, necessary to efficiently address the project needs.

Dr. Jones has testified in federal court and in front of public utility commissions as an expert on environmental issues and regulatory concerns, including sediments and contaminants in support of allocation activities. Dr. Jones continues to work on preparation of materials for various environmental litigation cases in the United States.

Relevant Experience

Marine and Sediment Services

Environmental Baseline Surveys, Mexico—Serving as principal in charge of field studies in support of environmental site characterization and risk assessment for oil and gas leases in the deep and shallow water leases in the Mexican Gulf of Mexico waters. The Mexican regulatory agencies require extensive environmental baseline surveys and risk assessments for the lease blocks that have been auctioned in recent years. Integral is supporting the developers with field assessment through offshore sampling activities, which include sediment profile imagery collection and analysis. The work is being submitted to both industry and Mexican government agencies. Integral is continually developing management procedures to assist with increasing the utility while reducing the costs of these activities for industry.

200 Washington Street
Suite 201
Santa Cruz, CA 95060

831.576.2872
cjones@integral-corp.com

Contaminated Sediment Transport Evaluation, Berry's Creek Study Area, New Jersey—Serving as project manager for field and modeling studies related to the risk assessment and remedial investigation of the Berry's Creek Study Area (BCSA) wetland in New Jersey. The BCSA is a tidal wetland/marsh adjacent to the Hackensack River. Historical releases of contaminants into the BCSA have resulted in the need for an RI/FS for the site. The study goals are to characterize the fate and transport of sediment-bound contaminants. Responsibilities include the design and implementation of the sediment transport investigation for the site. Implemented the field investigation, maintaining five permanent current and water quality monitoring stations while also employing real-time storm monitoring using vessel-mounted systems. The data are being used to develop a quantitative description of hydrodynamics and sediment transport in the system, providing contaminant fate and transport input to the risk analysis and remedial selection and design.

Marine Renewable Energy Support, Sandia National Laboratories—Serving as program manager for the development of tools and techniques to improve performance, lower costs, and accelerate the deployment of marine and hydrokinetic energy technologies. The project has evaluated all aspects of marine and hydrokinetic resource characterization and environmental evaluations, through applied research and developing tools and methods to improve device performance and minimize environmental disturbance. Of particular importance to this project is the development and application of software tools and guidance for the marine renewable energy industry.

United Heckathorn Superfund Site, Richmond, California—Served as project manager for a DDT fate and transport study that was performed for the Lauritzen Channel as part of a focused feasibility study. The objectives were to develop a quantitative contaminant fate and transport conceptual site model and DDT mass balance for the Lauritzen Channel, based on available analyses, and assess trends in DDT mass and concentration in the channel. Overall, the sediment transport analysis showed that the Lauritzen Channel is accumulating relatively clean sediment from San Francisco Bay. There are distinct regions with different sediment transport and accumulation characteristics in the channel that were characterized. For example, the west side of the channel, which experiences the highest vessel activity in relatively shallow regions, was investigated through the use of propeller scour modeling. The results of the analysis showed overall that the average DDT concentrations in the young bay mud sediment are decreasing in the channel.

Development of a Guide for Assessing Sediment Transport at Navy Facilities, U.S. Navy—Authored a U.S. Navy guidance document to ensure that sediment investigations and remedial actions are successful and cost effective. The guidance provides information on evaluating sediment transport at contaminated sediment sites, and describes how to use sediment transport information to support sediment management decisions. The framework developed in this report has been applied at three demonstration sites: Hunters Point Naval Shipyard (HPS) in San Francisco, California; Bremerton Naval Complex in Puget Sound, Washington; and Naval Station Newport in Newport, Rhode Island.

Development of a Real-Time Wave Assessment Tool, ARPA-E, U.S. Department of Energy—Supporting wave energy converter (WEC) development by collaborating with key WEC technologists to develop, test, and validate a wave measurement buoy that will be capable of providing real-time wave-by-wave information. This could increase WEC capture efficiency by up to 330 percent, potentially reducing the cost of wave power below $0.10 per kWh. Was primary inventor of transformational technology that can be networked to measure and relay real-time wave properties at a fraction of the cost of current systems.

Hamilton Wetland Restoration, San Pablo Bay, California—Served as project manager for the assessment of an open-water dredge material storage facility for beneficial reuse and restoration of Hamilton Wetlands in California. Evaluations were conducted for a temporary dredge material transfer facility in San Pablo Bay to support the restoration at the former Hamilton Army Airfield and surrounding land. The aquatic transfer facility (ATF) is designed to handle 24 million cubic yards of material over a 10- to 15-year operational life. Knowledge of the fate of the dredged material in and around the ATF, developed using SEDflume and modeling studies, was critical to the selection of an optimal location for the ATF, and for guiding the design and configuration so that impacts to the surrounding environment will be minimized.

Sediment Transport Investigation, Lower Passaic River, New Jersey—Led the development of a conceptual site model of sediment transport in the Passaic River. Historically, the Lower Passaic River below the Dundee Dam has been contaminated with a range of contaminants of potential concern. Since the most significant transport pathway for these hydrophobic contaminants is by transport of the sediments to which they are sorbed, sediment transport is a key system-wide process to understand when evaluating environmental risk and any remedial selection. Led the preparation of documents detailing the sediment transport processes important to the site while providing technical review of sediment transport analyses being conducted by EPA.

Remedial Investigation and Feasibility Study, Hunters Point Naval Shipyard, California—During the feasibility study phase of the work at HPS, provided the U.S. Navy with advice and analysis regarding the stability of PCB-contaminated sediments onsite. The work included the development of an agency-approved work plan, collection of cores for SEDflume analysis, and analysis of data to provide a "weight of evidence" approach to sediment stability at HPS. Managed field work and analysis associated with the sediment and contaminant transport investigation, and acted in a technical advisory capacity to the U.S. Navy and local and federal regulatory agencies. Managed the evaluation of the mobility of bottom sediment in areas of potential chemical contamination in the vicinity of HPS, in south San Francisco Bay, California. Also performed analysis of PCB releases into the bay, which were utilized in the feasibility study to select remedial options.

Dredge Disposal, Santa Cruz, California—Co-managed the design and implementation of the third inner Santa Cruz Harbor dredge monitoring program. Before these dredge monitoring programs, it was considered too great a risk to release sediment containing more than 20 percent mud into the surf zone because it might have damaging effects on the coastal environment. The project demonstrated negligible sedimentary changes occurred on the beaches and in nearshore benthic habitats of the Santa Cruz Bight during the dredging period. A variety of data collection efforts

were utilized to monitor the experimental dredging event, including local stream flow, wave, and current data collection; beach and offshore sediment sampling; pre- and post-dredging multi-beam surveys and benthic habitat mapping; and sediment transport modeling.

DDT Transport Investigation, Lago Maggiore, Italy—Served as project manager for a DDT transport investigation of the Toce River, Lake Mergozzo, and Lago Maggiore. The investigation was conducted to better understand hydrodynamic processes and the stability of sediments and contaminants in the area. Led the field investigation and modeling team and development of state-of-the-art, 3-dimensional, hydrodynamic and sediment transport models to investigate sediment transport in the Toce River and depositional patterns in Lago Maggiore. The model was successfully used to evaluate the patterns of contaminant deposition. The data were used to develop a risk assessment for the site.

Sediment and Contaminant Transport Investigation, Augusta Bay, Sicily, Italy—As a part of the Augusta Bay contaminated sediment investigation, developed and implemented a study to gain a better understanding of the transport of sediments and contaminants in the bay. The study goals were to develop a conceptual site model describing the key site processes and compile and collect site data to provide an adequate understanding of these processes. Led the field investigation and modeling team and developed a quantitative conceptual site model and state-of-the-art, 3-dimensional, hydrodynamic and sediment transport models to investigate sediment transport in Augusta Bay. A key process of interest was propeller scour during ship motion. Developed innovative techniques to determine sediment resuspension during ship movement events. The data and analysis were being used to develop remedial alternatives for evaluation in a feasibility study.

Remedy Effectiveness Monitoring, Anacostia River, Washington, DC—Managed the analysis of sediment stability in the vicinity of the Washington Navy Yard on the Anacostia River to provide a better understanding of the integrity of capping material and transport of contaminants of potential concern at the site. The studies provided rationale for the field study design, specifically selection of locations for sediment erosion rate measurements using SEDflume and current measurements using Acoustic Doppler Current Profiler deployments. The study focused on the collection and analysis of data to assess the remedial options of capping and monitored natural recovery employed at the site. Also performed a numerical analysis of sediment transport on the native and capped material using typical and extreme hydrodynamic conditions in the Washington Navy Yard region.

Contaminated Sediment Dredging, Ashtabula River, Ohio—An environmental dredging and disposal project was conducted by EPA to remove PCB-contaminated sediments from the Ashtabula River. Served as a technical lead in a program that was implemented to determine the nature and source of contaminated residuals during a typical dredging operation. Led efforts to monitor water quality and bathymetric variability during the Ashtabula River navigational and environmental dredging and disposal project. Conducted both fixed and mobile current and water quality measurements near the dredging operations. In addition, water quality moorings were

deployed upstream and downstream of the project to measure background conditions at the project extents. Conducted analysis to determine the nature and source of residuals post-dredging.

Technical Advisor, San Francisco Estuary Institute—Acted as an advisory member of a contaminated sediment advisory group for the Estuary Institute. In addition, continue to provide technical advice on the development of modeling studies to evaluate water quality issues in the San Francisco Bay region.

Evaluation of Sediment Transport, Chalk River Laboratories, Atomic Energy of Canada Limited—The Ottawa River contains a region of sediment offshore of Atomic Energy of Canada Limited's Chalk River Laboratories that has been shown to have above background levels of radioactivity, some of which is in the form of sand-sized radioactive particles. The sediments have been evaluated in past studies and do not currently pose a direct environmental or human health threat; however, assessments of human health risk must consider the possibility of sediment erosion and transport to shallow water areas. Responsible for investigating sediment erosion potential and sediment transport trends in the vicinity of the contaminated footprint. Initial studies were conducted using numerical models to predict river hydrodynamics, wind-wave production, and general sediment transport trends. The hydrodynamic model was refined using high-resolution bathymetry, and sediment erosion studies were conducted on the site's sediments; the sediment was found to be at low risk of transport during extreme events.

Dredge Material Transport, Delong Mountain Terminal, Alaska—Managed a project evaluation of erosion of a dredged material mound near the Delong Mountain Terminal in northwest Alaska, which is subject to various storm events. The evaluation was based on the combined hydrodynamics of Environmental Fluid Dynamics Code and the sediment transport algorithms of SEDZLJ. To help evaluate the physical processes and possible impacts due to dredge material placement from the Delong Mountain Terminal Navigation Improvements Project, a numerical modeling analysis of dredge mound erosion and transport was conducted. The model assisted the U.S. Army Corps of Engineers in developing the optimal methods and locations for dredge material placement to minimize future erosion and subsequent channel infilling.

Platform Usumacinta Investigation, Gulf of Mexico, Mexico—Conducted a geophysical survey and a seafloor geotechnical sampling program to investigate shallow soil conditions near a mat-supported drilling rig and offshore platform that encountered a failure in 2007. The study presented the results of a field and laboratory program to investigate geotechnical engineering properties of the site for a forensic evaluation of the failure. Overall operational conditions and pre-conditioning of the seafloor in the region coupled with a large storm event contributed to the failure. The team was able to make recommendations that could be used in future operations.

Prediction of Optical Variability in Dynamic Nearshore Environments, Santa Cruz, California—The objective of this project was to develop a system for forecasting marine optical conditions in the surf zone for the purpose of improving naval operations. Successful, rapid identification of mine-like objects in nearshore coastal oceans is critical for safe passage of the U.S. Navy fleet. Developed an *in situ* optical forecast model so the fleet will be able to deploy remote drifters, combine drifter

data with meteorological and oceanographic data within the model, and predict optical properties along a coastline of interest. The models have been developed and validated with field measurements in Santa Cruz, California, and Waimanalo, Hawaii. Physical and optical characterization can be conducted on multiple temporal and spatial scales spanning a wide, dynamic range of conditions with the system.

Hydrodynamic Analysis of the Lower Fox River, Green Bay, Wisconsin—Managed a study to develop an extensively validated hydrodynamic model of Reach 3 and 4 of the Lower Fox River to support cap design in the river. Detailed velocity profile measurements were used to validate shear stresses so that a cap stability analysis could be conducted under design flow conditions. The U.S. Geological Survey (USGS) conducted all data collection efforts and provided more than 100 total velocity profiles over four sampling events. The data, combined with continuous velocity measurements at the mouth of the Fox River by a USGS acoustic velocity meter, allowed for the development and refinement of a hydrodynamic model of Reaches 3 and 4. The model was shown to reproduce measured velocities and shear stress to allow for confident cap design evaluations.

Mare Island Naval Shipyard Stability Analysis, Mare Island, California—Managed a project to better characterize the stability and potential for future exposure of munitions of environmental concern (MEC) and potential unexploded ordnance in the sediment offshore of Mare Island Naval Shipyard. Sediment cores were collected and analyzed to evaluate sedimentation and sediment stability through the radioisotope and SEDflume analysis. Based on the long-term morphological change of the mudflats, it is possible for MEC to be exposed but there is no probability of MEC mobilizing. The results were carried forward into an engineering feasibility study of shoreline restoration.

Litigation Support

Expert Report, Direct Testimony, Cross Examination, and Rebuttal Testimony on behalf of Appleton Papers Inc. and NCR Corp. v. United States (Case No. 10-c-910)—Participated as an expert on behalf of the defendants, in an action brought against Appleton Papers and NCR by the United States. Provided an expert report and testimony to demonstrate that the defendants were not liable for the entire harm to the Lower Fox River due to the discharge of PCBs. Developed a numerical model of hydrodynamics, sediment transport, and PCB transport to show that PCBs discharged from multiple parties on the river could be apportioned by discharger. Provided testimony and rebuttal testimony in the 2013 trial in the U.S. District Court Eastern District of Wisconsin.

Expert Report and Testimony to the San Francisco Public Utilities Commission on behalf of the Surfrider Foundation (Application A.12-04-19)—In review of an application for a water supply project, provided an expert report and testimony on behalf of local stakeholders. The testimony reviewed the proposed brine discharge system for California American Water's Monterey Peninsula Water Supply Project. It also discussed brine mixing and dilution in marine environments. It finally discussed the modeling that will be necessary to accurately analyze the project's brine discharge and the design of appropriate facilities for that discharge.

Expert Testimony and Deposition on behalf of HoltraChem Manufacturing Company, L.L.C., in Natural Resources Defense Counsel and Maine People's Alliance v. HoltraChem Manufacturing Company, L.L.C. (Case No. 00-69-BW), United States District Court of Maine—Provided an expert report and testimony assessing proposed sediment remedies for the Lower Penobscot River. Developed a numerical model and quantitative assessment of hydrodynamics and sediment transport to evaluate remedial actions in the river. Provided deposition in August 2019 in the United States District Court of Maine.

Expert Testimony on behalf of Monsanto Company, in Monsanto Company v. Spirer et al. (Case No. 12SL-CC01263), Circuit Court of the City of St. Louis, State of Missouri—Provided testimony on the release, transport, and fate of PCBs in the global environment. The expert work included review of publicly available peer-reviewed research into the releases and transport of PCBs in the environment. The testimony detailed the routes of release and transport for PCBs from global manufacturing over the time period of global PCB production and use. Provided deposition in August 2016 in the Circuit Court of the City of St. Louis, State of Missouri.

Expert Testimony on behalf of Monsanto Company, in Monsanto Company v. Steele et al. (Case No. BC 497582), Superior Court of the State of California for the County of Los Angeles—Provided testimony on the release, transport, and fate of PCBs in the global environment. The expert work included review of publicly available peer-reviewed research into the releases and transport of PCBs in the environment. The testimony detailed the routes of release and transport for PCBs from global manufacturing over the time period of global PCB production and use. Provided deposition in April 2016 in the Superior Court of the State of California for the County of Los Angeles.

Expert Testimony on behalf of Monsanto Company, in Monsanto Company v. Walker et al. (Case No. 1122-CC09621-01), Circuit Court of the City of St. Louis, State of Missouri—Provided testimony on the release, transport, and fate of PCBs in the global environment. The expert work included review of publicly available peer-reviewed research into the releases and transport of PCBs in the environment. The testimony detailed the routes of release and transport for PCBs from global manufacturing over the time period of global PCB production and use. Provided deposition in April 2016 and trial testimony in May 2016 in the 22nd Judicial Court District of St. Louis.

Selected Publications

Kramer, S., C. Jones, G. Klise, J. Roberts, A. West, and Z. Barr. 2020. Environmental permitting and compliance cost reduction strategies for the MHK industry: Lessons learned from other industries. *J. Mar Sci. Engr.* 8:554. doi:10.3390/jmse8080554.

Raghukumar, K., G. Chang, F. Spada, and C. Jones. 2020. A vector sensor-based acoustic characterization system for marine renewable energy. *J. Mar. Sci. Eng.* 8(3):187. doi:10.3390/jmse8030187.

Jones, C., G. Chang, A. Dallman, J. Roberts, K. Raghukumar, and S. McWilliams. 2019. Assessment of wave energy resources and factors affecting conversion. B. Carrier and D. Ball (eds), Offshore Technology Conference, Houston, TX. doi:10.4043/29570-MS

Raghukumar, K., S. McWilliams, G. Chang, J. Roberts, and C. Jones. 2019. Wave energy converter arrays: Optimizing power production while minimizing environmental effects. C. Jones and J. Chitwood (eds), Offshore Technology Conference, Houston, TX. doi:10.4043/29658-MS

Raghukumar, K., G. Chang, F.W. Spada, and C.A. Jones. 2019. Performance characteristics of the NoiseSpotter: An acoustic monitoring and localization system. A. Cooper and P. Gibbs (eds), Offshore Technology Conference, Houston, TX. doi:10.4043/29425-MS

Raghukumar, K., G. Chang, F.W. Spada, and C.A. Jones. 2019. NoiseSpotter: A rapidly deployable acoustic monitoring and localization system. D. Vicinanza et al. (eds), Proc. of the 13th European Wave and Tidal Energy Conference, Naples, Italy.

Raghukumar, K., G. Chang, F. Spada, C. Jones, J. Spence, S. Griffin, and J. Roberts. 2019. Performance characteristics of a vector sensor array in an energetic tidal channel. pp. 653–658. J.S. Papadakis (ed), Proc. of the Fifth Underwater Acoustics Conference and Exhibition, Crete, Greece.

Raghukumar, K., G. Chang, F. Spada, C. Jones, W. Gans, and T. Janssen. 2019. Performance characteristic of Spotter, a newly developed real-time wave measurement buoy. *J. Atmos. Ocean. Tech.* doi: 10.1175/JTECH-D-18-0151.1

Chang, G., T. Martin, K. Whitehead, C. Jones, and F. Spada. 2018. Optically based quantification of fluxes of mercury, methyl mercury, and polychlorinated biphenyls (PCBs) at Berry's Creek tidal estuary, New Jersey. *Limnol. Oceanogr*. doi: 10.1002/lno.11021

Chang, G., T. Martin, F. Spada, B. Sackmann, C. Jones, and K. Whitehead. 2018. OPTically-based In-situ Characterization System (OPTICS) to quantify concentrations and mass fluxes of mercury and methylmercury in South River, Virginia, USA. *River Research and Applications* 2018:1–10. doi: 10.1002/rra.3361

Chang, G., C.A. Jones, J.D. Roberts, and V. Neary. 2018. A comprehensive evaluation of factors affecting the levelized cost of wave energy conversion projects. *Renewable Energy* 127:344-354.

Jones, C., G. Chang, K. Raghukumar, S. McWilliams, A. Dallman, and J. Roberts. 2018. Spatial Environmental Assessment Tool (SEAT): A modeling tool to evaluate potential environmental risks associated with wave energy converter deployments. *Energies* 11(8):2036. doi:10.3390/en11082036.

Chang, G., K. Ruehl, C.A. Jones, J. Roberts, and C. Chartrand. 2016. Numerical modeling of the effects of wave energy converter characteristics on nearshore wave conditions. *Renewable Energy* 89:636–648.

Jones, C., G. Chang, and J. Roberts. 2015. Wave energy converter effects on wave, current, and sediment circulation: A coupled wave and hydrodynamic model of Santa Cruz, Monterey Bay, CA. C.R. Nichols (ed), Proceedings of Ocean Waves Workshop, New Orleans, LA: University of New Orleans. Available online at http://scholarworks.uno.edu/oceanwaves/2015.

Roberts, J., G. Chang, and C. Jones. 2015. Wave energy converter effects on nearshore wave propagation. Clement et al. (eds), Proceedings of the 11th European Wave and Tidal Energy Conference. Nantes, France.

Chang, G., C. Jones, and M. Twardowski. 2013. Prediction of optical variability in dynamic nearshore environments. *Meth. Oceanogr*. 7:63–78.

Jones, C.A., and B.E. Jaffe. 2013. Influence of history and environment on the sediment dynamics of intertidal flats. *Mar. Geol.* 345:294–303.

James, S.C., C.A. Jones, M.D. Grace, and J.D. Roberts. 2010. Advances in sediment transport modeling. *J. Hydraul. Res*. 48(6):754–763.

James, S.C., E. Seetho, C.A. Jones, and J.D. Roberts. 2010. Simulating environmental changes due to marine hydrokinetic energy installations. *Oceans 2010.* September:1–10.

Jones, C., and J. Gailani. 2009. Discussion of "comparison of two techniques to measure sediment erodibility in the Fox River, Wisconsin" by T. Ravens. *J. Hydraul. Eng.* 135(5):432–434.

James, S.C., M.D. Grace, M.A. Ahlmann, C.A. Jones, and J.D. Roberts. 2008. Recent advances in sediment transport modeling. World Environmental and Water Resources Congress 2008. *American Society of Civil Engineers.* May:1–10.

Jones, C., and S. Watt. 2008. Modeling of wave driven circulation and water quality in nearshore environments. World Environmental and Water Resources Congress 2008. *American Society of Civil Engineers.* May:1–10.

Zimmerman, J.R., J.D. Bricker, C. Jones, P.J. Dacunto, R.L. Street, and R.G. Luthy. 2008. The stability of marine sediments at a tidal basin in San Francisco Bay amended with activated carbon for sequestration of organic contaminants. *Water Res.* 42:4133–4145.

Blake, A.C., D.B. Chadwick, P.J. White, and C.A. Jones. 2007. User's guide for assessing sediment transport at Navy facilities. Technical Report 1960. Available at: http://www.epa.gov/superfund/health/conmedia/sediment/pdfs/Sed_transport_guide_2007.pdf. U.S. Navy, SPAWAR Systems Center, San Diego, CA.

James, S.C., C.A. Jones, J.D. Roberts, M.A. Ahlmann, and D.A. Bucaro. 2006. Sediment transport and water quality model of Cedar Lake, *EOS Transactions*, American Geophysical Union, 87(52), H23B-1511.

Luo, X., W. Lick, and C.A. Jones. 2006. Modeling the sediment-water flux of hydrophobic organic chemicals due to bioturbation. Ninth International Conference on Estuarine and Coastal Modeling. *American Society of Civil Engineers.* July:468–485.

Jones, C.A., S.C. James, J.D. Roberts, and P.L. Shrestha. 2005. Continuous treatment of cohesive and non-cohesive sediment dynamics in a three-dimensional hydrodynamics model. Ninth International Conference on Estuarine and Coastal Modeling, 9A.

James, S.C., C.A. Jones, and J.D. Roberts. 2005. Consequence management, recovery and restoration after a contamination event. Sandia National Laboratories, Los Alamos, NM.

Jones, C.A., T.S. Jung, and W. Lick. 2001. Use of accurate erosion rates in sediment transport modeling. International Association of Great Lakes Research.

Jones, C.A., and W. Lick. 2000. An accurate model of sediment erosion and transport. International Association of Great Lakes Research.

Lick, W., Z. Chroneer, C.A. Jones, and R. Jepsen. 1997. A predictive model of sediment transport. Fifth International Conference on Estuarine and Coastal Modeling. *American Society of Civil Engineers*. October:389–399.

Invited Presentations

Short course titled "Evaluating Sediment Transport: Best Practices, Tools, Techniques, and Application to Site Management." Tenth International Conference on Remediation of Contaminated Sediments. January 2019.

Panel titled "Marine Renewable Energy Development – Oceanographic Measurements to Support an Emerging Low-Carbon Energy Source." Ocean Sciences Meeting 2018 Town Hall. February 2018.

Invited Moderator. Ocean Waves Workshop 2017. November 2017.

Short course titled "Evaluating Sediment Transport: Tools, Techniques, and Application to Site Management." Ninth International Conference on Remediation of Contaminated Sediments. January 2017.

Paper presentation titled "Evaluating Sediment Stability at Offshore Marine Hydrokinetic Energy Facilities." Ocean Waves Workshop 2015. January 2015.

Short course titled "Evaluating Sediment Transport: Tools, Techniques, and Application to Site Management." Eighth International Conference on Remediation of Contaminated Sediments. January 2015.

Selected Presentations/Posters

Jones, C., S. McWilliams, K. Raghukumar, G. Chang, and J. Roberts. 2020. Optimization of wave energy converter array deployments while minimizing potential environmental risks. Platform presentation at the 2020 Ocean Sciences Meeting. Co-sponsored by the American Geophysical

Union, the Association for the Sciences of Limnology and Oceanography, and The Oceanography Society, San Diego, CA. February 16–21.

Chang, G., F. Spada, C. Jones, G. Egan, S. Monismith, O. Fringer, and A. Manning. 2020. Variability of particle characteristics in a wave- and current-driven estuarine environment. Poster presentation at the Ocean Sciences Meeting. Co-sponsored by the American Geophysical Union, the Association for the Sciences of Limnology and Oceanography, and The Oceanography Society, San Diego, CA. February 16–21.

Sackmann, B., G. Revelas, K. Whitehead, C. Schultz, and C. Jones. 2020. Artificial intelligence and computer vision for cost-effective benthic habitat characterizations. Poster presentation at the Ocean Sciences Meeting. Co-sponsored by the American Geophysical Union, the Association for the Sciences of Limnology and Oceanography, and The Oceanography Society, San Diego, CA. February 16–21.

Spada, F., K. Raghukumar, G. Chang, and C. Jones. 2020. NoiseSpotter: Real-time underwater acoustic characterization in support of marine renewable energy projects. Poster presentation at the Ocean Sciences Meeting. Co-sponsored by the American Geophysical Union, the Association for the Sciences of Limnology and Oceanography, and The Oceanography Society, San Diego, CA. February 16–21.

Egan, G., M. Cowherd, F. Spada, K. Scheu, A. J. Manning, C. Jones, G. Chang, and O.B. Fringer. 2020. Cohesive sediment erosion in a shallow, wave- and current-driven flow. Poster presentation at the 2020 Ocean Sciences Meeting. Co-sponsored by the American Geophysical Union, the Association for the Sciences of Limnology and Oceanography, and The Oceanography Society, San Diego, CA. February 16–21.

Jones, C., K. Raghukumar, and L. Marx. 2019. Assessment of natural hazard vulnerability and resilience in coastal environments. Poster presentation at SERDP ESTCP Symposium, Washington, DC. December 3–5.

Raghukumar, K., C. Jones, J. Weidenbach, S. Kleinhelder, K. Catlett, and P. Black. 2019. An offshore munitions mobility study at Vandenberg Air Force Base, California. Poster presentation at SERDP ESTCP Symposium, Washington, DC. December 3–5.

Raghukumar, K., F.W. Spada, G. Chang, and C. Jones. 2019. Characterization of near-bed particle motion by the NoiseSpotter: A three-dimensional vector sensor array. Poster presentation at Fifth International Conference on the Effects of Noise on Aquatic Life. Den Haag, The Netherlands. July 7–12.

McWilliams, S., K. Scheu, C. Jones, and D. Revell. 2019. Matilija Dam ecosystem restoration—A comprehensive modeling approach. Poster presentation at Localizing California Waters: Ventura to SLO, Ojai, CA. April 29–30.

Raghukumar, K., G. Chang, F. Spada, and C. Jones. 2019. NoiseSpotter: New technology for underwater acoustic characterization. Poster presentation at 7th Annual Marine Energy Technology Symposium, Washington, DC. April 1–3.

Raghukumar, K., S. McWilliams, C. Jones, and J. Roberts. 2019. Marine hydrokinetic energy assessment: Balancing efficiency and environmental concerns. Poster presentation at 7th Annual Marine Energy Technology Symposium, Washington, DC. April 1–3.

Revelas, E., B. Sackmann, and C. Jones. 2019. A streamlined and standardized benthic habitat mapping approach for marine and hydrokinetic site environmental assessments. Poster presentation at 7th Annual Marine Energy Technology Symposium, Washington, DC. April 1−3.

Scheu, K., C. Flanary, K. Raghukumar, C. Jones, L. Ziliani, B. Groppelli, S. Ceccon, and D. Bocchiola. 2019. Evaluating climate change effects on natural recovery of a contaminated sediment site. Platform presentation at Tenth International Conference on the Remediation and Management of Contaminated Sediments, New Orleans, LA. February 11–14.

Sackmann, B.S., E. Revelas, K. Whitehead, D. Nielsen, C. Jones, and J. Durda. 2019. Using artificial intelligence and computer vision for cost-effective environmental monitoring and site characterization. Poster presentation at Tenth International Conference on the Remediation and Management of Contaminated Sediments, New Orleans, LA. February 11–14.

Egan, G., M. Cowherd, F. Spada, K. Scheu, A. Manning, C. Jones, S. Monismith, G. Chang, and O. Fringer. 2018. In situ observations of near-bed turbulence and cohesive sediment transport. Oral presentation at the American Geophysical Union Fall Meeting, Washington, DC. December 10–14.

Chang, G., F. Spada, G. Egan, A. Manning, K. Scheu, M. Cowherd, S. Monismith, C. Jones, and O. Fringer. 2018. Optics and acoustics for near-bed particle characterization and quantification of turbulence. Poster presentation at the Ocean Optics Conference (OOXIV), Dubrovnik, Croatia. October 7–12.

Scheu, K., C. Flanary, K. Raghukumar, and C. Jones. 2018. Evaluation of climate change effects on natural recovery in an alpine lake. Platform presentation. SETAC North America 39th Annual Meeting, Sacramento, CA. November 4–8.

Raghukumar, K., F. Spada, G. Chang, and C. Jones. 2018. Initial field trials of the NoiseSpotter: An acoustic monitoring and localization system. Oral presentation at the 6th Annual Marine Energy Technology Symposium, Washington, DC. April 30–May 2.

Sackmann, B., E. Revelas, and C. Jones. 2018. Standardized and cost-effective benthic habitat mapping tools for marine and hydrokinetic site environmental assessments. Poster presented at 6th Annual Marine Energy Technology Symposium, Washington, DC. April 30–May 2.

Raghukumar, K., G. Chang, and C. Jones. 2018. Improved sea state characterization in support of marine renewable energy projects. Poster presented at 6th Annual Marine Energy Technology Symposium, Washington, DC. April 30–May 2.

Raghukumar, K., F. Spada, G. Chang, and C. Jones. 2018. Spatial characterization of surface waves using an array of newly developed wave buoys. Poster presented at the Ocean Sciences Meeting. Co-sponsored by the American Geophysical Union, the Association for the Sciences of Limnology and Oceanography, and The Oceanography Society, Portland, OR. February 11–16.

Jones, C., and D. Revell. 2018. Coastal lagoon dynamics: An observational assessment of the San Lorenzo River mouth during natural and anthropogenic breaching. Poster presented at the Ocean Sciences Meeting. Co-sponsored by the American Geophysical Union, the Association for the Sciences of Limnology and Oceanography, and The Oceanography Society, Portland, OR. February 11–16.

Chang, G., C. Jones, and J. Roberts. 2018. A techno-economic analysis of wave energy conversion for the United States Pacific coast. Poster presented at the Ocean Sciences Meeting. Co-sponsored by the American Geophysical Union, the Association for the Sciences of Limnology and Oceanography, and The Oceanography Society, Portland, OR. February 11–16.

Spada, F., G. Chang, C. Jones, K. Raghukumar, P. Barney, W. Gans, T. Janssen, and Z. Kirshner. 2018. A motion-controlled wave buoy test stand for high fidelity data validation. Poster presented at the Ocean Sciences Meeting. Co-sponsored by the American Geophysical Union, the Association for the Sciences of Limnology and Oceanography, and The Oceanography Society, Portland, OR. February 11–16.

Flanary, C., G. Chang, C. Jones, F. Spada, and T. Martin. 2017. Innovative optically-based tools and techniques for water quality monitoring. Indian River Lagoon Research Institute, Technical Conference on Coastal Water Quality Issues, Melbourne, FL. September.

Martin, T., C. Jones, and G. Revelas. 2017. A novel approach to performance monitoring at sediment megasites. Sediment Management Work Group Fall Sponsor Forum, Charleston, SC. September 27–28.

Martin, T., G. Chang, C. Jones, and J. Durda. 2017. Use of high-frequency optically-based measurements to assess mercury cycling, transport, and fate in contaminated estuarine and riverine systems. Platform presentation. 13th International Conference on Mercury as a Global Pollutant, Providence, RI. July 16–21.

Jones, C., G. Chang, K. Nelson, and T. Martin. 2015. Field and modeling characterization of wetland hydrodynamics. Eighth International Conference on Remediation of Contaminated Sediments, New Orleans, LA.

Chang, G., C. Jones, and T. Martin. 2015. Near-bed sediment dynamics in the Berry's Creek tidal estuary. Eighth International Conference on Remediation of Contaminated Sediments, New Orleans, LA.

Thompson, R., K. Gustavson, C. Jones, and P. White. 2015. Investigating DDT fate and transport at the United Heckathorn Superfund site. Eighth International Conference on Remediation of Contaminated Sediments, New Orleans, LA.

Martin, T., P. de Haven, C. Jones, D. Glaser, and N. Kelsall. 2015. Evaluation of natural recovery in the Berry's Creek Study Area. Eighth International Conference on Remediation of Contaminated Sediments, New Orleans, LA.

Exhibit H

Lance W. Fontenot, Ph.D., PWS
Principal

integral consulting inc.

Education and Credentials

Ph.D., Zoology, Clemson University, Clemson, South Carolina, 1995

M.S., Biology, Southeastern Louisiana University, Hammond, Louisiana, 1990

B.S., Zoology, Southeastern Louisiana University, Hammond, Louisiana, 1987

Professional Wetland Scientist, (License No. 2565)

Continuing Education and Training

USACE-Sponsored Wetland Delineator Certification Training Program

Professional Affiliations

Society of Environmental Toxicology and Chemistry (Technical Reviewer)

Society of Wetland Scientists

Professional Profile

Dr. Fontenot specializes in assessing the human health and ecological effects of hazardous substance releases. His academic background in ecology and environmental toxicology, combined with applied consulting experience in toxicology and ecological studies, provides a unique approach to the field of risk assessment. Dr. Fontenot has more than 25 years of experience in teaching, technical literature review, and scientific research. He has published articles on several aspects of ecotoxicology and on other basic ecological studies, usually involving aquatic environments.
Dr. Fontenot has served as a technical reviewer and on the editorial board for the Society of Environmental Toxicology and Chemistry's journal *Environmental Toxicology and Chemistry*. Dr. Fontenot has experience in the preparation of human health risk assessments as well as ecological risk assessments and biological inventories. He has utilized the EPA Risk Assessment Guidance for Superfund, ASTM International Standard Guide for Risk-Based Corrective Action, Texas Risk Reduction Program, and the Louisiana Department of Environmental Quality (LDEQ) Risk Evaluation/ Corrective Action Program (RECAP) regulations for risk assessment projects. His field experience has included sample collection of soil, water, sediment, invertebrates, mussels, fish, amphibians, reptiles, birds, and mammals. Dr. Fontenot is qualified as an expert in environmental toxicology, risk assessment, and biology and has provided testimony on environmental impacts from a range of activities including oil and gas, pesticide use, and process/ stormwater discharges in Louisiana and Texas.

Relevant Experience

Risk Assessment

Industrial Clients, Louisiana—Prepared LDEQ RECAP Management Option 1 (MO-1), MO-2, and MO-3 risk assessments and developed environmental site investigations to support RECAP for more than 20 industrial clients in Louisiana.

Pesticide Manufacturer, St. Gabriel, Louisiana—Conducted a toxicity assessment for two semivolatile constituents (*o*-toluidine and 5-chloroaminotoluene) and proposed toxicity criteria for use in calculating LDEQ risk-based corrective action levels. The assessment and action levels were accepted by LDEQ.

8550 United Plaza Blvd.
Suite 702
Baton Rouge, LA 70809

225.266.1741
lfontenot@integral-corp.com

Chemical Manufacturer, Donaldsonville, Louisiana—Conducted a toxicity assessment for ammonia and calculated LDEQ RECAP standards for use in a RECAP MO-1 risk assessment. Developed a Groundwater Biogeochemical Characterization Program to determine the biodegradation potential of ammonia in shallow groundwater.

Chemical Company, Oakdale, Louisiana—Prepared LDEQ RECAP MO-1 and MO-2 risk assessments and developed environmental site investigations to support RECAP. Conducted toxicity assessment and developed a reference dose (RfD) for tall oil for the calculation of LDEQ RECAP standards. RECAP risk assessments and toxicity assessment were accepted by LDEQ and utilized for corrective action.

Major Railroad Company, Eunice Train Derailment, Louisiana—Participated in emergency response and risk communication activities associated with a major train derailment in Louisiana. Prepared LDEQ RECAP MO-1, MO-2, and MO-3 risk assessments and supported environmental site investigations. Conducted toxicity assessment and developed an RfD for disodium iminodiacetate for calculation of LDEQ RECAP standards. Utilized soil attenuation model for development of soil RECAP standards protective of groundwater. Conducted multiple fish tissue investigations and demonstrated that consumption of fish caught within the Eunice City Lake posed no excess health risk to human recreational receptors due to site-related constituents of concern (COCs). A health consultation conducted by ATSDR concurred with the results of the fish tissue investigations. Served as task manager for field sampling of surface water, sediment, and fish from a lake and bayou. Calculated LDEQ RECAP standards for sediment, surface water, and fish tissue.

USACE New Orleans District, Inner Harbor Navigation Canal—Conducted an evaluation of the potential risks to human health and the environment associated with the low-level organic chemical concentrations to be placed in the proposed confined disposal facility (CDF). An evaluation of potential human health risks was conducted based on normal operation of the CDF and an extreme catastrophic failure due to hurricane events or other significant flood events of the CDF (both operational and closed). The human health evaluation showed that the number of exposure pathways that could result in impacts to human health was limited, especially after closure of the facility. Human health risks from contact with dredged material placed in the facility even under an extreme failure were minimal based on comparison to conservative risk standards assuming no dilution of the dredged materials after release from the CDF. Risks after construction were considered to be even lower. Successfully conducted a RECAP evaluation utilizing existing data to confirm for LDEQ that the dredged material posed no significant risk to human health or the environment and was, therefore, exempt from solid waste regulations. This determination significantly reduced the cost of construction, impact to project schedule (associated with permitting a disposal unit), and long-term maintenance requirements associated with an LDEQ Solid Waste Permit.

Major Railroad Company, Southeast Louisiana—At a former wood treating facility, performed passive sampling using SiREM's SP3™ sampler in sediment below the mudline to measure upwelling groundwater COC concentrations before the groundwater transitioned into surface

water. Passive sampling data were evaluated within the context of EPA guidance on evaluating groundwater–surface water interactions to update the conceptual site model. Porewater concentrations of PAHs and pentachlorophenol (PCP), as measured by passive samplers, were used to evaluate the contaminant flux and to perform a screening level evaluation of the potential for human health and ecological risks. Passive sampling results enabled the identification of the location and concentrations of COC flux within the transition zone. EPA's equilibrium partitioning sediment benchmarks (ESB) screening approach for PAH mixtures was utilized to refine the screening level estimates and provide focus areas for further evaluation.

Trade Association, Baton Rouge, Louisiana—Developed a white paper for risk communication of ethylene oxide emissions to address growing concerns related to cancer risk associated with ethylene oxide emissions. Local industrial facility managers used the white paper as talking points.

Utility Supplier, South Louisiana—Provided exposure assessment, toxicological support and review of the public health effects claims from an accidental release of hydrated lime into a residential community.

Oil and Gas Supplier, South Louisiana—Performed LDEQ RECAP site investigations at three former petroleum release sites located in south Louisiana that were used as bulk storage sites for hydrocarbon products including crude oil, jet fuel, diesel fuel, and waste oil. BTEX, TPH, and PAH impacts were observed during the tank removal/closure activities and the LDEQ required additional assessment of the soil and groundwater. The sites were evaluated using RECAP under MO-1 and MO-2. For each site, a conceptual site model was developed to guide the investigation and RECAP evaluation. Activities included preparation of a RECAP investigation work plan, collection of soil and groundwater data, preparation of a RECAP report, and negotiations with the agency. LDEQ subsequently approved the RECAP reports for all three sites and granted a "no further action" determination. Based on the findings at each site, the BTEX, TPH, and PAH in soil and groundwater were within the limits of the respective limiting RECAP standards.

Former Retail Gasoline and Diesel Station, Natchitoches, Louisiana—Performed assessment, monitoring, and reporting activities for a former retail gasoline and diesel station located in Natchitoches, Louisiana. Activities included preparation of a RECAP investigation work plan, collection of additional soil and groundwater data for an expanded RECAP parameter list, preparation of a RECAP report, and negotiations with the agency. LDEQ subsequently approved the RECAP report. Based on the findings of the RECAP report, the COCs have been reduced to a single constituent (benzene) in one medium (groundwater). A corrective action plan was prepared to address the benzene in groundwater at the site. Corrective action was implemented and LDEQ regulatory closure was achieved.

Energy Company, South Louisiana—For the proposed development and permitting of an industrial riverfront area that included plans for dredging sediment and soil, performed environmental due diligence and property transaction support, onsite environmental investigations of soil and groundwater to clear areas for environmental concerns, onsite waste management assistance and developed remediation cost estimates. Offshore investigations included subaqueous soil sampling

of multiple groundwater bearing zones to evaluate potential migration of volatile organic compounds (VOCs) of concern in groundwater from adjacent areas of documented contamination. Sampling was conducted utilizing a barge mounted drilling rig to target the elevations of the groundwater zones. Results demonstrated that VOCs have not migrated to the sediment and soil areas proposed for dredging within the shallow groundwater zones. Permitting support was also provided for soil, groundwater, and wetland environmental issues and contingency planning for the potential of encountering contaminated sediment/soil during proposed dredging.

Former Louisiana State Police Firing Range, South Louisiana—Performed field screening utilizing x-ray fluorescence (XRF) to identify areas of elevated lead concentrations to develop a more focused and cost-effective scope of work for the environmental site assessment (ESA) to be conducted for the property. Conducted a limited soil and groundwater assessment that verified impacted soil areas identified by XRF screening and identified lead impacts in shallow groundwater.

Chemical Manufacturer, Westwego, Louisiana—Prepared five LDEQ RECAP MO-1 risk assessments at a chemical manufacturing facility with soil and groundwater impacted by volatile and semivolatile constituents, PCBs, and metals. The assessments were accepted by LDEQ and regulatory closure was achieved.

Inactive and Abandoned Facility, Louisiana—Performed preliminary risk screening, using LDEQ RECAP guidance, for an inactive and abandoned facility in Louisiana that was under consideration for Superfund listing. Conducted additional RECAP MO-1 risk assessment and field screening of soils for PCBs using a rapid immunoassay field screening kit.

Underground Storage Tanks, Shreveport, Louisiana—Prepared an LDEQ RECAP risk assessment and closure plan for an underground storage tank site in Louisiana. The assessment and corrective action were accepted by LDEQ.

Petrochemical Manufacturer, Louisiana—Prepared a baseline risk assessment work plan as part of a RCRA facility investigation (RFI) for two units at a Louisiana chemical manufacturing facility with soil and groundwater impacted by volatile and semivolatile constituents. Prepared LDEQ RECAP MO-1 and MO-2 risk assessments and supported environmental site investigations for the RFI. Successfully utilized the RECAP investigation for the response to an EPA RCRA 3013 Order.

Dutchtown Superfund Site, Dutchtown, Louisiana—Developed risk-based corrective action levels for groundwater, protective of a downgradient surface water resource, as part of the contingency measures for the monitoring program at the Dutchtown Oil Treatment Superfund site in Louisiana. The corrective action levels were accepted by EPA Region 6.

Industrial Landfill, Baton Rouge, Louisiana—Task manager for a human health and ecological risk assessment requiring development of site specific health-based levels for metals and organics in groundwater discharging to surface water at a major industrial landfill in Louisiana. An MO-3 baseline risk assessment was prepared to evaluate potential human health and environmental risks associated with a closed landfill. Historical analytical data indicated the occurrence of several

constituents in well samples collected at the landfill. Because of the proximity of a surface water body to the site, the focus of the risk assessment was to evaluate the potential impact of leachate discharging from the landfill into the surface water body. Results of the RECAP Ecological Risk Assessment Checklist indicated that the site did not meet the criteria for exclusion from further ecological assessment because of the long-term threat of release (via groundwater discharge) to the surface water body. Therefore, a screening level ecological risk assessment was conducted that evaluated the potential effects of groundwater discharge to aquatic receptors in the surface water body. A comparison of maximum predicted groundwater discharge concentrations (within the surface water body assuming no dilution) to ambient water quality criteria or to toxicological screening benchmarks for freshwater aquatic biota when LDEQ or EPA criteria were not available revealed that none of the COCs exceeded their risk-based aquatic toxicity criteria. The RECAP MO-3 risk assessment was accepted by LDEQ.

Agricultural Chemical Manufacturing Facility, Luling, Louisiana—Prepared a risk assessment as part of the RCRA Corrective Action Program being conducted at two solid waste management units. The risk assessment was consistent with the requirements of RECAP and evaluated the results of the RFI and site-specific exposure conditions for the development of the risk assessment. The screening option of the LDEQ RECAP guidance was employed to select COCs. A site conceptual exposure model was developed that depicted the potential sources of COCs, chemical release and transport mechanisms, affected media, known and potential routes of migration and potential human and ecological receptor populations. MO-1 RECAP standards were developed for COCs that exceeded LDEQ RECAP screening standards in groundwater. Concentrations of 1,2-dichloroethane and benzene exceeded the limiting MO-1 RECAP standards. Although BIOSCREEN modeling results demonstrated that groundwater would not migrate appreciably from the area where COCs were detected, the results of the MO-1 risk assessment indicated that corrective action was warranted for groundwater. A monitored natural attenuation compliance program was chosen to address the area of the site that exceeded the RECAP standards. The MO-1 RECAP standards were proposed as an action standard for the monitored natural attenuation compliance program. Conducted additional RECAP MO-1 and MO-2 risk assessments for other areas at the facility.

Gillis W. Long Hansen's Disease Center, Carville, Louisiana—Performed an environmental site investigation for three former disposal areas (i.e., landfills). The purpose of the investigation was to provide appropriate data sufficient to meet the requirements of the LDEQ RECAP. The investigation focused on assessing shallow soils and groundwater in the interior and the immediate area surrounding each landfill. A RECAP screening option evaluation was performed to identify areas of investigation and COCs. A conceptual site model was developed to depict the potential exposure pathways under both current and potential future exposure scenarios. The soil quality data compiled during the investigation indicated minor to moderate impacts of shallow soils at each landfill. The shallow groundwater data indicated that there were no adverse impacts to groundwater due to the landfill operations. Performed a MO-1 risk assessment of the three landfills. Results of the risk assessment indicated that corrective action was warranted for soils at one landfill only; no further action at this time was recommended for the remaining two landfills. A

soil cap/cover was recommended as the appropriate corrective action. A cap of clay and vegetated soil was placed over the affected area to prevent exposure to elevated lead concentrations.

Big Lake West Former Crude Oil Terminal, Big Lake, Louisiana—Performed an environmental site investigation and LDEQ RECAP risk assessment for the Big Lake West Former Crude Oil Terminal. Five areas of investigation for soil and groundwater were defined during the RECAP process and included both industrial and residential land use. Benzene, ethylbenzene, naphthalene, 2-methylnaphthalene, benzo[*a*]pyrene, and gasoline-, diesel-, and oil-range total petroleum hydrocarbons (TPH-GRO, TPH-DRO, and TPH-ORO) were the COCs. Corrective action was warranted for soil at the site for the protection of human health and the environment. The area of investigation for soil was defined by the limiting RECAP standards for TPH-DRO and benzo[*a*]pyrene. A corrective action plan was prepared and implemented to address the areas of corrective action identified for soil in the area of investigation. After additional RECAP evaluation using site-specific fate and transport modeling, corrective action for groundwater was not required at the site. The assessment and corrective action were accepted by LDEQ.

Superfund Site, Northwest Florida—Conducted a baseline ecological risk assessment associated with the operation of a battery reclamation facility at an NPL site in Florida. Results of the ecological assessment were used to develop an alternative approach to the EPA-accepted record of decision (ROD), which specified the dredging of approximately 29 acres of wetlands. As part of the approach, worked closely with EPA Region 4, Florida Department of Environmental Protection, and the U.S. Fish and Wildlife Service to design a strategy to conduct the required ecological assessment activities in a cost-effective manner that would satisfy the requirements of the regulatory community. This was one of the first ecological risk assessments mandated by EPA Region 4 to be conducted according to its Ecological Risk Assessment Guidance for Superfund (EPA 540-R-97-006, OSWER Directive 9285.7-25). As part of the ecological risk assessment, developed a detailed sampling and analysis plan for the evaluation of potential impacts to the wetland ecosystem potentially impacted by site activities. Tasks completed as part of the evaluation included surface water and sediment collection for metals analysis and for use in sediment toxicity tests using *Chironomus riparius* and *Hyalella azteca*. Prey species tissue samples were collected and analyzed to validate food-web exposure models and to determine site-specific bioaccumulation factors. A vegetation evaluation was conducted to determine the occurrence of, and potential for, cypress regeneration within the wetland ecosystem. Successfully completed the rigorous time-critical sampling event under EPA oversight. Following receipt of the analytical results, performed a weight-of-evidence evaluation to determine the potential impacts to the wetland ecosystem. The results of the evaluation were used to determine appropriate and realistic remediation goal options within the wetland system for protection of ecological populations and to develop an amendment to the ROD.

Superfund Site, Louisiana—Conducted a peer review of the ecological risk assessment prepared for a Superfund site in Louisiana with impacted soil, groundwater, surface water, and sediment. Recommendations included clarifications of the technical approach and adherence to established EPA ecological risk assessment guidance.

Petrochemical Plant, Port Neches, Texas—Prepared Texas Commission on Environmental Quality (TCEQ) affected property assessment reports for an industrial client in southeast Texas. Five affected property assessment reports, two response action plans, and multiple post-response action care reports were accepted by TCEQ. The response action plan for a landfill area included the use of dredged material as a cover. Performed a toxicity assessment and developed an RfD for morpholine to use for calculation of protective concentration levels.

Specialty Petrochemical Manufacturer, Baytown, Texas—Prepared two Risk Reduction Standard 2 closures and conducted additional risk assessment activities to support the RFI. Results were used to establish remedial goals for the groundwater corrective action program.

Chemical Facility, Galena Park, Texas—Prepared a screening-level ecological risk assessment for a chemical facility in Texas with PAH-impacted soils. Results of the Tier 2 screening-level ecological risk assessment indicated the potential for ecological risks to terrestrial receptors exposed to soils at one area of concern.

Synthetic Rubber Manufacturing Facility, Orange, Texas—Provided technical review and assistance with project strategies for an ecological risk assessment of PAH- and metal-impacted sediment at a synthetic rubber manufacturing facility in Texas.

Petrochemical Manufacturing Facility, Houston, Texas—Prepared a baseline human health risk assessment for a chemical facility in Texas with organic, pesticide, and metal constituents in groundwater.

Major Railroad Company, Gautier, Mississippi—Prepared a site-specific risk assessment to evaluate post-Hurricane Katrina risks to human health and the environment at a former wood treating and preserving facility in Mississippi. Major activities included a human health risk assessment of contaminants in soil, groundwater, sediment, and biota; ecological risk assessment of contaminants in sediment and biota; site-specific biological investigations; sediment quality triad assessment; and evaluation of benthic macroinvertebrate communities and fish and crab tissue residues. The human health and ecological risk assessment were approved by the Mississippi Department of Environmental Quality (MDEQ).

Petroleum Storage Sites, Southern Mississippi—Performed Phase II ESA soil and groundwater sampling activities at two petroleum release sites. Phase II ESA investigation results were evaluated using MDEQ Tier 2 Petroleum Hydrocarbon Evaluation – TPH Fractioning to limit the extent of corrective action required.

Human Health and Ecological Risk Assessment of PCBs, Crystal Springs, Mississippi—Prepared a human health and ecological risk assessment of PCBs in soil, sediments, and biota at a lake in Mississippi. Site-specific ecological field studies included benthic macroinvertebrate community evaluation and fish and crawfish tissue residue evaluation.

Major Railroad Company, Gautier, Mississippi—Performed an ecological risk assessment and assisted in the preparation of a human health risk assessment and a remedial action plan, for a

former wood treating and preserving facility in Mississippi with PAH and PCP constituents in soil, groundwater, and sediments. The risk-based remedial action plan was approved by MDEQ.

Shipbuilding Facility, Pascagoula, Mississippi—Developed risk-based cleanup goals for volatile organic compounds in groundwater, protective of a downgradient surface water resource, at a shipbuilding facility in Mississippi. The cleanup goals were considered in the decision-making process for termination of the remedial system currently in operation.

Major Utility, Kingston, Tennessee—Prepared ecological risk assessments of amphibian and reptile receptors for the baseline ecological risk assessment of the Kingston Ash Recovery Project in Roane County, Tennessee.

Major Railroad Company, Jacksonville, Florida—Prepared a screening-level ecological risk assessment for an industrial client in Florida with PAH- and pesticide-impacted sediment, surface water, and soil. This project included the derivation of site-specific sediment quality criteria and evaluation of benthic macroinvertebrate survey data.

Ecological Risk Assessments at a Chemical Facility, Mulberry, Florida—Prepared a screening-level ecological risk assessment and baseline ecological risk assessment problem formulation for a chemical facility in Florida with metal-impacted sediment, surface water, and soil.

U.S. Army, Fort Gordon, Georgia—Prepared screening-level ecological risk assessments for sediment waste management units as part of the RFI process.

Fertilizer Facility, Dodge City, Kansas—Performed an ecological exclusion screening and checklist as part of the RFI for the facility. Utilized a comprehensive habitat-based approach and ecological exposure analysis to demonstrate that the site meets the criteria for exclusion from further ecological assessment.

Industrial Clients, Alabama, Florida, Louisiana, and Texas—Prepared ecological reconnaissance reports and checklists for ecological assessment/sampling as part of the RFI for chemical manufacturing facilities in Alabama, Florida, Louisiana, and Texas.

Surface Water

Paper Mill, Bogalusa, Louisiana—Emergency Response Coordinator and Biological Team leader for a fish kill incident response and recovery evaluation in southeastern Louisiana. Performed endangered species agency coordination, fish population monitoring, and fish/seafood tissue safety evaluation. Coordinated with U.S. Fish and Wildlife Service for the threatened Gulf sturgeon and special endangered species protocol daily reporting for Gulf sturgeon as a result of the process wastewater discharge to the Pearl River.

Pest Control Company, Southeast Texas—Conducted an evaluation of a fish kill resulting from a pesticide application (Patrol® and Tekko Pro®) for mosquito control adjacent to a pond. Compiled a literature review on the ecotoxicity and fate and transport properties of the pesticides and identified contract laboratories for nonstandard analysis of the pesticides. Collected surface water,

sediment, tap water, and fish tissue samples and provided interpretative reporting for the fish kill incident.

USACE, New Orleans District—Supported preparation of baseline salinity conditions and preliminary ecological impact analysis for the Violet Freshwater Diversion project. This analysis included determination of the presence of endangered or threatened species and evaluation of the potential impacts on critical habitats.

Louisiana Department of Natural Resources, South Pecan Island Freshwater Diversion, Vermilion Parish, Louisiana—Technical reviewer for effects of salinity changes on fresh, intermediate, and brackish marshes for the South Pecan Island Freshwater Diversion, Vermilion Parish, Louisiana. An evaluation of the environmental assessment prepared by NOAA indicated there would not be water quality effects on wetland creation and restoration. The evaluation also concluded that there were no known endangered or threatened species, critical habitat, marine mammals, or other nontarget species occurring in the area.

Refinement of Aquatic Life Use Categories, Terrebonne Basin, Louisiana—Led a team that collected physical, chemical, and biological data to establish a basis for the refinement of aquatic life use categories and applicable water quality criteria for freshwater and estuarine water bodies in the Terrebonne Basin of Louisiana. In the Terrebonne Basin, all bodies of water are specified for the protection of fish and wildlife propagation and have a dissolved oxygen) criteria of either 4 mg/L (for estuarine waters) or 5 mg/L (for freshwater and coastal marine waters). Thus, a study was conducted in the basin to collect information that can be used as a basis for adjusting the dissolved oxygen criteria for water bodies within the basin to better reflect natural conditions. A reconnaissance was conducted to ensure the highest quality waters were chosen. Physical, chemical, and hydrological measurements were collected during each sampling event. Habitat assessment and biological sampling was performed only during the critical season (summer) events. Fish and small animals, such as insects living on the bottom, were collected at all locations. Benthic macroinvertebrates were collected at each location. The results of water quality analyses indicated that the selected sites did represent "least impacted" conditions with respect to basic water quality parameters. With respect to dissolved oxygen, however, average levels decrease to below the 5 mg/L criterion at some time (usually during the summer) at almost all of the freshwater and mixed salinity sites. The majority of the selected reference sites in the Terrebonne Basin supported a reasonably diverse and healthy biological community, despite the fact that dissolved oxygen is below the current standard. Neither minimum nor average dissolved oxygen below 4–5 mg/L appeared to be correlated with reductions in species richness or diversity.

Pipeline Company, South Louisiana—For a major pipeline company, collected data for a natural resource damage assessment pre-assessment for a gasoline spill in Louisiana, including field sampling of water, sediment, fish, and mussels. Environmental sampling reports were prepared that documented the methods used and summarized results of each investigation.

Petrochemical Manufacturer, Louisiana—Prepared a literature review of the environmental fate and toxicity of cyanide-bearing waste effluents. Performed stormwater sampling for NPDES permits.

Petrochemical Facility, Port Neches, Texas—Assessed the potential impact of constituents in a stormwater discharge at a petrochemical facility in Texas in accordance with applicable water quality standards, Texas Natural Resource Conservation Commission standards, and EPA Region 6 permitting policy.

Major Railroad Company, Effingham, Illinois—Reviewed aquatic toxicity data for two organic compounds (*tert*-butyl phenol and butyraldehyde) and the calculation methodology used by the Illinois Environmental Protection Agency for development of water quality criteria to determine conformance with regulatory requirements and to evaluate possible alternative criteria development approaches.

Ecological Studies

Major Railroad Company, Eunice Train Derailment, Louisiana—Conducted a comprehensive ecotoxicological tissue residue and pathology study on turtles from the Eunice City Lake in response to reports of turtles being affected by an apparent shell disease. The findings of this study demonstrated that the turtle shell disease observed in red-eared slider turtles was not related to the chemicals from the train derailment.

Frog Population Assessment, Western Massachusetts—Prepared a literature-based frog population assessment and conducted a laboratory audit of a frog reproduction and development toxicity study. Conducted a northern leopard frog egg mass survey in PCB-contaminated wetland habitats.

Chemical Manufacturer, Westwego, Louisiana—Conducted wetland delineation using the USACE Wetlands Delineation Manual to define the extent of wetlands surrounding an industrial landfill.

Major Telecommunications Client, South Louisiana—Conducted wetland assessments and delineations in South Louisiana using the USACE Wetlands Delineation Manual. Obtained wetland permits following USACE, New Orleans District, guidelines.

Ready-Mix Concrete Plant, Baton Rouge, Louisiana—Conducted a field delineation of the area to survey the extent of impacted wetlands by recently deposited cement fines. Soil pits were used to distinguish between the cement fines and native soils within the wetland area and also to determine the volume of cement fines present. Healthy vegetated areas with historical cement fines were considered as the limit of the delineation. After completion of the soil delineation, the limits of areas that required excavation were identified with survey stakes and approximate depths of cement fines were recorded. Approximately 1,700 cubic yards of cement fines were removed from the jurisdictional wetland area. USACE indicated that the voluntary restoration was satisfactory, and no additional action was required. However, a voluntarily replanting of the project area was implemented. Planting consisted of 250 trees (200 cypress and 50 water hickory) planted on an approximately 12- by 12-ft spacing. The area was inundated to a depth of approximately 1 ft during

this planting. An additional 50 willow oak trees were planted. Based on a qualitative estimate, greater than 90 percent tree survival was achieved.

Major Railroad Company, Eunice Train Derailment, Louisiana—Obtained emergency wetland permit for remediation activities for a tributary and bayou adjacent to a train derailment site. Completed remediation of tributary by removal of contaminated sediments and restored tributary to natural conditions. Developed wetland restoration plan for a railroad bridge replacement and environmental remediation that included restoration to pre-project natural surface contours and restoration of bottomland hardwood wetlands in the mitigation area by planting appropriate tree seedlings as needed to fulfill compensatory mitigation requirements specified in the USACE permits. Restoration of 4.5 acres of wetlands with bottomland hardwood adjacent to the proposed bridge replacement and environmental remediation site was completed.

Kansas Lane Connector Environmental Impact Statement, Monroe, Louisiana—Senior ecologist for the Kansas Lane Connector environmental impact statement in Monroe, Louisiana, for the Louisiana Department of Transportation and Development (LADOTD). Responsible for wetlands, threatened and endangered species desktop research and field surveys. Protected species included the pallid sturgeon, red cockaded woodpecker, bald eagle, and the Louisiana black bear.

Kansas Lane-Garrett Road Connector and Interchange Improvements Environmental Assessment, Monroe, Louisiana—As, senior ecologist, completed technical review of the draft wetlands delineation and findings technical memorandum for the Kansas Lane-Garrett Road connector and interchange improvements environmental assessment in Monroe, Louisiana, for LADOTD. Changes in the features of this interchange improvement and railroad overpass project increased the project footprint. New areas impacted were reviewed against available electronic data to confirm the presence/absence of wetlands signatures. Also responsible for review of findings related to threatened and endangered species and critical habitat presence.

Chef Menteur Bridge and Approaches Replacement Environmental Assessment, Louisiana—Served as senior ecologist for the Chef Menteur Bridge and Approaches Replacement environmental assessment and line and grade study for a high-priority bridge replacement for LADOTD. Responsibilities included fieldwork; wetlands, biological, and desktop research; and related coordination of the Phase I ESA technical documents.

LA 143–US 165 Connector and Ouachita River Bridge, Louisiana—Served as senior ecologist for the LA 143–US 165 Connector and Ouachita River Bridge, Ouachita Parish, Louisiana, for the LADOTD. Responsible for wetlands, threatened and endangered species desktop research and field surveys.

Wetlands Delineation Update and Permit Revisions, Louisiana—Senior ecologist for the wetlands delineation update and permit revisions for the Kansas Lane Extension update of the Jurisdictional Determination, Wetlands Delineation, and Mitigation Plan submitted to the Vicksburg District of the USACE.

I-49 South-Raceland to Westbank Expressway Environmental Impact Statement, Louisiana—Served as senior ecologist for the I-49 South-Raceland to Westbank Expressway environmental impact statement for LADOTD for final field investigations and sample collection for the wetlands delineation report produced for the second segment of this interstate project on the West Bank of the Mississippi River in Lafourche and Jefferson Parishes, Louisiana. Also responsible for desktop research and fieldwork related to threatened and endangered species presence and impacts. Protected species included piping plover, bald eagle, West Indian manatee, brown pelican, pallid sturgeon, Gulf sturgeon, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, and the loggerhead sea turtle.

Ecological Database and Biological Inventory, Louisiana—Reviewed an ecological database and biological inventory and evaluation report of an aquatic ecosystem for a major industrial client in Louisiana. Recommendations included clarification of technical approach and data limitations.

Southeastern Louisiana University, Louisiana—Assisted in field sampling of fishes from the Tangipahoa River and processing of plankton net samples from Pass Manchac in Louisiana. Assisted in a study of the ecology of alligators from the Manchac Wildlife Management Area in Louisiana.

Louisiana Department of Wildlife and Fisheries Reptile and Amphibian Task Force—Served as a member of the task force and, in this capacity, conducted a hazard assessment of pesticides to amphibian and reptile populations.

EPA Region 4—Provided technical assistance for a PCB bioaccumulation study in an aquatic food web conducted by EPA. Northern water snakes (*Nerodia sipdeon*) were collected from a PCB-contaminated watershed and ecological data provided for the study.

South Carolina Wildlife and Marine Resources Department, Clemson, South Carolina—Conducted a status survey of the threatened bog turtle, *Clemmys muhlenbergii*, for the South Carolina Wildlife and Marine Resources Department. A final report was submitted to the department and the U.S. Fish and Wildlife Service.

Selected Expert Testimony

Pesticide Spray Drift and Crawfish Mortality, Louisiana—Provided expert opinion and trial testimony for the defense of a pesticide spray drift and crawfish mortality case. The case involved the environmental toxicity and aquatic assessment of two pesticides (Curacron and Baythroid). The case was decided in favor of the defendants.

Oilfield Legacy Site, South Louisiana—Provided expert opinion and deposition testimony regarding alleged environmental damages and human health risks for the defense of an oilfield "legacy" site in south Louisiana. The case settled.

Crawfish Pond and Hydrocarbons, Louisiana—Provided deposition testimony for the defense of a crawfish pond case. The case involved the potential impact of hydrocarbons on the taste and marketability of crawfish. The case settled.

Pesticide Use for Mosquito Control, South Louisiana—Provided expert litigation support in the matter of a pesticide (permethrin) used in aerial applications for adult mosquito control in south Louisiana. The evaluation utilized the exposure assessment and ecological effects elements of EPA ecological risk assessment guidance, established fish kill investigation principles, and a review of toxicological data to conclude that ultra-low volume aerosol applications of permethrin were not likely to have caused a crawfish kill.

Oilfield Legacy Cases, Louisiana—Provided litigation support for multiple oilfield "legacy" cases in south Louisiana regarding site investigation, risk assessment, and ecological damages.

Selected Publications

Clarkson, J.R., L. Fontenot, and L. Yu. 2005. Sulfates. pp. 110–112. In: *Encyclopedia of Toxicology.* Second Edition. Elsevier Inc.

Fontenot, L.W., G.P. Noblet, J.M. Akins, M.D. Stephens, and G.P. Cobb. 2000. Bioaccumulation of polychlorinated biphenyls in ranid frogs and northern water snakes from a hazardous waste site and a contaminated watershed. *Chemosphere* 40:803–809.

Platt, S.G., K.R. Russell, W.E. Snyder, L.W. Fontenot, and S. Miller. 1999. Distribution and conservation status of selected amphibians and reptiles in the Piedmont of South Carolina. *J. Elisha Mitch. Sci. S.* 115:8–19.

Fontenot, L.W., G.P. Noblet, S.G. Platt, and J.M. Akins. 1996. A survey of the herpetofauna inhabiting polychlorinated biphenyl contaminated and reference watersheds in Pickens County, South Carolina. *J. Elisha Mitch. Sci. S.* 112:20–30.

Fontenot, L.W., and S.G. Platt. 1996. *Regina septemvittata* (queen snake): Reproduction. *Herpetological Review* 27:205.

Fontenot, L.W., and W.F. Font. 1996. Helminth parasites of four species of aquatic snakes from two habitats in southeastern Louisiana. *Journal of the Helminthological Society of Washington* 63:66–75.

Fontenot, L.W. 1995. Utilization of amphibians and reptiles and their parasite communities as bioindicators of environmental contamination. Dissertation, Clemson University.

Fontenot, L.W., and S.G. Platt. 1995. The status of the bog turtle (*Clemmys muhlenbergii*) in South Carolina. *Bulletin of the Chicago Herpetological Society* 30:145-147.

Fontenot, L.W., C. Rockett, W. Mashburn, J. Gottschalk, G. Noblet, and R.L. Dickerson. 1995. Effect of Aroclor 1254 exposure on bullfrog (*Rana catesbeiana*) helminth parasite burden and CYP1A1 activity. *The Toxicologist* 15:189.

Platt, S.G., and L.W. Fontenot. 1995. Geographic distribution. *Eleutherodactylus planirostris* (greenhouse frog). *Herpetological Review* 26:207.

Fontenot, L.W., G.P. Noblet, and S.G. Platt. 1994. Rotenone hazards to amphibians and reptiles. *Herpetological Review* 25:150–156.

Platt, S.G., and L.W. Fontenot. 1994. Geographic distribution. *Anolis sagrei* (brown anole). *Herpetological Review* 25:33.

Platt, S.G., and L.W. Fontenot. 1994. Geographic distribution. *Macroclemys temminckii* (alligator snapping turtle). *Herpetological Review* 25:75.

Fontenot, L.W., S.G. Platt, and M.B. Strayer. 1993. A survey of the distribution and abundance of the bog turtle, *Clemmys muhlenbergii*, in South Carolina. *Carolina Herpetology* 1:1–2.

Platt, S.G., and L.W. Fontenot. 1993. Bullfrog (*Rana catesbeiana*) predation on Gulf Coast toads (*Bufo valliceps*) in Louisiana. *Bulletin of the Chicago Herpetological Society* 28:189–190.

Fontenot, L.W., S.G. Platt, and C.M. Dwyer. 1993. Observations on crayfish predation by water snakes, *Nerodia* (Reptilia: Colubridae). *Brimleyana* 19:95–99.

Platt, S.G., and L.W. Fontenot. 1992. The red-eared slider, *Trachemys scripta elegans* (Weid), in South Korea. *Bulletin of the Chicago Herpetological Society* 27:113–114.

Fontenot, L.W. 1990. Helminth parasites of aquatic snakes from southeastern Louisiana. Thesis, Southeastern Louisiana University.

Platt, S.G., C.G. Brantley, and L.W. Fontenot. 1989. Herpetofauna of the Manchac Wildlife Management Area, St. John the Baptist Parish, Louisiana. *Proceedings of the Louisiana Academy of Sciences* 52:22–28.

Fontenot, C.L., Jr., and L.W. Fontenot. 1989. *Amphiuma tridactylum*: Feeding. *Herpetological Review* 20:48.

Fontenot, L.W., and W.F. Font. 1989. Trematode parasites of *Amphiuma tridactylum* and *Siren intermedia* from Louisiana. *Proceedings of the Louisiana Academy of Sciences* 52:70.

Peer Review

Perform peer review for the University of Wisconsin Sea Grant College Program as well as the following journals: *Environmental Toxicology and Chemistry, Archives of Environmental Contamination and Toxicology, American Midland Naturalist,* and *The Journal of Parasitology.*

Presentations/Posters

Pautler, B., J. Roberts, M. Healey, J. Conder, D. Toler, L. Fontenot, and S. Aufdenkampe. 2020. Groundwater/surface water interactions at the transition zone: Utilizing an in-situ passive sampling program to evaluate groundwater upwelling. SCICON2: Society of Environmental Toxicology and Chemistry North America 41st Annual Meeting.

Fontenot, L.W. 2018. Effects of salt water intrusion on coastal amphibian populations: biodiversity and evolutionary perspectives. Louisiana Coastal Geology Symposium 2018, Baton Rouge, LA. July 11.

Fontenot, L.W. 2017. Safety of dietary supplements. Louisiana Solid Waste Association Environmental Conference, Lafayette, LA. March 15–17.

Fontenot, L.W. 2016. Bioindicator approaches to assess environmental health. Louisiana Solid Waste Association Environmental Conference, Lafayette, LA. March 16–18.

Fontenot, L., and S. Sager. 2014. Proposed revisions to Louisiana Department of Environmental Quality Risk Evaluation/Corrective Action Program – RECAP 2014. Railroad Environmental Conference, University of Illinois at Urbana-Champaign, IL. October 28.

Shisler, J., M. Adkins, J. Beckner, T. Iannuzzi, and L. Fontenot. 2013. Creation of a multi habitat system on upland and subaqueous caps at the former Gautier oil site, Gautier, MS. Seventh International Conference on Remediation of Contaminated Sediments, Dallas, TX. February 4–7.

Iannuzzi, T., M. Adkins, L. Fontenot, J. Shisler, and J. Beckner. 2013. Determining risk-based remedial goals for estuarine river and marsh sediments at a former wood treating facility, Gautier, MS. Seventh International Conference on Remediation of Contaminated Sediments, Dallas, TX. February 4–7.

Iannuzzi, T., J. Beckner, L. Fontenot, M. Adkins. 2012. A risk-based remedy for wood treating compounds in estuarine river and marsh sediments adjacent to the former Gautier oil site, Gautier, MS. Society of Environmental Toxicology and Chemistry North America 33rd Annual Meeting.

Jones, D., M. Beauchemin, N. Bonnevie, D. Buys, L. Fontenot, B. Fulton, C. Meyer, J. Meyer, D. Rigg, T. Schlekat, A.R. Stojak, M. Wacksman, S. Young, and N. Carriker. 2012. Ecological risk assessment for Phase 3 of the TVA Kingston Ash Recovery Project; Roane County, TN. Society of Environmental Toxicology and Chemistry North America 33rd Annual Meeting.

Iannuzzi, T., L. Fontenot, and M. Adkins. 2011. Sediment quality triad assessment to support remedy development for an estuarine system adjacent to a former wood treatment site. Railroad Environmental Conference, University of Illinois at Urbana-Champaign, IL. October 25.

Fontenot, L., and J. Ellis. 2011. RECAP overview and technical approaches. Presented to CenterPoint Energy, Shipley Snell Montgomery, LLP, and Taylor, Porter, Brooks & Phillips L.L.P. September 26.

Fontenot, L.W., J. Ellis, and G. Cramer. 2010. Utilization of RECAP for legacy oil field sites: Technical approaches and draft LDNR guidance for Site Evaluation and Remediation Procedures (SERP). Louisiana Solid Waste Association 30th Annual Conference, Lafayette, LA. March 24–26.

Sager, S., K. Baker, J.R. Clarkson, H. Hayward, L. Yu, L. Fontenot, C. Day, and B. Locey. 2009. Evolving strategies for integration of human health and ecological risk assessment in the United States and the United Kingdom. Society of Environmental Toxicology and Chemistry North America 30th Annual Meeting, New Orleans, LA. November 19–23.

Fontenot, L.W., T.S. Isacks, and M.M. Fontenot, Jr. 1999. Toxicity assessment and development of risk-based remediation goals for *o*-toluidine and 5-chloroaminotoluene. Air & Waste Management Association, Fall Environmental Conference, RECAP/Risk Assessment Session, Baton Rouge, LA. November 8.

Fontenot, L.W. 1999. Assessing effects of pesticides on amphibian populations in Louisiana. Society of Environmental Toxicology and Chemistry, South Central Chapter Meeting, Houston, TX. April 12–13.

Fontenot, L.W., T.A. Ayers, C.H. Day, S.B. Ellingson, and S.L. Sager. 1998. Ecological risk assessment of endocrine-disrupting chemicals to amphibians. ASTM Eighth Symposium on Environmental Toxicology and Risk Assessment: Standardization of Biomarkers for Endocrine Disruption and Environmental Assessment, Atlanta, GA. April 20–22.

Fontenot, L.W. 1997. A phased approach for evaluation of contaminated sediments: Applications for ecological risk assessment. Society of Environmental Toxicology and Chemistry, Southeastern Chapter Meeting, Pensacola, FL. May 8–10.

Fontenot, L.W. 1996. Framework for ecological risk assessment. Louisiana State University Continuing Education Course: Ecotoxicological Risk Assessment, Baton Rouge, LA. February 9.

Fontenot, L.W. 1996. Ecological risk assessment case Study. Louisiana State University Continuing Education Course: Ecotoxicological Risk Assessment, Baton Rouge, LA. February 9.

Fontenot, L.W. 1995. Ecological risk assessment. 5th Annual Conference & Technical Exhibition, The American Society of Environmental Sciences, Lafayette, LA. October 7.

Fontenot, L.W., G.P. Noblet, and G.P. Cobb. 1995. Use of amphibians and reptiles and their parasite communities as bioindicators of environmental contamination. International Congress on Hazardous Waste: Impact on Human and Ecological Health, Atlanta, GA. June 5–8.

Fontenot, L.W., G. Noblet, W. Mashburn, C. Rockett, and R.L. Dickerson. 1995. Effect of Aroclor 1254 exposure on bullfrog (*Rana catesbeiana*) helminth parasite burden and CYP1A1 activity. Annual Meeting of the Association of Southeastern Biologists and the Southeastern Society of Parasitologists, Knoxville, TN. April 20.

Fontenot, L.W., C. Rockett, W. Mashburn, J. Gottschalk, G. Noblet, and R.L. Dickerson. 1995. Effect of Aroclor 1254 exposure on bullfrog (*Rana catesbeiana*) helminth parasite burden and CYP1A1 activity. Annual Meeting of the Society of Toxicology, Baltimore, MD. March 5–9.

Fontenot, L.W., and G.P. Noblet. 1994. A comparison of the helminth parasites of water snakes (*Nerodia sipedon*) from PCB-contaminated and reference localities. Annual Meeting of the Southeastern Society of Parasitologists, Baton Rouge, LA. March 28–30.

Wood, P.D., J. Akins, L.W. Fontenot, P. Silwal, and G.P. Cobb. 1993. Trophic movement of PCBs on hazardous waste sites. Society of Environmental Toxicology and Chemistry, Carolinas SETAC Chapter Meeting, Clemson, SC. May 6–8.

Fontenot, L.W., and G.P. Noblet. 1993. Parasites as bioindicators of toxic pollution: An amphibian model system. Annual Meeting of the Association of Southeastern Biologists and the Southeastern Society of Parasitologists, Virginia Beach, VA. April 14–16.

Fontenot, L.W. 1991. Ecological relationships between helminth parasites and aquatic snakes from Louisiana. North Carolina Herpetological Society Conference and General Meeting, Fall 1991, Raleigh, NC. November 2.

Fontenot, L.W., and W.F. Font. 1990. Helminth communities of aquatic snakes from southeastern Louisiana. Annual Meeting of the Southeastern Society of Parasitologists, Boone, NC. April 10–13.

Fontenot, L.W., and W.F. Font. 1990. Host specificity of the trematode parasites of sympatric aquatic snakes from southeastern Louisiana. Annual Meeting of the Louisiana Academy of Sciences. Baton Rouge, LA. February 1–3.

Fontenot, L.W., and W.F. Font. 1989. Trematode parasites of *Amphiuma tridactylum* and *Siren intermedia* from Louisiana. Annual Meeting of the Louisiana Academy of Sciences, Alexandria, LA. February 2–4.

Fontenot, L.W., and W.F. Font. 1988. Trematode parasites of aquatic snakes from southeastern Louisiana. Annual Meeting of the Southeastern Society of Parasitologists, Clemson, SC. March 30–April 1.

Exhibit I

Alex E. Wesner, P.E.
Vice President

Mr. Wesner is a Senior Project Manager and chemical engineer with extensive experience in the planning, design and construction of municipal membrane water treatment projects. Mr. Wesner has participated in the development of some of the largest full-scale microfiltration and reverse osmosis systems treating potable and reclaimed water supplies for municipal clients. His responsibilities include process design, equipment selection, equipment procurement, detailed piping and instrumentation diagrams, construction, startup and ongoing operations assistance.

Mr. Wesner also has extensive experience with various project delivery methods, including conventional design-bid-build and design-build. He has prepared design-build RFP packages for numerous large scale microfiltration and reverse osmosis systems.

Education:

B.S., Chemical Engineering
University of California at San Diego

Registrations/Certifications:

Professional Engineer, Chemical,
CA-CH5182
NCEES-38993

Professional Affiliations:

AWWA
WateReuse

Employment History:

Separation Processes, Inc.
1995 to Present
Black & Veatch Corp.
1990-1994

Areas of Expertise:

Microfiltration
Reverse Osmosis
Drinking Water
Waste Water Reclamation
Seawater Desalination

Years of Experience:

24

Years with SPI:

19

EXPERIENCE

Water Treatment – Seawater

WEST BASIN MUNICIPAL WATER DISTRICT
Ocean Water Desalination Environment Impact Report, El Segundo, CA (2013-Present)
Design Engineer – This project involves development of an environmental impact report (EIR) for a proposed coastal seawater RO system, from 20-60 mgd capacity. Alex was responsible for components of the project description related to onsite treatment processes, including MF/UF, RO, pre- and post-treatment chemical feed systems. He developed a treatment process flow diagram summarizing primary stream flows and rates of chemical application and waste discharge.

MONTEREY PENINSULA REGIONAL WATER AUTHORITY
Evaluation of Seawater Desalination Projects, Monterey, CA (2012-2013)
Project Manager – The MPRWA is considering support of a planned seawater desalination plant as a replacement regional water supply of either 6 mgd or 9 mgd. Alex performed a comprehensive technical and economic evaluation of three candidate development projects at various locations on the peninsula. He prepared a summary report, presented findings to a public meeting of the MPRWA Board and testified before the California Public Utilities Commission (CPUC).

MONTEREY PENINSULA WATER SUPPLY PROJECT (MPWSP) GOVERNANCE COMMITTEE
Monterey Peninsula Water Supply Project, Monterey, CA (2013-Present)
Technical Advisor – This project involves a planned 6 mgd or 9 mgd seawater RO system to be constructed for California American Water. Alex is providing consulting services to a public-private governance committee. He is providing technical review services related to the proposed treatment facility.

MARINA COAST WATER DISTRICT
Marina Coast Desalination Plant Predesign, Marina, CA (2006-2007)
Project Manager – This project involved preparation of a detailed predesign and cost estimate for a proposed 1.5 mgd seawater desalter in California. Alex was responsible for system process design including RO treatment, energy recovery, and product stabilization systems. He prepared conceptual P&IDs and process equipment layouts, along with text and tables for the final report.

CITY OF SAND CITY
Water Supply Project, Sand City, CA (2007-2008)
Project Manager – This project is a 0.3 mgd seawater desalter incorporating RO for reduction of TDS, with the product water augmenting local potable supplies. Alex was responsible for the detailed process design, P&ID development, and specification of the RO system. Work products were included in a set of procurement documents for solicitation of design-build contractors. He assisted with review of construction progress submittals.

WEST BASIN MUNICIPAL WATER DISTRICT
Seawater Demonstration Project, El Segundo, CA (2007-2011)
Project Manager – This project treats up to 0.7 mgd of Pacific Coast Seawater using UF and RO to demonstrate the treatment processes' ability to reliably and economically produce potable water. Alex was responsible for process design, equipment selection, and preparation of construction documents (drawings and specifications); including a separate pre-procurement package for the UF system which was competitively selected from three pre-qualified vendors.

Water Reclamation

COUNTY SANITATION DISTRICTS OF LOS ANGELES COUNTY
Valencia AWT, Valencia, CA (2015)
Project Manager - Provided guide specifications for RO and universal MF/UF procurement and consulted on proposed 6.5 mgd AWT facility for chloride reduction. SPI also prepared P&IDs for the proposed universal MF/UF system, RO system, and a proprietary closed circuit desalination (CCD) system to support system equipment procurement.

WEST BASIN MUNICIPAL WATER DISTRICT
Carson RWRF Phase II Tesoro Expansion, Carson, CA (2013-Present)
Project Manager-MF/RO System 30% Design – The proposed project will expand supplies of RO and nitrified treated water to the former British Petroleum (now Tesoro) refinery in Carson, CA. Services included preparation of 30 percent documents for the planned expansions of MF and RO facilities, including drawings, technical specifications, and cost estimates.

WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA
Leo J. Vander Lans Expansion, Long Beach, CA (2011-2015)
Project Manager – Developed a 5 mgd design of the facility from 3 mgd to 8 mgd without increasing the waste discharge volume. Project included a high recovery 3rd stage RO system, and backwash treatment and recovery systems. Developed detailed pilot study plan for 12 gfd flux increase and the third stage RO system which uses a first of its kind forward and reversing RO train to control scaling across the third stage. Also participated in facility startup and demonstration testing as well as operator training.

SOUTH COAST WATER DISTRICT
Aliso Creek Urban Runoff Recovery, Reuse and Conservation Project, Aliso Creek, CA (2011-2014)
Project Manager – This project seeks to reduce the TDS of up to 2.0 mgd of recycled water through blending with 350 gpm of demineralized RO product water. Alex prepared a predesign and technical memorandum for a proposed 350 gpm MF-RO system capable of treating water from Aliso Creek or secondary effluent. He assisted with the preparation of procurement documents for design-build (DB) contractors as well as evaluated bids from DB teams. He provided support during DB design and construction phase.

MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY
Monterey Peninsula Groundwater Replenishment Project, Monterey, CA (2011-Present)
Project Manager – The project is being developed to reclaim wastewater to provide a new source of potable water to the region under the new 2011 draft groundwater recharge regulations from CDPH. Alex developed a feasibility study for a 4.4, 5 and 6 mgd MF, RO and UVAOP facility.

Exhibit AR-4

Texas Commission on Environmental Quality
TCEQ Industrial Wastewater Permit Application
Port of Corpus Christi Authority of Nueces County
Proposed Desalination Plant
Harbor Island

Table of Contents

Administrative Report

Attachments:

1. Payment Voucher
2. Core Data Form
3. Original USGS Quadrangle Map
4. Affected Landowners Map
5. Landowner Disk
6. Photographic Log and Photograph Location Map

Supplemental Permit Information Form (SPIF)

Attachment:

7. USGS Quadrangle Map

Payment Submittal Form

Technical Report

Attachments:

8. Process Design Basis and Narrative
9. Facility Map

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

TCEQ INDUSTRIAL WASTEWATER PERMIT APPLICATION

INDUSTRIAL ADMINISTRATIVE REPORT

Complete and submit this checklist with the application.

APPLICANT: Port of Corpus Christi Authority of Nueces County

PERMIT NUMBER: N/A

Indicate if each of the following items is included in your application.

	Y	N		Y	N
Administrative Report 1.0	☒	☐	Worksheet 8.0	☐	☒
Administrative Report 1.1	☒	☐	Worksheet 9.0	☐	☒
SPIF	☒	☐	Worksheet 10.0	☐	☒
Core Data Form	☒	☐	Worksheet 11.0	☐	☒
Technical Report 1.0	☒	☐	Worksheet 11.1	☐	☒
Worksheet 1.0	☐	☒	Worksheet 11.2	☐	☒
Worksheet 2.0	☒	☐	Worksheet 11.3	☐	☒
Worksheet 3.0	☐	☒	Original USGS Map	☒	☐
Worksheet 3.1	☐	☒	Affected Landowners Map	☒	☐
Worksheet 3.2	☐	☒	Landowner Disk or Labels	☒	☐
Worksheet 3.3	☐	☒	Flow Diagram	☒	☐
Worksheet 4.0	☒	☐	Site Drawing	☒	☐
Worksheet 4.1	☐	☒	Original Photographs	☒	☐
Worksheet 5.0	☐	☒	Solids Management Program	☐	☒
Worksheet 6.0	☐	☒	Water Balance	☒	☐
Worksheet 7.0	☐	☒			

RECEIVED
MAR 0 7 2018
WATER QUALITY DIVISION
Applications Team
Hand Delivery
Lam K. Thomas

For Commission Use Only:
Segment Number: _____ County: _____ Expiration Date: _____
Proposed/Current Permit Number: _____ Region: _____

INDUSTRIAL ADMINISTRATIVE REPORT 1.0

The following information **is required** for **all** applications—renewals, new, and amendments.

1. TYPE OF APPLICATION AND FEES (Instructions, Page 21)

Permit No.: N/A

EPA ID No.: N/A

- ☒ New TPDES permit
- ☐ New TLAP permit
- ☐ Major Amendment with Renewal
- ☐ Major Amendment without Renewal
- ☐ Renewal of existing permit
- ☐ Stormwater only discharge
- ☐ Minor Amendment to permit
- ☐ Minor modification to permit

If applying for an **amendment** or modification of a permit, please describe the request in detail.

N/A

Please indicate by a check mark the amount submitted for the application fee:

EPA Classification	New	Major Amendment (With or Without Renewal)	Renewal Only	Minor Amendment/ Minor Modification
Minor facility not subject to EPA categorical effluent guidelines (*40 CFR Parts 400-471*)	☒ $350	☐ $350	☐ $315	☐ $150
Minor facility subject to EPA categorical effluent guidelines (*40 CFR Parts 400-471*)	☐ $1,250	☐ $1,250	☐ $1,215	☐ $150
Major facility	N/A *	☐ $2,050	☐ $2,015	☐ $450

* All facilities are designated as minors until formally classified as a major by EPA.

Payment Information:

Mailed Check or Money Order Number: Click here to enter text.

Check or Money Order Amount: Click here to enter text.

Named Printed on Check or Money Order: Click here to enter text.

EPAY Voucher Number: 358549/358550

Copy of Voucher Enclosed? ☒ Yes

Attachment: 1

2. APPLICANT INFORMATION (Instructions, Pages 21-22)

a. Facility Owner

(Owner of the facility must apply for the permit.)

What is the Legal Name of the entity (applicant) applying for this permit?

Port of Corpus Christi Authority of Nueces County

(The legal name must be spelled exactly as filed with the Texas Secretary of State, County, or in the legal documents forming the entity.)

If the applicant is currently a customer with the TCEQ, what is the Customer Number (CN)? You may search for your CN on the TCEQ website at http://www15.tceq.texas.gov/crpub/index.cfm?fuseaction=cust.CustSearch

CN: 600885248

What is the name and title of the person signing the application? The person must be an executive official meeting signatory requirements in *30 TAC § 305.44*.

First/Last Name: ~~John P. LaRue~~ Sean Strawbridge

Title: ~~Executive Director~~ Chief Executive Officer Credential:

b. Co-applicant Information

What is the Legal Name of the co-applicant applying for this permit?

N/A

(The legal name must be spelled exactly as filed with the TX SOS, with the County, or in the legal documents forming the entity.)

If the co-applicant is currently a customer with the TCEQ, what is the Customer Number (CN)? You may search for your CN on the TCEQ website at http://www15.tceq.texas.gov/crpub/index.cfm?fuseaction=cust.CustSearch:

CN: N/A

What is the name and title of the person signing the application? The person must be an executive official meeting signatory requirements in *30 TAC § 305.44*.

First/Last Name: N/A

Title: N/A Credential: N/A

Provide a brief description of the need for a co-permittee:

N/A

c. Core Data Form

Complete the Core Data Form for each customer and include as an attachment. If the customer type selected on the Core Data Form is **Individual**, complete **Attachment 1** of Administrative Report 1.0.

Attachment: 2

3. APPLICATION CONTACT INFORMATION (Instructions, Page 22)

If the TCEQ needs additional information regarding this application, who should be contacted?

a. First/Last Name: Sarah L. Garza Credential: Click here to enter text.
Organization Name: Port of Corpus Christi Authority Title: Director Environmental Planning
Mailing Address: P.O. Box 1541
City: Corpus Christi State: Texas ZIP Code: 78403
Phone No.: 361-885-6163 Ext.: Click here to enter text. Fax No.: Click here to enter text.
E-mail Address: sarah@pocca.com
Check one or both: ☒ Administrative Contact ☒ Technical Contact

b. First/Last Name: ~~David R. Hoffman~~ N/A Credential: ~~Agent~~
Organization Name: ~~Amec Foster Wheeler E&I, Inc.~~ Title: ~~Vice President~~
Mailing Address: ~~585 N. Dairy Ashford Road~~
City: ~~Houston~~ State: ~~Texas~~ ZIP Code: ~~77079~~
Phone No.: ~~713-579-1016~~ Ext.: ~~N/A~~ Fax No.: ~~N/A~~
E-mail Address: ~~david.hoffman@amecfw.com~~
Check one or both: ☒ ~~Administrative Contact~~ ☒ ~~Technical Contact~~

Attachment: N/A

4. PERMIT CONTACT INFORMATION (Instructions, Page 22)

Provide two names of individuals that can be contacted throughout the permit term.

a. First/Last Name: ~~John P. LaRue~~ Sean Strawbridge Credential: N/A
Organization Name: Port of Corpus Christi Authority Title: ~~Executive Director~~ Chief Executive Officer
Mailing Address: P.O. Box 1541
City: Corpus Christi State: Texas ZIP Code: 78403
Phone No.: 361-882-5633 Ext.: N/A Fax No.: N/A
E-mail Address: ~~john@pocca.com~~ sstrawbridge@pocca.com

b. First/Last Name: ~~Sean Strawbridge~~ Sarah L. Garza Credential: N/A
Organization Name: Port of Corpus Christi Authority Title: ~~Deputy Director and COO~~ Director of Environmental Planning
Mailing Address: P.O. Box 1541
City: Corpus Christi State: Texas ZIP Code: 78403
361-885-6163
Phone No.: ~~361-882-5633~~ Ext.: N/A Fax No.: N/A
E-mail Address: ~~sstrawbridge~~@pocca.com sarah@pocca.com
Attachment: N/A

5. BILLING CONTACT INFORMATION(Instructions, Page 22)

The permittee is responsible for paying the annual fee. The annual fee will be assessed to permits **in effect on September 1 of each year**. *The TCEQ will send a bill to the address provided in this section. The permittee is responsible for terminating the permit when it is no longer needed (using form TCEQ-20029).*

First/Last Name: Sarah L. Garza Credential: Click here to enter text.

Organization Name: Port of Corpus Christi Authority Title: Director Environmental Planning

Mailing Address: PO Box 1541

City: Corpus Christi State: Texas ZIP Code: 78403

Phone No.: (361) 885-6163 Ext.: Click here to enter text. Fax No.: (361) 881-5161

E-mail Address: sarah@pocca.com

6. DMR/MER CONTACT INFORMATION (Instructions, Pages 22-23)

Provide the name and complete mailing address of the person delegated to receive and submit Discharge Monitoring Reports (EPA 3320-1) or Monthly Effluent Reports.

First/Last Name: Sarah L. Garza Credential: Click here to enter text.

Organization Name: Port of Corpus Christi Authority Title: Director Environmental Planning

Mailing Address: PO Box 1541

City: Corpus Christi State: Texas ZIP Code: 78403

Phone No.: (361) 885-6163 Ext.: Click here to enter text. Fax No.: (361) 881-5161

E-mail Address: sarah@pocca.com

You can submit DMR data on the TCEQ website at https://www.tceq.texas.gov/field/netdmr/netdmr.html. Establish an electronic reporting account with the permit number.

7. NOTICE INFORMATION (Instructions, Pages 23-24)

a. Individual Publishing the Notices

First/Last Name: Sarah L. Garza Credential: Click here to enter text.

Organization Name: Port of Corpus Christi Authority Title: Director Environmental Planning

Mailing Address: PO Box 1541

City: Corpus Christi State: Texas ZIP Code: 78403

Phone No.: (361) 885-6163 Ext.: Click here to enter text. Fax No.: (361) 881-5161

E-mail Address: sarah@pocca.com

b. Method for Receiving Notice of Receipt and Intent to Obtain a Water Quality Permit Package

Indicate by a check mark the preferred method for receiving the first notice and instructions:

☒ E-mail Address:

☐ Fax No.:

☒ Regular Mail:

Mailing Address: PO Box 1541

City: Corpus Christi State: Texas ZIP Code: 78403

Phone No.: (361) 885-6163 Ext.: Click here to enter text. Fax: (361) 881-5161

c. Contact in the Notice

First/Last Name: Sarah L. Garza Credential: Click here to enter text.

Organization Name: Port of Corpus Christi Authority Title: Director Environmental Planning

Phone No.: (361) 885-6163 Ext.: Click here to enter text. E-mail: sarah@pocca.com

d. Public Place Information

If the facility or outfall is located in more than one county, a public viewing place for each county must be provided.

Public building name: La Retama Central Library

Location within the building: Reference Shelf

Physical Address of Building: 805 Comanche

City: Corpus Christi County: Nueces

Contact Name: Russell Beard

Phone No.: 361-826-7000 Ext.: Click here to enter text.

e. Bilingual Notice Requirements:

This information **is required** for **new, major amendment, and renewal applications**. It is not required for minor amendment or minor modification applications.

This section of the application is only used to determine if alternative language notices will be needed. Complete instructions on publishing the alternative language notices will be in your public notice package.

Please call the bilingual/ESL coordinator at the nearest elementary and middle schools and obtain the following information to determine whether an alternative language notices are required.

1. Is a bilingual education program required by the Texas Education Code at the elementary or middle school nearest to the facility or proposed facility?

   ☐ Yes ☒ No

   If **no**, publication of an alternative language notice is not required; **skip to** Item 8 (REGULATED ENTITY AND PERMITTED SITE INFORMATION.)

2. Are the students who attend either the elementary school or the middle school enrolled in a bilingual education program at that school?

   ☐ Yes ☐ No

3. Do the students at these schools attend a bilingual education program at another location?

   ☐ Yes ☐ No

4. Would the school be required to provide a bilingual education program but the school has waived out of this requirement under 19 TAC §89.1205(g)?

   ☐ Yes ☐ No

5. If the answer is yes to question 1, 2, 3, or 4, public notices in an alternative language are required. Which language is required by the bilingual program? Click here to enter text

8. REGULATED ENTITY AND PERMITTED SITE INFORMATION (Instructions Pages 24-26)

If the site of your business is part of a larger business site, a Regulated Entity Number (RN) may already be assigned for the larger site. Use the RN assigned for the larger site. Search the TCEQ's Central Registry at http://www15.tceq.texas.gov/crpub/index.cfm?fuseaction=regent.RNSearch to determine the RN or to see if the larger site may already be registered as a regulated site:

If the site is found, provide the assigned Regulated Entity Number and provide the information for the site to be authorized through this application below. The site information for this authorization may vary from the larger site information.

TCEQ issued Regulated Entity Number (RN): **RN** 105622112

a. State/TPDES Permit No.: Click here to enter text Expiration Date: Click here to enter text

   EPA Identification No. (TPDES Permits only): TX Click here to enter text

b. Name of project or site (the name known by the community where located): Harbor Island

c. Is the location address of the facility in the existing permit the same?

   ☒ Yes ☐ No

d. If the facility is located in Bexar, Comal, Hays, Kinney, Medina, Travis, Uvalde, or Williamson County, additional information concerning protection of the Edwards Aquifer may be required.

e. Owner of treatment facility: Port of Corpus Christi

   Ownership of Facility: ☐ Public ☐ Private ☒ Both ☐ Federal

f. Owner of land where treatment facility is or will be:

   First/Last Name: Port of Corpus Christi Authority

   Mailing Address: PO Box 1541

   City: Corpus Christi State: Texas ZIP Code: 78403

   Phone No.: 361-885-6163 E-mail Address: sarah@pocca.com

If not the same as the facility owner, there must be a long-term lease agreement in effect for at least six years. In some cases, a lease may not suffice - see instructions.

Attachment: N/A

g. Owner of effluent disposal site:

First/Last Name: N/A

Mailing Address: N/A

City: N/A State: N/A ZIP Code: N/A

Phone No.: N/A E-mail Address: N/A

If not the same as the facility owner, there must be a long-term lease agreement in effect for at least six years.

Attachment: N/A

h. Owner of sewage sludge disposal site:

First/Last Name: N/A

Mailing Address: N/A

City: N/A State: N/A ZIP Code: N/A

Phone No.: N/A E-mail Address: N/A

If not the same as the facility owner, there must be a long-term lease agreement in effect for at least six years.

Attachment: N/A

(This information is required only if authorization is sought in the permit for sludge disposal on property owned or controlled by the applicant.)

9. DISCHARGE/ DISPOSAL INFORMATION (Instructions, Pages 26-28)

a. Is the facility located on or does the treated effluent cross American Indian Land?

☐ Yes ☒ No

b. Provide an **original** full size USGS Topographic Map with all required information. Indicate by a check mark that the following information is provided.

☒ Applicant's property boundary

☒ Treatment facility boundaries

☒ Labeled point(s) of discharge and highlighted discharge route(s)

☐ Sewage sludge disposal site

☐ Effluent disposal site boundaries

☒ New and future construction

☒ One-mile radius and three-miles downstream information

☐ All ponds

c. Is the location of the sewage sludge disposal site in the existing permit accurate?

☐ Yes ☐ No

If **no**, **or a new permit application**, please give an accurate description:

N/A

d. Are the point(s) of discharge and the discharge route(s) in the existing permit correct?

☒ Yes ☐ No

If **no**, **or a new or amendment permit application**, provide an accurate description:

This is a new permit application. The discharge route is via an HDPE pipeline to a multi-port diffuser approximately ~~300~~ 229 ft off shore on the south side of Harbor Island in Corpus Christi Channel (Segment 2481). From this point, the discharge is tidal, and will flow either into the Gulf of Mexico via Aransas Pass or through the Corpus Christi Channel toward Corpus Christ Bay.

e. City nearest the outfall(s): Port Aransas

f. County in which the outfalls(s) is/are located: Nueces

g. Outfall Latitude: ~~27.503882°~~ 27.844412 Longitude: ~~-97.034908°~~ -97.063602

h. Is or will the treated wastewater discharge to a city, county, or state highway right-of-way, or a flood control district drainage ditch?

☐ Yes ☒ No

If **yes**, indicate by a check mark if:

☐ Authorization granted ☐ Authorization pending

For **new and amendment** applications, provide copies of letters that show proof of contact and the approval letter upon receipt.

Attachment: N/A

i. For all applications involving an average daily discharge of 5 MGD or more, provide the names of all counties located within 100 statute miles downstream of the point(s) of discharge.

N/A – The point of discharge is Corpus Christi Channel. No counties are located downstream of the point of discharge.

Ship

j. For TLAPs, is the location of the effluent disposal site in the existing permit accurate?

☐ Yes ☐ No

If **no, or a new or amendment permit application**, provide an accurate description:

N/A

k. City nearest the disposal site: N/A

l. County in which the disposal site is located: N/A

m. Disposal Site Latitude: N/A Longitude: N/A

n. For **TLAPs**, describe the routing of effluent from the treatment facility to the disposal site:

N/A

o. For **TLAPs**, please identify the nearest watercourse to the disposal site to which rainfall runoff might flow if not contained:

N/A

10. MISCELLANEOUS INFORMATION (Instructions, Pages 28-29)

a. Did any person formerly employed by the TCEQ represent your company and gert paid for service regarding this application?

☐ Yes ☒ No

List each person formerly employed by the TCEQ who represented your company and was paid for service regarding the application:

N/A

b. Do you owe any fees to the TCEQ?

☐ Yes ☒ No

If **yes**, provide the following information:

Account number: N/A Amount past due: N/A

c. Do you owe any penalties to the TCEQ?

☐ Yes ☒ No

If **yes**, please provide the following information:

Enforcement order number: N/A Amount past due: N/A

11. SIGNATURE PAGE (Instructions, Page29)

Permit Number:

Applicant:

Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code §305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signatory name (typed or printed): ~~John P. LaRue~~ Sean Strawbridge

Signatory title: ~~Executive Director~~ Chief Executive Officer

Signature: _____ Date: MAR 05 2018

(Use blue ink)

Signature and Notary to be Replaced

Subscribed and Sworn to before me by the said John LaRue

on this 5th day of March, 20 18.

My commission expires on the 29 day of July, 20 18.

Notary Public

LESLYE LILIANA CAVAZOS
Notary Public, State of Texas
Comm. Expires 07-29-2018
Notary ID 129900160

[SEAL]

Nueces
County, Texas

If co-applicants are necessary, each entity must submit an original, separate signature page.

INDUSTRIAL ADMINISTRATIVE REPORT 1.1

The following information is required for new and amendment applications.

1. AFFECTED LANDOWNER INFORMATION (Instructions, Pages 30-32)

a. Indicate by a check mark that the landowners map or drawing, with scale, includes the following information, as applicable.

- ☒ The applicant's property boundaries
- ☒ The facility site boundaries within the applicant's property boundaries
- ☒ The distance the buffer zone falls into adjacent properties and the property boundaries of the landowners located within the buffer zone
- ☒ The property boundaries of all landowners surrounding the applicant's property (Note: if the application is a major amendment for a lignite mine, the map must include the property boundaries of all landowners adjacent to the new facility (ponds).)
- ☒ The point(s) of discharge and highlighted discharge route(s) clearly shown for one mile downstream
- ☒ The property boundaries of the landowners located on both sides of the discharge route for one full stream mile downstream of the point of discharge
- ☒ The property boundaries of the landowners along the watercourse for a one-half mile radius from the point of discharge if the point of discharge is into a lake, bay, estuary, or affected by tides
- ☐ The boundaries of the effluent disposal site (for example, irrigation area or subsurface drainfield site) and all evaporation/holding ponds within the applicant's property
- ☐ The property boundaries of all landowners surrounding the applicant's property boundaries where the effluent disposal site is located
- ☐ The boundaries of the sludge land application site (for land application of sewage sludge for beneficial use) and the property boundaries of landowners surrounding the applicant's property boundaries where the sewage sludge land application site is located
- ☐ The property boundaries of landowners within one-half mile in all directions from the applicant's property boundaries where the sewage sludge disposal site (for example, sludge surface disposal site or sludge monofill) is located

b. Indicate by a check mark in which format the landowners list is submitted:

☒ Readable/Writeable CD ☐ Four sets of labels

c. ☒ Indicate by a check mark that a separate list with the landowners' names and mailing addresses cross-referenced to the landowners map has been provided.

d. Provide the source of the landowners' names and mailing addresses: Nueces County Appraisal District

e. As required by *Texas Water Code § 5.115*, is any permanent school fund land affected by this application?

☐ Yes ☒ No

f. If **yes**, provide the location and foreseeable impacts and effects this application has on the land(s):

N/A

2. ORIGINAL PHOTOGRAPHS (Instructions, Page 32)

Provide original ground level photographs. Indicate with checkmarks that the following information is provided.

☒ At least one original photograph of the new or expanded treatment unit location

☒ At least two photographs of the existing/proposed point of discharge and as much area downstream (photo 1) and upstream (photo 2) as can be captured. If the discharge is to an open water body (e.g., lake, bay), the point of discharge should be in the right or left edge of each photograph showing the open water and with as much area on each respective side of the discharge as can be captured.

☐ At least one photograph of the existing/proposed effluent disposal site

☒ A plot plan or map showing the location and direction of each photograph

ATTACHMENT 1

Payment Voucher

TCEQ ePay Receipt

Transaction Information

Trace Number:	582EA000291959
Date:	03/06/2018 04:42 PM
Payment Method:	ACH - Authorization 0000000000
Amount:	$1,250.00
ePay Actor:	Sarah Garza

Payment Contact Information

Name:	Sarah Garza
Company:	Port Of Corpus Christi
Address:	Po Box 1541, Corpus Christi, TX 78403
Phone:	361-885-6163

Cart Items

Voucher	Fee Description	AR Number	Amount
358549	WW PERMIT - MINOR FACILITY SUBJECT TO 40 CFR 400-471 - NEW		$1,200.00
358550	30 TAC 305.53B WQ NOTIFICATION FEE		$50.00

TCEQ ePay Voucher Receipt

Transaction Information

Voucher Number:	358549
Trace Number:	582EA000291959
Date:	03/06/2018 04:42 PM
Payment Method:	ACH - Authorization 0000000000
Amount:	$1,200.00
Fee Type:	WW PERMIT - MINOR FACILITY SUBJECT TO 40 CFR 400-471 - NEW
ePay Actor:	Sarah Garza

Payment Contact Information

Name:	Sarah Garza
Company:	Port Of Corpus Christi
Address:	Po Box 1541, Corpus Christi, TX 78403
Phone:	361-885-6163

Site Information

Site Name:	HARBOR ISLAND PROPERTY - FORMER FINA TANK FARM
Site Location:	PROPERTY ADJACENT TO HIGHWAY 361 AND FERRY LANDING TO THE NORTHWEST

Customer Information

Customer Name:	PORT OF CORPUS CHRISTI OF NUECES COUNTY
Customer Address:	PO BOX 1541, CORPUS CHRISTI, TX 78403

TCEQ ePay Voucher Receipt

Transaction Information

Voucher Number:	358550
Trace Number:	582EA000291959
Date:	03/06/2018 04:42 PM
Payment Method:	ACH - Authorization 0000000000
Amount:	$50.00
Fee Type:	30 TAC 305.53B WQ NOTIFICATION FEE
ePay Actor:	Sarah Garza

Payment Contact Information

Name:	Sarah Garza
Company:	Port Of Corpus Christi
Address:	Po Box 1541, Corpus Christi, TX 78403
Phone:	361-885-6163

ATTACHMENT 2

Core Data Form

TCEQ Core Data Form

TCEQ Use Only

For detailed instructions regarding completion of this form, please read the Core Data Form Instructions or call 512-239-5175.

SECTION I: General Information

1. Reason for Submission (If other is checked please describe in space provided.)

☒ New Permit, Registration or Authorization (Core Data Form should be submitted with the program application.)

☐ Renewal (Core Data Form should be submitted with the renewal form) ☐ Other

2. Customer Reference Number (if issued)	Follow this link to search for CN or RN numbers in Central Registry**	3. Regulated Entity Reference Number (if issued)
CN 600885248		RN 105622122

SECTION II: Customer Information

4. General Customer Information	5. Effective Date for Customer Information Updates (mm/dd/yyyy)	4/25/2018

☐ New Customer ☒ Update to Customer Information ☐ Change in Regulated Entity Ownership
☐ Change in Legal Name (Verifiable with the Texas Secretary of State or Texas Comptroller of Public Accounts)

The Customer Name submitted here may be updated automatically based on what is current and active with the Texas Secretary of State (SOS) or Texas Comptroller of Public Accounts (CPA).

6. Customer Legal Name (If an individual, print last name first: e.g.: Doe, John)	If new Customer, enter previous Customer below:
Port Of Corpus Christi Authority Of Nueces County	

7. TX SOS/CPA Filing Number	8. TX State Tax ID (11 digits)	9. Federal Tax ID (9 digits)	10. DUNS Number (if applicable)
NA	74-6000609		063069835

11. Type of Customer:	☐ Corporation	☐ Individual	Partnership: ☐ General ☐ Limited
Government: ☐ City ☐ County ☐ Federal ☐ State ☒ Other		☐ Sole Proprietorship	☐ Other:

12. Number of Employees	13. Independently Owned and Operated?
☐ 0-20 ☐ 21-100 ☒ 101-250 ☐ 251-500 ☐ 501 and higher	☒ Yes ☐ No

14. Customer Role (Proposed or Actual) - as it relates to the Regulated Entity listed on this form. Please check one of the following:

☐ Owner ☐ Operator ☒ Owner & Operator
☐ Occupational Licensee ☐ Responsible Party ☐ Voluntary Cleanup Applicant ☐ Other:

15. Mailing Address:	P.O. Box 1541						
	City	Corpus Christi	State	TX	ZIP	78403	ZIP + 4

16. Country Mailing Information (if outside USA)	17. E-Mail Address (if applicable)
	sarah@pocca.com

18. Telephone Number	19. Extension or Code	20. Fax Number (if applicable)
(361) 885 - 6163		( ) -

SECTION III: Regulated Entity Information

21. General Regulated Entity Information (If "New Regulated Entity" is selected below this form should be accompanied by a permit application)

☐ New Regulated Entity ☐ Update to Regulated Entity Name ☒ Update to Regulated Entity Information

The Regulated Entity Name submitted may be updated in order to meet TCEQ Agency Data Standards (removal of organizational endings such as Inc, LP, or LLC).

22. Regulated Entity Name (Enter name of the site where the regulated action is taking place.)

Harbor Island Property - Former FINA Tank Farm

23. Street Address of the Regulated Entity: (No PO Boxes)							
	City		State		ZIP		ZIP + 4
24. County							

Enter Physical Location Description if no street address is provided.

25. Description to Physical Location:			
26. Nearest City		State	Nearest ZIP Code

27. Latitude (N) In Decimal:			28. Longitude (W) In Decimal:		
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds

29. Primary SIC Code (4 digits)	30. Secondary SIC Code (4 digits)	31. Primary NAICS Code (5 or 6 digits)	32. Secondary NAICS Code (5 or 6 digits)
4491			

33. What is the Primary Business of this entity? (Do not repeat the SIC or NAICS description.)

Loading and Unloading Cargo from and to Vessels, Rail, and Trucks.

34. Mailing Address:							
	City		State		ZIP		ZIP + 4
35. E-Mail Address:	sarah@pocca.com						

36. Telephone Number	37. Extension or Code	38. Fax Number (if applicable)
(361) 885 - 6163		(361) 881 - 5161

39. **TCEQ Programs and ID Numbers** Check all Programs and write in the permits/registration numbers that will be affected by the updates submitted on this form. See the Core Data Form instructions for additional guidance.

☐ Dam Safety	☐ Districts	☐ Edwards Aquifer	☐ Emissions Inventory Air	☐ Industrial Hazardous Waste
☐ Municipal Solid Waste	☐ New Source Review Air	☐ OSSF	☐ Petroleum Storage Tank	☐ PWS
☐ Sludge	☐ Storm Water	☐ Title V Air	☐ Tires	☐ Used Oil
☐ Voluntary Cleanup	☒ Waste Water	☐ Wastewater Agriculture	☐ Water Rights	☐ Other:
	New Permit Application			

SECTION IV: Preparer Information

40. Name: Sarah Garza			41. Title: Director Environmental Planning
42. Telephone Number	43. Ext./Code	44. Fax Number	45. E-Mail Address
(361) 885 - 6163		(361) 881 - 5161	sarah@pocca.com

SECTION V: Authorized Signature

46. By my signature below, I certify, to the best of my knowledge, that the information provided in this form is true and complete, and that I have signature authority to submit this form on behalf of the entity specified in Section II, Field 6 and/or as required for the updates to the ID numbers identified in field 39.

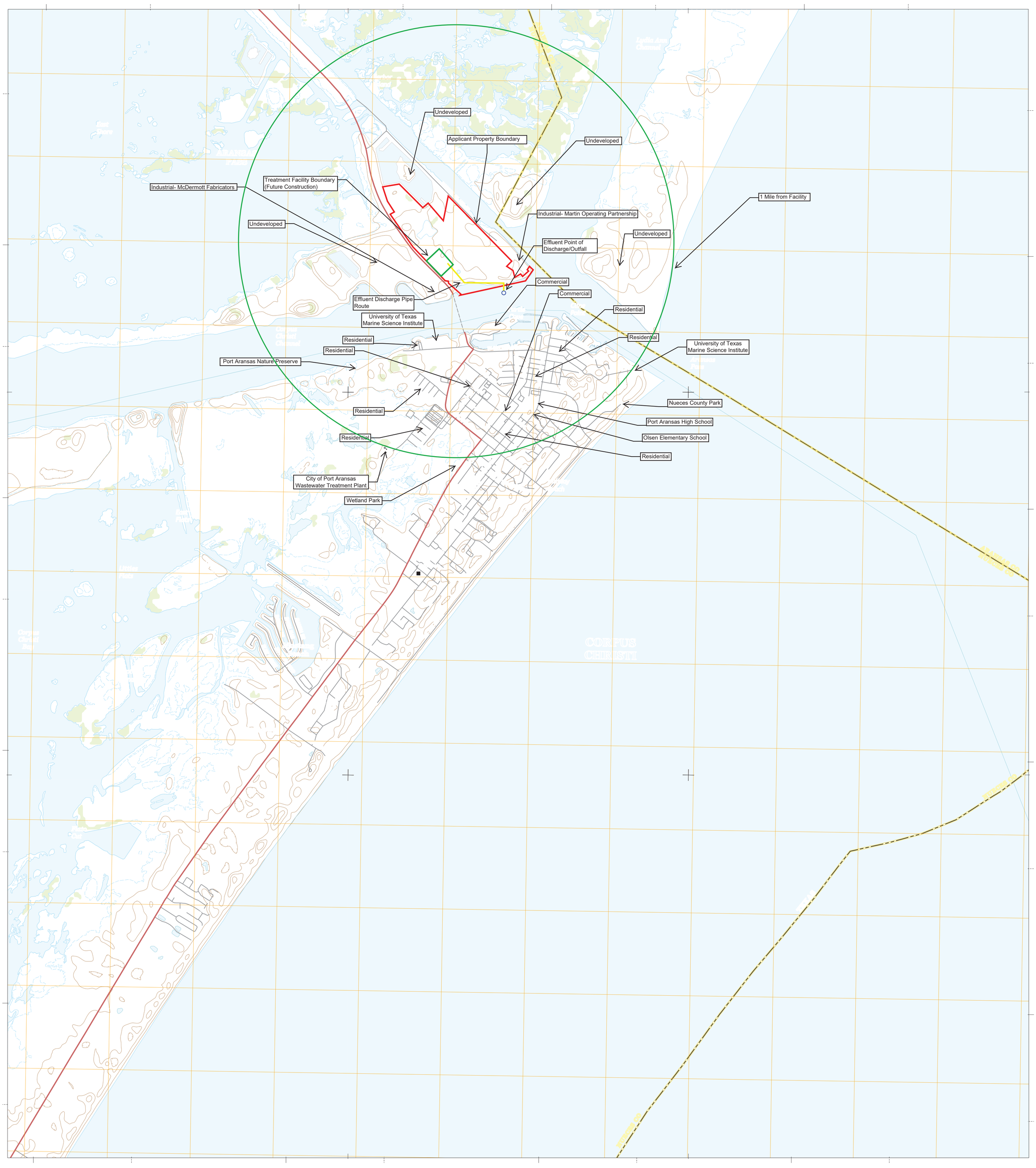
Company:	Port Of Corpus Christi Authority Of Nueces County	Job Title:	Executive Director
Name(*In Print*):	John P LaRue	Phone:	(361) 882 - 5633
Signature:		Date:	MAR 0 5 2018

ATTACHMENT 3

Original USGS Quadrangle Map

USGS
science for a changing world

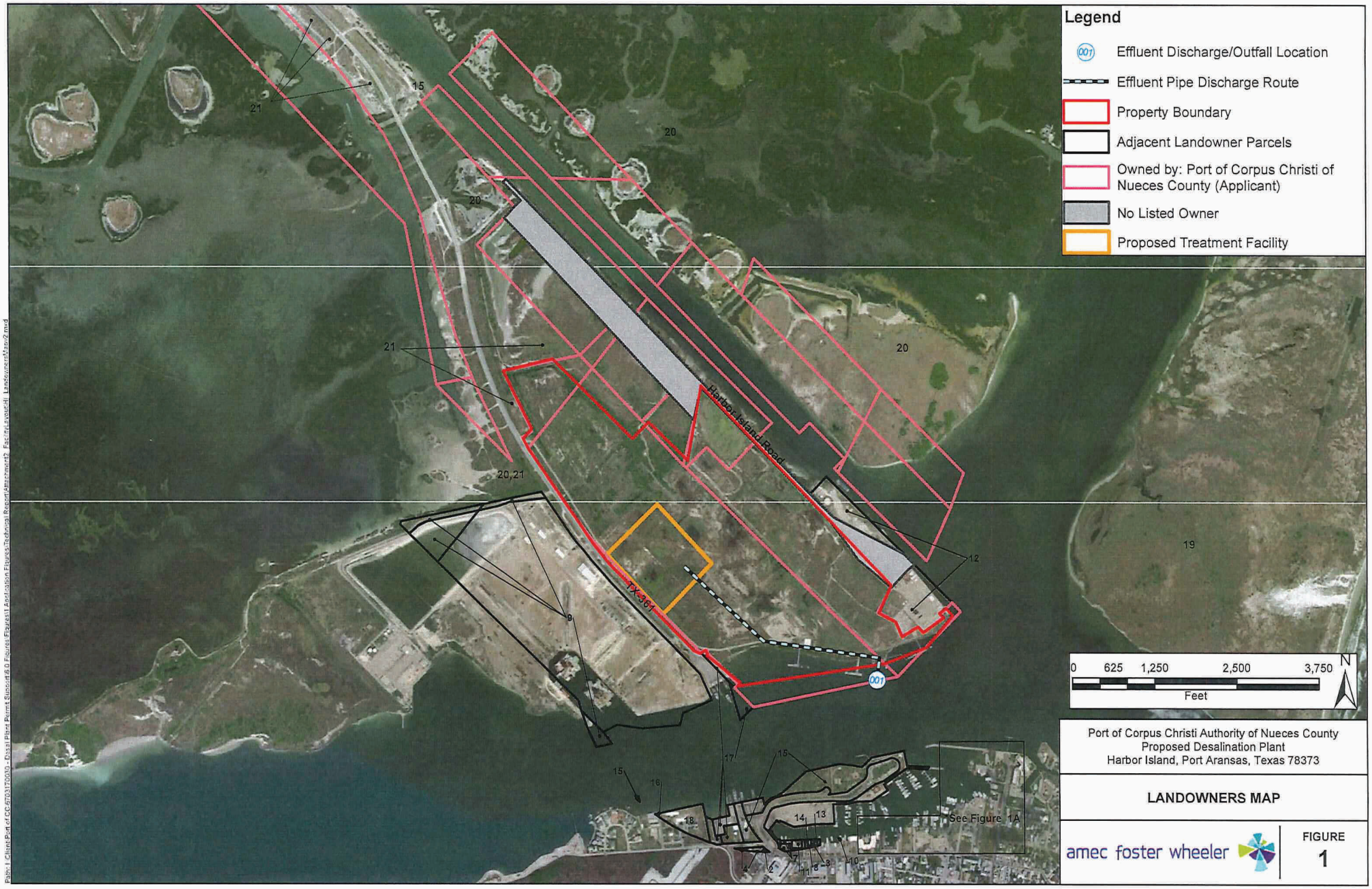
The National Map
US Topo



NSN. 7 6 4 3 0 1 6 3 9 7 7 7 8
NGA REF NO. U S G S X 2 4 K 3 6 0 1 9

ATTACHMENT 4

Affected Landowners Map



Port of Corpus Christi Authority of Nueces County
Proposed Desalination Plant
Harbor Island, Port Aransas, Texas 78373

LANDOWNERS MAP

amec foster wheeler

FIGURE
1

Port of Corpus Christi Authority of Nueces County
Proposed Desalination Plant
Harbor Island, Port Aransas, Texas 78373

LANDOWNERS MAP

amec foster wheeler

FIGURE
1A

ATTACHMENT 5

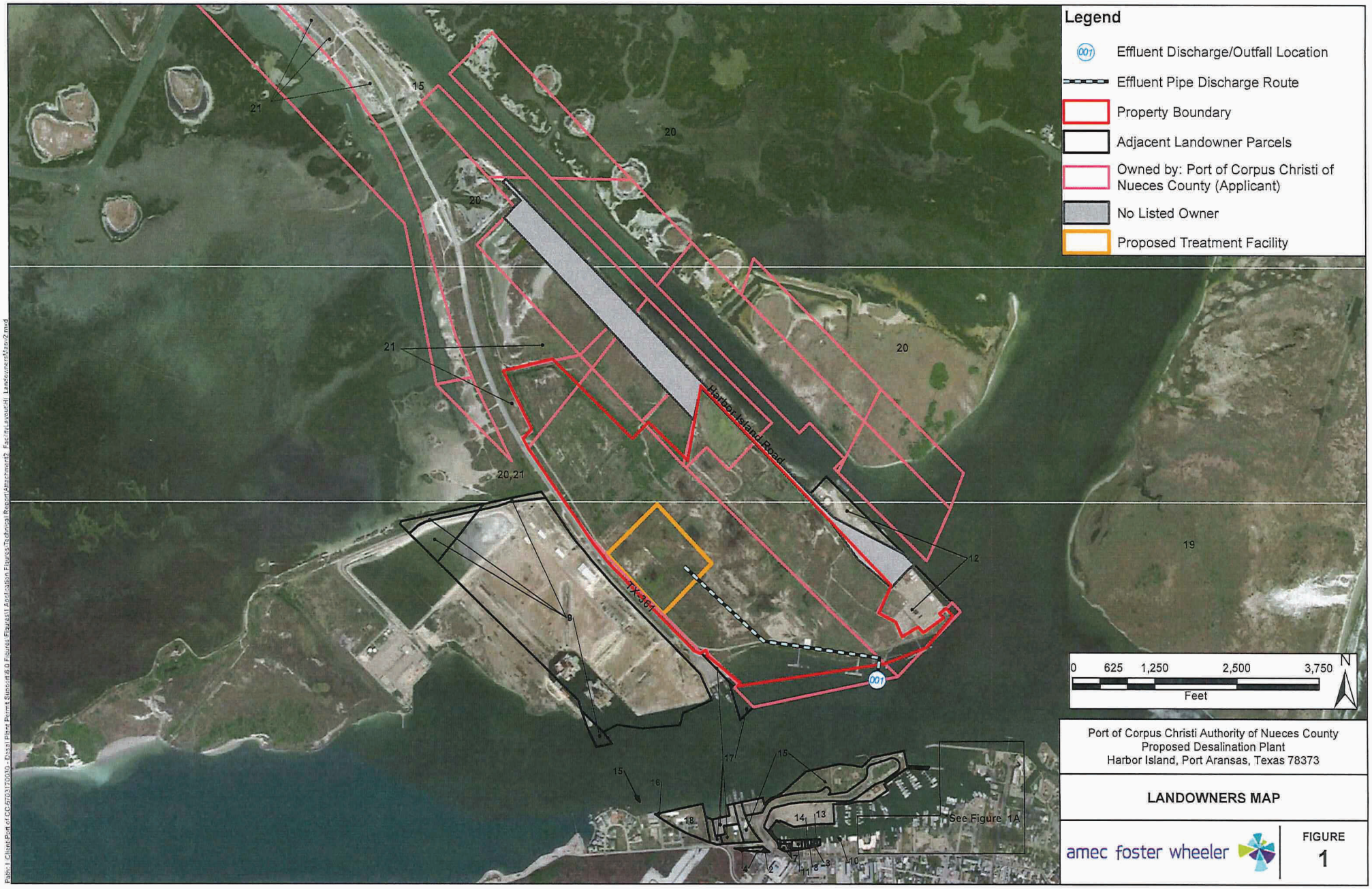
Landowner Disk

Port of Corpus Christi Authority of Nueces County
Proposed Desalination Plant
Harbor Island, Port Aransas, Texas 78373

LANDOWNERS MAP

amec foster wheeler

FIGURE
1A



Port of Corpus Christi Authority of Nueces County
Proposed Desalination Plant
Harbor Island, Port Aransas, Texas 78373

LANDOWNERS MAP

amec foster wheeler

FIGURE
1

Applicant's Name: Port of Corpus Christi of Nueces County
Permit Number: N/A (New Permit Application)

ALVEY MERRI LEE & HUSB JO
PO Box 10
MARBLE FALLS, TX 78654

BARNFAIR PROP/UTOTEM INC
1370 AVE OF AMERICAS
NEW YORK, NY 10019

CAPPS PHYLLIS J
P. O. BOX 1728
PORT ARANSAS, TX 78373

CITY OF PORT ARANSAS
710 W. AVENUE A
PORT ARANSAS, TX 78373

CORPUS CHRISTI LIQUEFACTI
700 MILAM ST #800
HOUSTON, TX 77002

DCD INVESTMENTS INC
5155 FLYNN PKWY STE 500
CORPUS CHRISTI, TX 78411

DEEP SEA PROPERTIES INC
P O BOX 388
PORT ARANSAS, TX 78373

DURHAM JOSEPH
225 S 16th St
LA PORTE, TX 77571

ERF PORT ARANSAS INC
555 N CARANCAHUA ST #700
CORPUS CHRISTI, TX 78401

GULLEYS DIVING SERVICE IN
P O BOX 521
PORT ARANSAS, TX 78373

HOWELL KEVIN T & WF CHRIS
1619 S 2nd St
AUSTIN, TX 78704

MARTIN OPERATING PARTNERS
4900 STONE RD
KILGORE, TX 75662

MILLER CHARLES K AND SHARON M
MILLER WFE
P O BOX 5233
CORPUS CHRISTI, TX 78465

NORTON OWEN A
4003 BUNNY RUN
AUSTIN, TX 78746

PORT OF CORPUS CHRISTI
222 POWER STREET
CORPUS CHRISTI, TX 78401

PORT ARANSAS MARICULTURE
CENTER - TEXAS A&M
1300 PORT ST
CORPUS CHRISTI, TX 78403

STATE OF TEXAS
PO BOX 12608
AUSTIN, TX 78711

UNITED STATES OF AMERICA DEPT
OF INTERIOR
1849 C STREET, N.W.
WASHINGTON, DC 20240

BASS BROTHERS ENTERPRISES,
INC.
201 MAIN STREET, SUITE 2500
FORT WORTH, TX 76102

TX GENERAL LAND OFFICE
1700 CONGRESS AVENUE
AUSTIN, TX 78701

TEXAS DEPARTMENT OF
TRANSPORTATION
125 EAST 11TH ST
AUSTIN, TX 78701

UNITED STATE COAST GUARD.
13411 HILLARD STREET
HOUSTON, TX 77034

PORT A PARASAIL
136 W COTTER AVE
PORT ARANSAS, TX 78373

THE HARBOUR LUXURY
CONDOMINIUMS
235 W COTTER AVE
PORT ARANSAS, TX 78373

"CONDO.1659"
116 W COTTER AVE
PORT ARANSAS, TX 78373

ELLIS WILLIAM R TRUST SUC
309 CAPE ARON DR
CORPUS CHRISTI, TX 78412

FISHERMANS WHARF
PO BOX 387
PORT ARANSAS, TX 78373

URBAN JAMES L & MARK GROS
PO BOX 872
PORT ARANSAS, TX 78373

231 PORT A LLC
203 HUMBLE AVE
SAN ANTONIO, TX 77225

SEUREAU GLENN E TRUSTEE
3214 INWOOD DR
HOUSTON, TX 77019

Applicant's Name: Port of Corpus Christi of Nueces County
Permit Number: N/A (New Permit Application)

BRAMAN RANCHES LLC
PO BOX 400
VICTORIA, TX 77902

EDWARDS & RICHTER LLP
PO BOX 3185
PORT ARANSSAS, TX 78373

MILLER CHARLES & SHARON M
PO BOX 5253
CORPUS CHRISTI, TX 78465

C & F WEIL TRUST ETAL
500 N SHORELINE BLVD STE
CORPUS CHRISTI, TX 78401

SEUREAU GLENN
3214 INWOOD DR
HOUSTON, TX 77019

ABELL REALTY LMTD PARTNER
4608 CRESTWAY DR
AUSTIN, TX 78731

GROSSE RICHARD M ET UX
PO BOX 872
PORT ARANSAS, TX 78373

SHUTTERS PORTA LLC
203 HUMBLE AVE
SAN ANTONIO, TX 78225

231 PORT A LLC
203 HUMBLE AVE
SAN ANTONIO, TX 78225

GUENTHER LIFE INSURANCE T
153 TREELINE PARK
SAN ANTONIO, TX 78209

WATSON-PINBROOK INC
PO BOX 170155
ARLINGTON, TX 76003

MCALLISTER WALTER W III
4940 BROADWAY STE 104
SAN ANTONIO, TX 78209

WOODY'S INC
136 W COTTER
PORT ARANSAS, TX 78373

PORTA CORPORATION
PO BOX 460968
SAN ANTONIO, TX 78246

TURTLE COVE MARINE INC
PO BOX 1909
PORT ARANSAS, TX 78373

SCOTT MICHAEL D & WF CONN
5548 COUNTY ROAD 81
ROBSTOWN, TX 78380

WISE GORDON E ET UX
PO BOX 398
PORT ARANSAS, TX 78373

VAUGHAN BEN F IV AND THE
PO BOX 460968.
SAN ANTONIO, TX 78246

VAUGHAN BEN F III TRUSTEE
PO BOX 460968
SAN ANTONIO, TX 78246

,

,

Cross-Referenced Landowner List

Landowner Number	Name	Address	CITY	STATE	ZIP
1	ALVEY MERRI LEE & HUSB JO	PO Box 10	MARBLE FALLS	TX	78654
2	BARNFAIR PROP/UTOTEM INC	1370 AVE OF AMERICAS	NEW YORK	NY	10019
3	CAPPS PHYLLIS J	P. O. BOX 1728	PORT ARANSAS	TX	78373
4	CITY OF PORT ARANSAS	710 W. AVENUE A	PORT ARANSAS	TX	78373
5	CORPUS CHRISTI LIQUEFACTI	700 Milam St #800	HOUSTON	TX	77002
6	DCD INVESTMENTS INC	5155 FLYNN PKWY STE 500	CORPUS CHRISTI	TX	78411
7	DEEP SEA PROPERTIES INC	P O BOX 388	PORT ARANSAS	TX	78373
8	DURHAM JOSEPH	225 S 16th St	LA PORTE	TX	77571
9	ERF PORT ARANSAS INC	555 N Carancahua St #700	CORPUS CHRISTI	TX	78401
10	GULLEYS DIVING SERVICE IN	P O BOX 521	PORT ARANSAS	TX	78373
11	HOWELL KEVIN T & WF CHRIS	1619 S 2nd St	AUSTIN	TX	78704
12	MARTIN OPERATING PARTNERS	4900 STONE RD	KILGORE	TX	75662
13	MILLER CHARLES K AND SHARON M MILLER WFE	P O BOX 5233	CORPUS CHRISTI	TX	78465
14	NORTON OWEN A	4003 BUNNY RUN	AUSTIN	TX	78746
15	PORT OF CORPUS CHRISTI	222 POWER STREET	CORPUS CHRISTI	TX	78401
16	PORT ARANSAS MARICULTURE CENTER - TEXAS A&M	1300 PORT ST	CORPUS CHRISTI	TX	78403
17	STATE OF TEXAS	PO BOX 12608	AUSTIN	TX	78711
18	UNITED STATES OF AMERICA DEPT OF INTERIOR	1849 C STREET, N.W.	WASHINGTON	DC	20240
19	BASS BROTHERS ENTERPRISES, INC.	201 MAIN STREET, SUITE 2500	FORT WORTH	TX	76102
20	TEXAS GENERAL LAND OFFICE	1700 CONGRESS AVENUE	AUSTIN	TX	78701
21	TXDOT	125 EAST 11TH ST	AUSTIN	TX	78701
23	US COAST GRD	13411 HILLARD ST	HOUSTON	TX	77034
24	PORT A PARASAIL	136 W COTTER AVE	PORT ARANSAS	TX	78373
26	THE HARBOUR LUXURY CONDOMINIUMS	235 W COTTER AVE	PORT ARANSAS	TX	78373
27	CONDO.1659	116 W COTTER AVE	PORT ARANSAS	TX	78373
28	ELLIS WILLIAM R TRUST SUC	309 CAPE ARON DR	CORPUS CHRISTI	TX	78412
29	FISHERMANS WHARF	P O BOX 387	PORT ARANSAS	TX	78373
30	URBAN JAMES L & MARK GROS	P O BOX 872	PORT ARANSAS	TX	78373
31	231 PORT A LLC	203 HUMBLE AVE	SAN ANTONIO	TX	78225
32	SEUREAU GLENN E TRUSTEE	3214 INWOOD DR	HOUSTON	TX	77019
33	BRAMAN RANCHES LLC	PO BOX 400	VICTORIA	TX	77902
34	EDWARDS & RICHTER LLP	P O BOX 3185	PORT ARANSAS	TX	78373

Cross-Referenced Landowner List

35	MILLER CHARLES & SHARON M	PO BOX 5253	CORPUS CHRISTI	TX	78465
36	C & F WEIL TRUST ETAL	500 N SHORELINE BLVD STE	CORPUS CHRISTI	TX	78401
37	SEUREAU GLENN	3214 INWOOD DR	HOUSTON	TX	77019
38	ABELL REALTY LMTD PARTNER	4608 CRESTWAY DR	AUSTIN	TX	78731
39	GROSSE RICHARD M ET UX	BOX 872	PORT ARANSAS	TX	78373
40	SHUTTERS PORTA LLC	203 HUMBLE AVE	SAN ANTONIO	TX	78225
41	231 PORT A LLC	203 HUMBLE AVE	SAN ANTONIO	TX	78225
42	GROSSE RICHARD M ET UX	P.O .BOX 872	PORT ARANSAS	TX	78373
43	GUENTHER LIFE INSURANCE T	153 TREELINE PARK	SAN ANTONIO	TX	78209
44	WATSON-PINBROOK INC	P.O. BOX 170155	ARLINGTON	TX	76003
45	MCALLISTER WALTER W III	4940 BROADWAY STE 104	SAN ANTONIO	TX	78209
46	WOODY'S INC	136 W COTTER	PORT ARANSAS	TX	78373
47	PORTA CORPORATION	PO BOX 460968	SAN ANTONIO	TX	78246
48	TURTLE COVE MARINE INC	P O BOX 1909	PORT ARANSAS	TX	78373
49	GUENTHER LIFE INSURANCE T	153 TREELINE PARK	SAN ANTONIO	TX	78209
50	SCOTT MICHAEL D & WF CONN	5548 COUNTY ROAD 81	ROBSTOWN	TX	78380
37	SEUREAU GLENN	3214 INWOOD DR	HOUSTON	TX	77019
51	WISE GORDON E ET UX	P.O. BOX 398	PORT ARANSAS	TX	78373
40	SHUTTERS PORTA LLC	203 HUMBLE AVE	SAN ANTONIO	TX	78225
52	VAUGHAN BEN F IV AND THE	PO BOX 460968	SAN ANTONIO	TX	78246
52	VAUGHAN BEN F III TRUSTEE	PO BOX 460968	SAN ANTONIO	TX	78246

ATTACHMENT 6

Photographic Log and Photograph Location Map

PHOTO 1:

View looking northeast towards the approximate location of the proposed Treatment Facility.

PHOTO 2:

View looking east towards the approximate location of the proposed Treatment Facility.

PHOTO 3:

View looking southeast along the approximate western boundary of the proposed Treatment Facility.

PHOTO 4:

View looking northwest along the approximate western boundary of the proposed Treatment Facility.

PHOTO 5:

View looking north towards the approximate location of the proposed Treatment Facility.

PHOTO 6:

View looking east along the approximate discharge route.

PHOTO 7:

View looking northeast at the approximate outfall location from Roberts Point Park across the Bay.

PHOTO 8:

View looking northwest at the approximate outfall location from Roberts Point Park across the Bay.

Legend

- Photograph Location and Direction
- Property Boundary
- Discharge Route
- 001 Outfall Location
- Treatment Facility Boundary (Future Construction)

0 250 500 1,000 1,500
Feet

N

Port of Corpus Christi
Proposed Desalination Plant
Harbor Island, Port Aransas, Texas 78373

PHOTOGRAPH LOCATION MAP

ATTACHMENT 3

S-Application 000246

Path: I:\Client\Port of CC\6.0 Figures\Figures1 Application Figures\Technical Report\Attachment2 Facility\Layout\H1 FacilityMap Photo Locs.mxd

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

SUPPLEMENTAL PERMIT INFORMATION FORM (SPIF)

FOR AGENCIES REVIEWING INDUSTRIAL TPDES WASTEWATER PERMIT APPLICATIONS

TCEQ USE ONLY:

Application type: ____Renewal _____Major Amendment _____Minor Amendment _____New

County: _____ Segment Number: _____

Admin Complete Date: _____

Agency Receiving SPIF:

_____ Texas Historical Commission _____ U.S. Fish and Wildlife

_____ Texas Parks and Wildlife Department _____ U.S. Army Corps of Engineers

This form applies to TPDES permit applications only. (Instructions, Page 33)

The SPIF must be completed as a separate document. The TCEQ will mail a copy of the SPIF to each agency as required by the TCEQ agreement with EPA. If any of the items are not completely addressed or further information is needed, you will be contacted to provide the information before the permit is issued. Each item must be completely addressed.

Do not refer to a response of any item in the permit application form. Each attachment must be provided with this form separately from the administrative report of the application. The application will not be declared administratively complete without this form being completed in its entirety including all attachments.

The following applies to all applications:

1. Permittee: Port of Corpus Christi Authority of Nueces County

2. Permit No. WQ00 N/A EPA ID No. TX N/A

3. Address of the project (location description that includes street/highway, city/vicinity, and county):
   Harbor Island, North side of Highway 361 at Ferry Landing, Nueces County

4. Provide the name, address, phone and fax number of an individual that can be contacted to answer specific questions about the property.

   First/Last Name: Sarah L. Garza Credential: N/A

   Organization Name: Port of Corpus Christi Title: Director Environmental Planning

   Mailing Address: PO Box 1541

   City: Corpus Christi State: Texas ZIP Code: 78403

   Phone: 361-885-6163 Fax: N/A E-mail Address: sarah@pocca.com

5. List the county in which the facility is located: Nueces

6. If the property is publicly owned and the owner is different than the permittee/applicant, please list the owner of the property.

N/A

7. Provide a description of the effluent discharge route. The discharge route must follow the flow of effluent from the point of discharge to the nearest major watercourse (from the point of discharge to a classified segment as defined in *30 TAC Chapter 307*). If known, please identify the classified segment number.

This is a new permit application. The discharge route is via an HDPE pipeline to a multi-port diffuser approximately ~~300~~ 229 ft off shore on the south side of Harbor Island in Corpus Christi Channel (Segment 2481). From this point, the discharge is tidal, and will flow either into the Gulf of Mexico via Aransas Pass or through the Corpus Christi Channel toward Corpus Christ Bay.

8. Please provide a separate 7.5-minute USGS quadrangle map with the project boundaries plotted and a general location map showing the project area. Please highlight the discharge route from the point of discharge for a distance of one mile downstream. (This map is required in addition to the map in the administrative report).

9. Provide original photographs of any structures 50 years or older on the property.

10. Does your project involve any of the following? Check all that apply.

- ☒ Proposed access roads, utility lines, construction easements
- ☐ Visual effects that could damage or detract from a historic property's integrity
- ☒ Vibration effects during construction or as a result of project design
- ☐ Additional phases of development that are planned for the future
- ☐ Sealing caves, fractures, sinkholes, other karst features
- ☒ Disturbance of vegetation or wetlands

11. List proposed construction impact (surface acres to be impacted, depth of excavation, sealing of caves, or other karst features):

Construction will impact approximately 33 acres of Harbor Island in a former fuel tank storage area. The discharge pipe will enter Corpus Christi Channel on the southeast side of the island. The pipeline will feed a multiport diffuser oriented parallel to and located approximately ~~300~~ 229 ft off the shoreline.

12. Describe existing disturbances, vegetation, and land use:

The property is the former site of a petroleum tank farm. Currently, the site is vacant and covered with intermittent natural vegetation.

THE FOLLOWING ITEMS APPLY ONLY TO APPLICATIONS FOR NEW TPDES PERMITS AND MAJOR AMENDMENTS TO TPDES PERMITS

13. List construction dates of all buildings and structures on the property:

N/A – No existing structures.

14. Provide a brief history of the property, and name of the architect/builder, if known.

The property is the location of the Former Atofina and Exxon Pipeline Tank Terminals. The tank farms have been removed many years ago and now the property is vacant with no current development. ~~The dock structures do still remain but are in very poor condition and are slated for future removal. The Texas Treasure also used to be located at Harbor Island and only the main building still remains but is in poor condition as well.~~

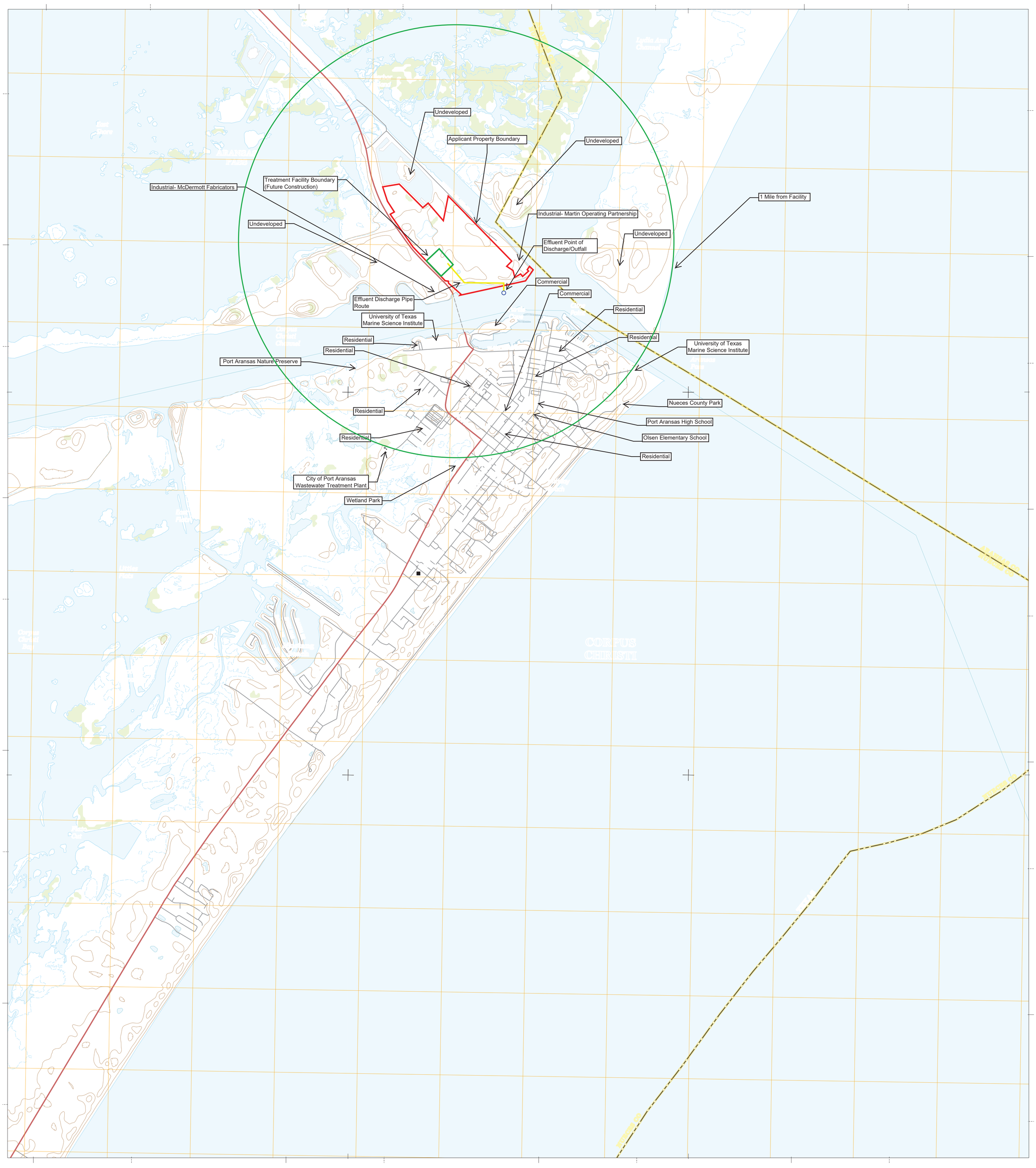
Items have been removed.

ATTACHMENT 7

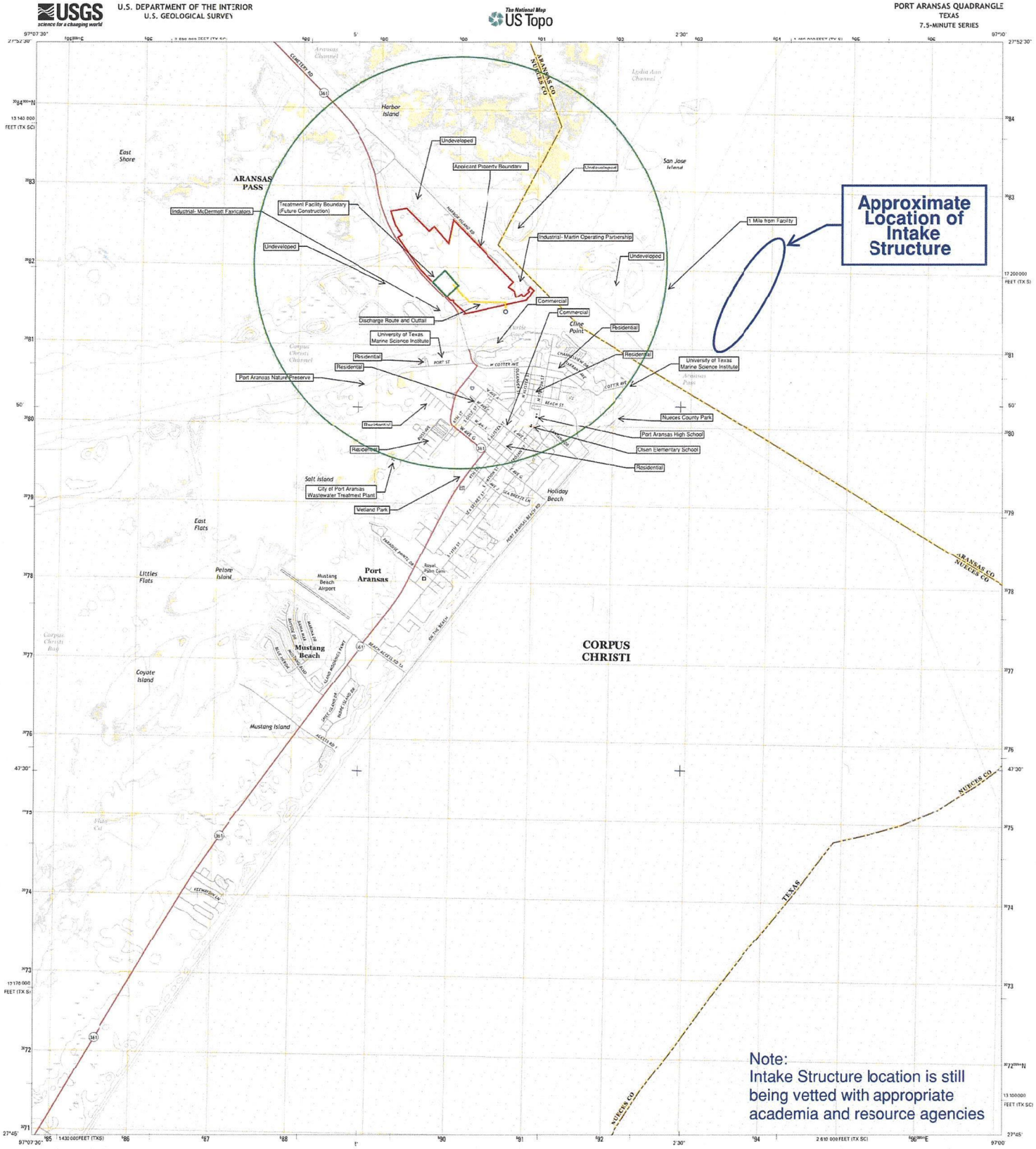
SPIF - USGS Quadrangle Map

USGS
science for a changing world

The National Map
US Topo



NSN. 7 6 4 3 0 1 6 3 9 7 7 7 8
NGA REF NO. U S G S X 2 4 K 3 6 0 1 9



S-Application 000252

TECHNICAL REPORT 1.0
INDUSTRIAL

This application form is for an industrial wastewater discharge authorization only. Your facility may need additional authorizations from the TCEQ Waste Permitting Division or the TCEQ Air Permitting Division.

The following information is required for **all TPDES** and **TLAP** renewal, new, and amendment applications.

1. FACILITY/SITE INFORMATION (Instructions, Pages 35-36)

a. Describe the type of activity and general nature of your business.

The Port of Corpus Christi (POCC) is developing a project to provide a sustainable supply of potable water for the Corpus Christi area that is not dependent upon rain water. The proposed system will provide up to 50 million gallon (MGD) of permeate through the process of desalination.

b. Describe the wastewater-generating processes.

See Process Design Basis and Narrative in Attachment 8.

c. Provide a list of raw materials, major intermediates, and products handled at your facility.

Materials List

Raw Materials	Intermediate Products	Final Products
Sea Water	None	Potable Use Water

d. Attach a facility map (drawn to scale) with the following information:

- Production areas, maintenance areas, materials-handling areas, and waste-disposal areas
- The location of each unit of the wastewater treatment plant including the location of wastewater collection sumps, impoundments, and outfalls (also include locations of sampling points if significantly different from outfall locations)

Attachment: 9

e. Is this a new permit application for an existing facility?

☐ Yes ☒ No

If **yes**, provide background discussion below.

Click here to enter text.

f. Is the treatment facility/disposal site located above the 100-year frequency flood level?

☒ Yes ☐ No

List source(s) used to determine 100-year frequency flood plain:

FEMA Flood Insurance Rate Map Panel Number 485498 0001 F dated September 30, 1992. The facility is located in Zone X, outside the 500 year flood plain.

If **no**, provide the elevation of the 100-year frequency flood plain and describe what protective measures are in use or planned to be used to prevent flooding of the treatment facility/disposal area.

Click here to enter text.

g. For new or amendment permit applications, will any construction operations result in a discharge of fill material into a water in the state?

☒ Yes ☐ No

If **no**, proceed to Item 2.

h. If **yes** to the above question, has the applicant applied for a U.S. Army Corps of Engineers 404 Dredge and Fill permit?

☐ Yes ☒ No

If **yes**, provide the permit number: TBD

If **no**, provide the approximate date you anticipate submitting your application to the Corps: ~~July 2018.~~ After TPDES permit is issued.

2. TREATMENT SYSTEM (Instructions, Page 36)

a. List any physical, chemical, or biological treatment process that you use for the treatment of wastewater at your facility. Include a description of each treatment process, starting with initial treatment and finishing with the outfall/point of disposal.

See Process Design Basis and Narrative in Attachment 8.

b. Attach a flow schematic with a water balance showing each treatment unit and all sources of water and wastewater flow into the treatment plant and to each outfall/point of disposal.

Attachment: 8

3. IMPOUNDMENTS (Instructions, Pages 36-39)

Do you use or plan to use any wastewater lagoons, ponds, or impoundments?

☐ Yes ☒ No

If **yes**, complete **Item 3.a** for **existing** impoundments and **Items 3.a-3.h** for **new or proposed** impoundments. If **no**, proceed to Item 4.

Please note: Surface impoundments may also require additional authorizations from the TCEQ Waste Permit Division.

a. Provide the following information in the table provided:

Use Designation: Indicate the appropriate use designation for each pond: Treatment **(T)**, Disposal **(D)**, Containment **(C)**, or Evaporation **(E)**.

Associated Outfall Number: If a discharge occurs from the impoundments, designate the outfall associated with the impoundment.

Liner Type: If the impoundments are lined to comply with specifications outlined for 1) a compacted clay liner (C), 2) an in-situ clay liner (I), or 3) a synthetic/plastic/rubber liner (S), indicate the liner type with the appropriate letter designation **(see instructions for further detail on liner specifications)**. If not, provide a reference to the attachment that provides a description of the alternate liner and any additional technical information necessary for an evaluation.

Dimensions: Provide the dimensions, freeboard, surface area, and storage capacity of the impoundments. For impoundments with irregular shapes, submit surface area (instead of length and width), the average depth, and the maximum depth below natural ground level.

Impoundment Information

Parameter	Pond #	Pond #	Pond #	Pond #
Use Designation: (T) (D) (C) or (E)				
Associated Outfall Number				
Liner Type (C) (I) or (S)				
Alt. Liner Attachment Reference				
Length (ft)				
Width (ft)				
Depth from Water Surface (ft)				
Avg Depth from Nat. Ground Level (ft)				
Max Depth from Nat. Ground Level (ft)				
Freeboard (ft)				
Surface Area (acres)				
Storage Capacity (gallons)				
Compliance with *40 CFR Chapter 257, Subpart D* is required.	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

Impoundment Information

Parameter	Pond #	Pond #	Pond #	Pond #
Use Designation: (T) (D) (C) or (E)				
Associated Outfall Number				
Liner Type (C) (I) or (S)				
Alt. Liner Attachment Reference				
Length (ft)				
Width (ft)				
Depth from Water Surface (ft)				
Avg Depth from Nat. Ground Level (ft)				
Max Depth from Nat. Ground Level (ft)				
Freeboard (ft)				
Surface Area (acres)				
Storage Capacity (gallons)				
Compliance with *40 CFR Chapter 257, Subpart D* is required.	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

The following information (b - h) is required only for **new or proposed** impoundments.

b. Indicate if any of the following data was provided with the application:

☐ Compacted clay liner data

☐ Synthetic/plastic/rubber liner data

☐ In-situ clay liner data

Attachment: Click here to enter text.

c. Are there any leak detection systems or groundwater monitoring wells in place or planned?

☐ Yes ☐ No

If **yes**, attach information on the leak detection system for each pond and groundwater monitoring well data.

Attachment: Click here to enter text.

d. Is the bottom of the pond above the seasonal high water table in the shallowest waste-bearing zone?

☐ Yes ☐ No

If **no**, attach additional information describing the depth of the seasonal high water table in the shallowest waste-bearing zone in relation to the depth of the bottom of the new or proposed impoundment and how this may or may not impact groundwater.

Attachment: Click here to enter text.

e. Attach a USGS quadrangle map or a color copy of original quality and scale which accurately locates and identifies water supply wells and monitor wells within ½ mile radius of the impoundments

Attachment: Click here to enter text.

f. Attach copies of State Water Well Reports (driller's logs, completion data), and data on depths to groundwater for water supply wells including a description of how the depths to groundwater were obtained

Attachment: Click here to enter text.

g. For TLAP permit applications: Are new or proposed impoundment(s) and the land application disposal area are located in the same general area?

☐ Yes ☐ No

If **yes**, provide information for this item in Worksheet 3.0 (Item 5).

h. Attach information pertaining to the groundwater, soils, geology, etc. used to assess the potential for migration of wastes from the impoundments or the potential for contamination of groundwater or surface water.

Attachment: Click here to enter text.

4. OUTFALL/DISPOSAL METHOD INFORMATION (Instructions, Pages 39-40)

Complete the following tables to describe the location and wastewater discharge or disposal operations for each outfall for discharge operations and for each point of disposal for TLAP operations.

For TLAP permit applications: Indicate the disposal method and each individual irrigation area (I), evaporation pond (E), or subsurface drainage system (S) by providing the appropriate letter designation for the disposal method followed by a numerical designation for each disposal area in the space provided for "Outfall" designation (e.g. "E1" for evaporation pond 1, "I2" for irrigation area No. 2, etc.).

Outfall Latitude and Longitude

Outfall Number	Latitude-degrees	Latitude-minutes	Latitude-seconds	Longitude-degrees	Longitude-minutes	Longitude-seconds
~~001~~	~~27~~	~~50~~	~~38.82~~	~~-97~~	~~03~~	~~49.08~~
001	27	50	39.8826	-97	03	48.9672

Outfall Location Description

Outfall Number	Location Description
001	Outfall will consist of a buried/submerged pipeline and diffuser into the Corpus Christi Channel.

Description of Sampling Points (if different from Outfall location)

Outfall Number	Description of Sampling Point
001	The sampling point will be on land following comingling of all wastewaters and prior to discharging into Corpus Christi Channel.

Outfall Flow Information – Permitted and Proposed

Outfall Number	Permitted Daily Avg Flow (MGD)	Permitted Daily Max Flow (MGD)	Proposed Daily Avg Flow (MGD)	Proposed Daily Max Flow (MGD)
001	N/A	N/A	95.6	110

Outfall Discharge – Method and Measurement

Outfall Number	Pumped Discharge? Y/N	Gravity Discharge? Y/N	Type of Flow Measurement Device Used
001	Y	N	Totalizer

Outfall Discharge – Flow Characteristics

Outfall Number	Intermittent Discharge? Y/N	Seasonal Discharge? Y/N	Continuous Discharge? Y/N	Discharge Duration (hours/ day)	Discharge Duration (days/ month)	Discharge Duration (months/ year)
001	N	N	Y	24	30.417	12

Wastestream Contributions

Outfall No.: 001

Contributing Wastestreams	Volume (MGD)	% of Total Flow
Reverse Osmosis Reject	75	78.5
Pre-Treatment System Reject	20.6	21.5

Outfall No.: N/A

Contributing Wastestreams	Volume (MGD)	% of Total Flow

Outfall No.: N/A

Contributing Wastestreams	Volume (MGD)	% of Total Flow

Additional Outfall wastestream contributions included as **Attachment:** N/A

5. BLOWDOWN AND ONCE-THROUGH COOLING WATER DISCHARGES (Instructions, Pages 40-41)

a. Does your facility use any cooling towers or boilers that discharge blowdown or other wastestreams to the outfall(s)?

☐ Yes ☒ No

b. Does your facility discharge once-through cooling water to the outfall(s)?

☐ Yes ☒ No

c. If **yes** to either Item a **or** b, attach the appropriate SDS with the following information for each chemical additive.

- Manufacturers Product Identification Number
- Product use (e.g., biocide, fungicide, corrosion inhibitor, etc.)
- Chemical composition including CASRN for each ingredient
- Classify product as non-persistent, persistent, or bioaccumulative
- Product or active ingredient half-life
- Frequency of product use (e.g., 2 hours/day once every two weeks)
- Product toxicity data specific to fish and aquatic invertebrate organisms
- Concentration of whole product in wastestream (if above item is for whole product)
- Concentration of active ingredient in wastestream (if above item is for active ingredient)

Please provide a summary attachment of this information in addition to the submittal of the SDS for each specific wastestream and the associated chemical additives and specify which outfalls are affected.

Attachment: Click here to enter text.

d. Cooling Towers and Boilers

Cooling Towers and Boilers

Type of Unit	Number of Units	Dly Avg Blowdown (gallons/day)	Dly Max Blowdown (gallons/day)
Cooling Towers			
Boilers			

6. STORMWATER MANAGEMENT (Instructions, Page 41)

Are there any existing or proposed outfalls which discharge stormwater runoff commingled with other wastestreams?

☐ Yes ☒ No

If **no**, proceed to Item 7.

If **yes**, briefly describe the industrial processes and activities that occur outdoors or in some manner that may result in exposure of the materials to precipitation or runoff in areas where runoff is generated.

7. DOMESTIC SEWAGE, SEWAGE SLUDGE, AND SEPTAGE MANAGEMENT AND DISPOSAL (Instructions, Pages 41-42)

a. Please check the appropriate method(s) of domestic sewage and domestic sewage sludge treatment/disposal and complete Worksheet 5.0 or Item 7.b if directed to do so.

☒ Facility is connected to a wastewater treatment plant permitted to receive domestic sewage, or the domestic sewage is transported off-site to a permitted facility for treatment, disposal, or both. COMPLETE ITEM 7.b BELOW.

☒ Domestic sewage is disposed of by an on-site septic tank and drainfield system. COMPLETE ITEM 7.b BELOW.

☐ Both domestic and industrial treatment sludge ARE commingled prior to use or disposal.

☐ Industrial wastewater and domestic sewage are treated separately, and the respective sludge IS NOT commingled prior to sludge use or disposal. COMPLETE WORKSHEET 5.0 OF THIS APPLICATION.

☐ Facility is a POTW. COMPLETE WORKSHEET 5.0 OF THIS APPLICATION.

☐ Domestic sewage is not generated on-site.

☐ Other (e.g., portable toilets): Please provide a detailed description:

Click here to enter text

b. Provide the name and TCEQ, NPDES, or TPDES Permit No. of the waste-disposal facility which receives the domestic sewage/septage. If hauled by motorized vehicle, provide the name and TCEQ Registration No. of the hauler.

Domestic Sewage Plant/Hauler Name

Plant/Hauler Name	Permit/Registration No.
~~New facility. Information will be provided to the TCEQ in a supplement.~~	~~TBD~~
N/A	

8. IMPROVEMENTS OR COMPLIANCE/ENFORCEMENT REQUIREMENTS (Instructions, Page 42)

Is the permittee currently required to meet any implementation schedule for compliance or enforcement?

☐ Yes ☒ No

If **yes**, provide a brief summary of the requirements and a status update.

Click here to enter text

9. TOXICITY TESTING (Instructions, Pages 42-43)

Have any biological tests for acute or chronic toxicity been made on any of your discharges or on a receiving water in relation to your discharge within the last three years?

☒ Yes ☒ No

If **yes**, identify the tests and describe their purposes below. Please attach a copy of all tests performed that have not been previously sent to the TCEQ or the EPA.

Attachment: See Attachment 11 - Laboratory reports for salinity toxicity in synthetic sea water.

10. OFF-SITE/THIRD PARTY WASTES (Instructions, Page 43)

Do you receive wastes from off-site sources for any or all of the following: treatment in your facility, disposal on-site via land application, or discharge via a permitted outfall?

☐ Yes ☒ No

If **no**, proceed to Item 11.

If **yes**, provide responses to Items a, b, and c below.

a. Attach the following information to the application:

- List of wastes received
- Characterization of wastes received
- Volumes of each waste received
- Information on compatibility with on-site wastes
- Identified sources of wastes received
- Name and addresses of generators
- Description of the relationship of waste source(s) with your facility's activities

Attachment: Click here to enter text.

b. Is wastewater from a TCEQ, NPDES, or TPDES permitted facility commingled with your wastewater after your final treatment and prior to discharge via your final outfall/point of disposal?

☐ Yes ☐ No

If **yes**, provide the name, address, and TCEQ, NPDES, or TPDES permit number of the contributing facility and a copy of any agreements or contracts relating to this activity.

Attachment: Click here to enter text.

c. Is your facility a Publicly Owned Treatment Works (POTW) that accepts process wastewater from any Significant Industrial User (SIU) and has or is required to have an approved pretreatment program under the NPDES/TPDES program?

☐ Yes ☐ No

If **yes**, complete **Worksheet 6.0** of this application.

11. RADIOACTIVE MATERIALS (Instructions, Page 44)

a. Are radioactive materials mined, used, stored, or processed at this facility?

☐ Yes ☒ No

If **yes**, use the following table to provide the results of one analysis of your effluent for all radioactive materials that may be present. Provide results in picocuries per liter (pCi/L).

Radioactive Materials Mined, Used, Stored, or Processed

Radioactive Material	Concentration (pCi/L)

b. Do you have any knowledge or reason to believe that radioactive materials may be present in the discharge, including naturally occurring radioactive materials in the source waters or on the facility property?

☐ Yes ☒ No

If **yes**, use the following table to provide the results of one analysis of your effluent for all radioactive materials that may be present. Provide results in picocuries per liter (pCi/L). Do not include information provided in response to Item 11.a.

Radioactive Materials Present in the Discharge

Radioactive Material	Concentration (pCi/L)

12. COOLING WATER INTAKE STRUCTURES (Instructions, Pages 44-46)

a. The facility uses or proposes to use water for cooling purposes?

☐ Yes ☒ No

If **yes**, complete this item (12. Cooling Water Intake Structures); otherwise, stop here.

b. Cooling Water Supplier

1. Complete the following table with information regarding the Cooling Water Intake Structure(s) owner(s), operator(s), and location

Cooling Water Intake Structure(s) Owner(s), Operator(s), and Location

CWIS ID				
Owner				
Operator				
Latitude				
Longitude				

2. Cooling water is obtained from a Public Water Supplier (PWS)

☐ Yes ☐ No

If **yes**, provide the Public Water Supplier Registration No. for the entity providing cooling water in the space provided, and stop here.

- PWS Registration Number: Click here to enter text.

3. Cooling water is obtained from an Independent Supplier

☐ Yes ☐ No

If **no**, proceed to section c; otherwise, if **yes** provide the following:

- Independent Supplier's TPDES permit number: Click here to enter text.

  If the Independent Supplier holds a TPDES Industrial Wastewater Permit, provide the permit number in the space provided. Otherwise enter N/A and continue.

- Independent Supplier's CWIS AIF (in MGD): Click here to enter text.

  Enter the Independent Supplier's CWIS actual intake flow (AIF) in million gallons per day in the space provided, and continue.

- The facility uses or proposes to use less than 25% of the Independent Supplier's CWIS AIF for cooling purposes?

  ☐ Yes ☐ No

  If **yes**, stop here. If **no**, proceed to section c.

c. 316(b) General Criteria

Compete all questions in this section unless otherwise directed.

1. The CWIS(s) have or will have a design intake flow of 2 MGD or greater

   ☐ Yes ☐ No

2. At least 25% of the total water withdrawn by the CWIS is used or will be used exclusively for cooling purposes on an annual average basis

   ☐ Yes ☐ No

3. The facility withdraws or proposes to withdraw water for cooling purposes from surface waters that meet the definition of Waters of the United States in *40 CFR § 122.2*

   ☐ Yes ☐ No

   If **no**, provide an explanation of how the waterbody does not meet the definition of Waters of the United States in *40 CFR § 122.2* in the space provided. If additional space is needed for the explanation, include the information as an attachment to the application and provide the attachment number in the space instead.

   Explanation:

   Click here to enter text

If **yes** to all three questions in section c above, proceed to section d. If **no** to any of the questions in section c above the facility does not meet the minimum criteria to be subject to the full requirements of 316(b). Complete Worksheet 11.0, items 1(a), 1(b)(i-iii) and (vi), 2(b)(i), and 3(a) to allow for a determination based upon best professional judgement (BPJ).

d. Phase I vs Phase II Facilities

1. Existing facility (Phase II)

   ☐ Yes ☐ No

   If **yes**, complete Worksheets 11.0 through 11.3, as applicable. Otherwise, continue.

2. New Facility – (Phase I)

   ☐ Yes ☐ No

   If **yes**, continue.

3. Compliance track selection (For Phase I only; must choose one of the following)

   ☐ Track I - AIF greater than 2 MGD, but less than 10 MGD

   If selected, include information required under *40 CFR §§ 125.86(b)(2)-(4)* as an attachment and complete Worksheet 11.0, items 2 and 3, and Worksheet 11.2.

   ☐ Track I - AIF greater than 10 MGD

   If selected, include information required under *40 CFR § 125.86(b)* as an attachment and complete Worksheet 11.0, items 2 and 3, and Worksheet 11.2.

   ☐ Track II

   If selected, include information required under *40 CFR § 125.86(c)* as an attachment and complete Worksheet 11.0, items 2 and 3, and Worksheet 11.2.

   Attachment: Click here to enter text

Note: Items 12, 13, and 14 are required only for **existing permitted** facilities.

13. MAJOR AMENDMENT REQUESTS (Instructions, Page 46)

Are you requesting a major amendment of an existing permit?

☐ Yes ☒ No

If **yes**, list each specific request and provide discussion on the scope of any requested permit changes. If necessary, provide supplemental information or additional data that will support the request.

Click here to enter text.

14. MINOR MODIFICATION REQUESTS (Instructions, Page 47)

Are you requesting any minor modifications to the permit? Note: see the instructions for an exclusive list of changes considered as minor modifications.

☐ Yes ☒ No

If **yes**, list and discuss the requested changes.

Click here to enter text.

15. MINOR AMENDMENT REQUESTS (Instructions, Page 47)

Are you requesting any minor amendments to the permit?

☐ Yes ☒ No

If **yes**, list and discuss the requested changes.

Click here to enter text.

WORKSHEET 1.0
EPA CATEGORICAL EFFLUENT GUIDELINES

This worksheet is required for all applications for TPDES permits for discharges of wastewaters subject to EPA categorical effluent guidelines.

1. CATEGORICAL INDUSTRIES (Instructions, Pages 50-51)

Is your facility subject to any of the 40 CFR effluent guidelines outlined on page 52 of the instructions?

☐ Yes ☒ No

If **yes**, provide the appropriate information in the table below.

If **no**, this worksheet is not required.

40 CFR Effluent Guidelines

Industry	40 CFR Part

2. PRODUCTION/PROCESS DATA (Instructions, Page 51)

a. Production Data

Provide the appropriate data for effluent guidelines with production-based effluent limitations.

Production Data

Subcategory	Actual Quantity/Day	Design Quantity/Day	Units

b. Organic Chemicals, Plastics, and Synthetic Fibers Manufacturing Data (*40 CFR Part 414*)

Provide each appropriate subpart and the percent of total production. Also provide the appropriate data for metal-bearing wastestreams as required in *40 CFR Part 414*, Appendices A and B.

Percentages of Total Production

Subcategory	Percent of Total Production	Appendix A and B - Metal	Appendix A and B – Process

c. Refineries (*40 CFR Part 419*):

Provide the applicable subcategory and a brief justification.

Click here to enter text.

3. PROCESS/NON-PROCESS WASTEWATER FLOWS (Instructions, Page 51)

Provide a breakdown of process wastewater flow(s) and non-process wastewater flow(s) as directed.

Click here to enter text.

4. NEW SOURCE DETERMINATION (Instructions, Page 51)

Provide a list of wastewater-generating processes subject to effluent guidelines and the appropriate information.

Wastewater-generating Processes Subject to Effluent Guidelines

Process	EPA Guideline: Part	EPA Guideline: Subpart	Date Process/ Construction Commenced

WORKSHEET 2.0
POLLUTANT ANALYSES REQUIREMENTS

Worksheet 2.0 is **required** for applications submitted for a TPDES permit.

Worksheet 2.0 is **not required** for applications for a permit to dispose of all wastewater by land disposal or for discharges solely of stormwater runoff.

1. LABORATORY ACCREDITATION (Instructions, Page 52)

Effective July 1, 2008, all laboratory tests performed must meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification* with the following general exemptions:

a. The laboratory is an in-house laboratory and is:

   1. periodically inspected by the TCEQ; or
   2. located in another state and is accredited or inspected by that state; or
   3. performing work for another company with a unit located in the same site; or
   4. performing pro bono work for a governmental agency or charitable organization.

b. The laboratory is accredited under federal law.

c. The data are needed for emergency-response activities, and a laboratory accredited under the Texas Laboratory Accreditation Program is not available.

d. The laboratory supplies data for which the TCEQ does not offer accreditation.

The applicant should review *30 TAC Chapter 25* for specific requirements. The following certification statement shall be signed and submitted with every application. See Instructions, Page 32, for a list of designated representatives who may sign the certification.

I,_____, certify that all laboratory tests submitted with this application meet the requirements of *30 TAC Chapter 25*, Environmental Testing Laboratory Accreditation and Certification.

2. GENERAL TESTING REQUIREMENTS (Instructions, Pages 52-54)

Please read the general testing requirements in the instructions for important information about sampling, test methods, MALs, and averaging sample results.

3. SPECIFIC TESTING REQUIREMENTS (Instructions, Pages 54-66)

Table 1 and Table 2 (Instructions, Page 54)

Completion of Tables 1 and 2 is required for all external outfalls for new, renewal, and amendment applications.

Sample 1 and 2 from GOM intake location and Average estimated for 40% recovery in Outfall 001

Table 1 for Outfall No.: ~~001 – Concentrations for applicable Tables were estimated using source water data from Freese & Nichols, Variable Salinity Desalination Demonstration Project, April 26, 2016. Source water will be sampled, modeled, and updated tables will be provided to the TCEQ in a supplement.~~

Samples are (check one): ☐ **Composites** ☒ **Grabs**

Pollutant	Sample 1 (mg/L)	Sample 2 (mg/L)	Sample 3 (mg/L)	Sample 4 (mg/L)	Average (mg/L)
BOD (5-day)					
CBOD (5-day)					
Chemical oxygen demand					
Total organic carbon					1.0
Dissolved oxygen					
Ammonia nitrogen					
Total suspended solids					30.0
Nitrate nitrogen					3.6
Total organic nitrogen					
Total phosphorus					
Oil and grease					
Total residual chlorine					
Total dissolved solids					66,000
Sulfate					4,800
Chloride					36,700
Fluoride					3.2
Total alkalinity (mg/L as $CaCO_3$)					
Temperature (°F)					14-32
pH (standard units)					7.5

Data to be updated from sampling proposed intake location.

Table 2 for Outfall No.: ~~001~~ **Sample 1 and 2 from GOM intake location and Average estimated for 40% recovery in Outfall 001**

Samples are (check one): ☐ **Composites** ☒ **Grabs**

Pollutant	Sample 1 (µg/L)	Sample 2 (µg/L)	Sample 3 (µg/L)	Sample 4 (µg/L)	Average (µg/L)	MAL (µg/L)
Aluminum, total						2.5
Antimony, total						5
Arsenic, total						0.5
Barium, total					60.0	3
Beryllium, total						0.5
Cadmium, total						1
Chromium, total						3
Chromium, hexavalent						3
Chromium, trivalent						N/A
Copper, total						2
Cyanide, available						2/10
Lead, total						0.5
Mercury, total						0.005/0.0005
Nickel, total						2
Selenium, total						5
Silver, total						0.5

Data to be updated from sampling proposed intake location.

Pollutant	Sample 1 (µg/L)	Sample 2 (µg/L)	Sample 3 (µg/L)	Sample 4 (µg/L)	Average (µg/L)	MAL (µg/L)
Thallium, total						0.5
Zinc, total						5.0

TABLE 3 (Instructions, Page 54).

Completion of Table 3 is required for all external outfalls which discharge process wastewater.

Partial completion of Table 3 is required for all external outfalls with non-process wastewater discharges.

For discharges of stormwater runoff commingled with other wastestreams, complete Table 3 as instructed

Table 3 for Outfall No.: ~~001~~ **Sample 1 and 2 from GOM intake location and Average estimated for 40% recovery in Outfall 001**

Samples are (check one): ☐ **Composites** ☒ **Grabs**

Pollutant	Samp. 1 (µg/L)*	Samp. 2 (µg/L)*	Samp. 3 (µg/L)*	Samp. 4 (µg/L)*	Avg. (µg/L)*	MAL (µg/L)*
Acrylonitrile						50
Anthracene						10
Benzene						10
Benzidine						50
Benzo(a)anthracene						5
Benzo(a)pyrene						5
Bis(2-chloroethyl)ether						10
Bis(2-ethylhexyl)phthalate						10
Bromodichloromethane [Dichlorobromomethane]						10
Bromoform						10
Carbon tetrachloride						2
Chlorobenzene						10
Chlorodibromomethane [Dibromochloromethane]						10
Chloroform						10
Chrysene						5
m-Cresol [3-Methylphenol]						10
o-Cresol [2-Methylphenol]						10
p-Cresol [4-Methylphenol]						10
1,2-Dibromoethane						10
m-Dichlorobenzene [1,3-Dichlorobenzene]						10
o-Dichlorobenzene [1,2-Dichlorobenzene]						10
p-Dichlorobenzene [1,4-Dichlorobenzene]						10
3,3'-Dichlorobenzidine						5
1,2-Dichloroethane						10
1,1-Dichloroethene [1,1-Dichloroethylene]						10

Data to be updated from sampling proposed intake location.

Pollutant	Samp. 1 (µg/L)*	Samp. 2 (µg/L)*	Samp. 3 (µg/L)*	Samp. 4 (µg/L)*	Avg. (µg/L)*	MAL (µg/L)*
Dichloromethane [Methylene chloride]						20
1,2-Dichloropropane						10
1,3-Dichloropropene [1,3-Dichloropropylene]						10
2,4-Dimethylphenol						10
Di-n-Butyl phthalate						10
Ethylbenzene						10
Fluoride					3200.0	500
Hexachlorobenzene						5
Hexachlorobutadiene						10
Hexachlorocyclopentadiene						10
Hexachloroethane						20
Methyl ethyl ketone						50
Nitrobenzene						10
N-Nitrosodiethylamine						20
N-Nitroso-di-n-butylamine						20
Nonylphenol						333
Pentachlorobenzene						20
Pentachlorophenol						5
Phenanthrene						10
Polychlorinated biphenyls (PCBs) (**)						0.2
Pyridine						20
1,2,4,5-Tetrachlorobenzene						20
1,1,2,2-Tetrachloroethane						10
Tetrachloroethene [Tetrachloroethylene]						10
Toluene						10
1,1,1-Trichloroethane						10
1,1,2-Trichloroethane						10
Trichloroethene [Trichloroethylene]						10
2,4,5-Trichlorophenol						50
TTHM (Total trihalomethanes)						10
Vinyl chloride						10

(*) Indicate units if different from µg/L.

(**) Total of detects for PCB-1242, PCB-1254, PCB-1221, PCB-1232, PCB-1248, PCB-1260, and PCB-1016. If all non-detects, enter the highest non-detect preceded by a “<”.

TABLE 4 (Instructions, Page 55

Partial completion of Table 4 (only those pollutants which are required by the conditions specified below) **is required** for each external outfall.

Completion of Table 4 **is not required** for internal outfalls.

a. *Tributyltin*

Is your facility an industrial/commercial facility which directly disposes of wastewater from the types of operations listed below or a domestic facility which receives wastewater from the types of industrial/commercial operations listed below?

☐ Yes ☒ No

If **yes**, indicate all of the following criteria which apply and provide the appropriate testing results in the table below.

☐ Manufacturers and formulators of tributyltin or related compounds

☐ Painting of ships, boats and marine structures

☐ Ship and boat building and repairing

☐ Ship and boat cleaning, salvage, wrecking and scaling

☐ Operation and maintenance of marine cargo handling facilities and marinas

☐ Facilities engaged in wood preserving

☐ Any other industrial/commercial facility for which tributyltin is known to be present, or for which there is any reason to believe that tributyltin may be present in the effluent.

b. *Enterococci*

Does or will your facility discharge **directly** into **saltwater** receiving waters **and**:

Enterococci bacteria are expected to be present in the discharge based on facility processes?

☒ Yes ☐ No

Domestic wastewater is or will be discharged?

☐ Yes ☒ No

If **yes** to either question, provide the appropriate testing results in Table 4 below.

c. *E. coli*

Does or will your facility discharge **directly** into **freshwater** receiving waters **and**:

E. coli bacteria are expected to be present in the discharge based on facility processes?

☐ Yes ☒ No

Domestic wastewater is or will be discharged?

☐ Yes ☒ No

If **yes** to either question, provide the appropriate testing results in Table 4 below.

Table 4 for Outfall No.: 001

Samples are (check one): ☐ **Composites** ☐ **Grabs**

Pollutant	Sample 1	Sample 2	Sample 3	Sample 4	Average	MAL
Tributyltin (µg/L)						0.010
Enterococci (cfu or MPN/100 mL)						N/A
E. coli (cfu or MPN/100 mL)						N/A

TABLE 5 (Instructions, Page 56)

Completion of Table 5 **is required** for all external outfalls which discharge process wastewater or other wastewaters which may contain pesticides or herbicides from a facility which manufactures or formulates pesticides or herbicides. Completion of Table 5 **is not required** for internal outfalls.

Does your facility manufacture or formulate pesticides or herbicides?

☐ Yes ☒ No

If **yes**, provide the appropriate testing results in Table 5.

Table 5 for Outfall No.: Click here to enter text.

Samples are (check one): ☐ **Composites** ☐ **Grabs**

Pollutant	**Sample 1 (µg/L)***	**Sample 2 (µg/L)***	**Sample 3 (µg/L)***	**Sample 4 (µg/L)***	**Average (µg/L)***	**MAL (µg/L)***
Aldrin						0.01
Carbaryl						5
Chlordane						0.2
Chlorpyrifos						0.05
4,4'-DDD						0.1
4,4'-DDE						0.1
4,4'-DDT						0.02
2,4-D						0.7
Danitol [Fenpropathrin]						—
Demeton						0.20
Diazinon						0.5/0.1
Dicofol [Kelthane]						1
Dieldrin						0.02
Diuron						0.090
Endosulfan I (*alpha*)						0.01
Endosulfan II (*beta*)						0.02
Endosulfan sulfate						0.1
Endrin						0.02
Guthion [Azinphos methyl]						0.1
Heptachlor						0.01
Heptachlor epoxide						0.01
Hexachlorocyclohexane (*alpha*)						0.05
Hexachlorocyclohexane (*beta*)						0.05
Hexachlorocyclohexane (*gamma*) [Lindane]						0.05
Hexachlorophene						10
Malathion						0.1
Methoxychlor						2.0
Mirex						0.02
Parathion (ethyl)						0.1
Toxaphene						0.3
2,4,5-TP [Silvex]						0.3

* Indicate units if different from µg/L.

TABLE 6 (Instructions, Page 56)

Completion of Table 6 is required for all external outfalls but is not required for internal outfalls.

Table 6 for Outfall No.: ~~001~~ **Sample 1 and 2 from GOM intake location and Average estimated for 40% recovery with Maximum estimated for 50% recovery in Outfall 001**

Samples are (check one): ☐ **Composites** ☒ **Grabs**

Pollutants	Believed Present	Believed Absent	Average Concentration (mg/L)	Maximum Concentration (mg/L)	No. of Samples	MAL (µg/L)*
Bromide	☒	☐	Data to be updated from sampling proposed intake location.			400
Color (PCU)	☐	☒				—
Nitrate-Nitrite (as N)	☒	☐				—
Sulfide (as S)	☒	☐				—
Sulfite (as SO3)	☒	☐	4,800 mg/L	5,660 mg/L	1	—
Surfactants	☐	☒				—
Boron, total	☒	☐	8.0 mg/L	9.4 mg/L	1	20
Cobalt, total	☐	☒				0.3
Iron, total	☒	☐	1.5 mg/L	2.4 mg/L	1	7
Magnesium, total	☒	☐	2,240 mg/L	2, 640 mg/L	1	20
Manganese, total	☒	☐				0.5
Molybdenum, total	☐	☒				1
Tin, total	☒	☐				5
Titanium, total	☐	☒				30

* Indicate units if different from µg/L.

TABLE 7 (Instructions, Page 56)

Indicate any of the industrial categories applicable to your facility; otherwise, check the "N/A" box below. If GC/MS testing is required, indicate with an 'x' in the box provided that the testing results for the appropriate parameters are provided with the application.

☒ N/A

Table 7 for Applicable Industrial Categories

Industrial Category	40 CFR Part	Volatiles Table 8	Acids Table 9	Bases/Neutrals Table 10	Pesticides Table 11
☐ Adhesives and Sealants		☐ Yes	☐ Yes	☐ Yes	No
☐ Aluminum Forming	467	☐ Yes	☐ Yes	☐ Yes	No
☐ Auto and Other Laundries		☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Battery Manufacturing	461	☐ Yes	No	☐ Yes	No
☐ Coal Mining	434	No	No	No	No
☐ Coil Coating	465	☐ Yes	☐ Yes	☐ Yes	No
☐ Copper Forming	468	☐ Yes	☐ Yes	☐ Yes	No
☐ Electric and Electronic Components	469	☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Electroplating	413	☐ Yes	☐ Yes	☐ Yes	No
☐ Explosives Manufacturing	457	No	☐ Yes	☐ Yes	No
☐ Foundries		☐ Yes	☐ Yes	☐ Yes	No
☐ Gum and Wood Chemicals - Subparts A,B,C,E	454	☐ Yes	☐ Yes	No	No
☐ Gum and Wood Chemicals - Subparts D,F	454	☐ Yes	☐ Yes	☐ Yes	No
☐ Inorganic Chemicals Manufacturing	415	☐ Yes	☐ Yes	☐ Yes	No
☐ Iron and Steel Manufacturing	420	☐ Yes	☐ Yes	☐ Yes	No
☐ Leather Tanning and Finishing	425	☐ Yes	☐ Yes	☐ Yes	No
☐ Mechanical Products Manufacturing		☐ Yes	☐ Yes	☐ Yes	No
☐ Nonferrous Metals Manufacturing	421,471	☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Ore Mining - Subpart B	440	No	☐ Yes	No	No
☐ Organic Chemicals Manufacturing	414	☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Paint and Ink Formulation	446,447	☐ Yes	☐ Yes	☐ Yes	No
☐ Pesticides	455	☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Petroleum Refining	419	☐ Yes	No	No	No
☐ Pharmaceutical Preparations	439	☐ Yes	☐ Yes	☐ Yes	No
☐ Photographic Equipment and Supplies	459	☐ Yes	☐ Yes	☐ Yes	No
☐ Plastic and Synthetic Materials Manufacturing	414	☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Plastic Processing	463	☐ Yes	No	No	No
☐ Porcelain Enameling	466	No	No	No	No
☐ Printing and Publishing		☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ Pulp and Paperboard Mills - Subpart C	430	☐ *	☐ Yes	☐ *	☐ Yes
☐ Pulp and Paperboard Mills - Subparts F, K	430	☐ *	☐ Yes	☐ *	☐ *
☐ Pulp and Paperboard Mills - Subparts A, B, D, G, H	430	☐ Yes	☐ Yes	☐ *	☐ *
☐ Pulp and Paperboard Mills - Subparts I, J, L	430	☐ Yes	☐ Yes	☐ *	☐ Yes
☐ Pulp and Paperboard Mills - Subpart E	430	☐ Yes	☐ Yes	☐ Yes	☐ *
☐ Rubber Processing	428	☐ Yes	☐ Yes	☐ Yes	No
☐ Soap and Detergent Manufacturing	417	☐ Yes	☐ Yes	☐ Yes	No
☐ Steam Electric Power Plants	423	☐ Yes	☐ Yes	No	No
☐ Textile Mills (Not Subpart C)	410	☐ Yes	☐ Yes	☐ Yes	No
☐ Timber Products Processing	429	☐ Yes	☐ Yes	☐ Yes	☐ Yes

* Test if believed present.

TABLES 8, 9, 10, and 11 (Instructions, Pages 56-57)

Completion of Tables 8, 9, 10, and 11 **is required** as specified in Table 7 for all external outfalls that contain process wastewater.

Completion of Tables 8, 9, 10, and 11 **is not required** for internal outfalls.

Completion of Tables 8, 9, 10, and 11 **may be required** for types of industry not specified in Table 7 for specific parameters that are believed to be present in the wastewater.

Table 8 for Outfall No.: N/A: Volatile Compounds

Samples are (check one): ☐ **Composites** ☐ **Grabs**

Pollutant	Average (µg/L)*	Maximum (µg/L)*	No. of Samples	MAL (µg/L)
Acrolein				50
Acrylonitrile				50
Benzene				10
Bromoform				10
Carbon tetrachloride				2
Chlorobenzene				10
Chlorodibromomethane				10
Chloroethane				50
2-Chloroethylvinyl ether				10
Chloroform				10
Dichlorobromomethane [Bromodichloromethane]				10
1,1-Dichloroethane				10
1,2-Dichloroethane				10
1,1-Dichloroethylene [1,1-Dichloroethene]				10
1,2-Dichloropropane				10
1,3-Dichloropropylene [1,3-Dichloropropene]				10
Ethylbenzene				10
Methyl bromide [Bromomethane]				50
Methyl chloride [Chloromethane]				50
Methylene chloride [Dichloromethane]				20
1,1,2,2-Tetrachloroethane				10
Tetrachloroethylene [Tetrachloroethene]				10
Toluene				10
1,2-Trans-dichloroethylene [1,2-Trans-dichloroethene]				10
1,1,1-Trichloroethane				10
1,1,2-Trichloroethane				10
Trichloroethylene [Trichloroethene]				10
Vinyl chloride				10

Table 9 for Outfall No.: N/A: Acid Compounds
Samples are (check one): ☐ Composites ☐ Grabs

Pollutant	Average (µg/L)*	Maximum (µg/L)*	No. of Samples	MAL (µg/L)
2-Chlorophenol				10
2,4-Dichlorophenol				10
2,4-Dimethylphenol				10
4,6-Dinitro-o-cresol				50
2,4-Dinitrophenol				50
2-Nitrophenol				20
4-Nitrophenol				50
p-Chloro-m-cresol				10
Pentachlorophenol				5
Phenol				10
2,4,6-Trichlorophenol				10

Table 10 for Outfall No.: N/A: Base/Neutral Compounds
Samples are (check one): ☐ Composites ☐ Grabs

Pollutant	Average (µg/L)*	Maximum (µg/L)*	No. of Samples	MAL (µg/L)
Acenaphthene				10
Acenaphthylene				10
Anthracene				10
Benzidine				50
Benzo(a)anthracene				5
Benzo(a)pyrene				5
3,4-Benzofluoranthene [Benzo(b)fluoranthene]				10
Benzo(ghi)perylene				20
Benzo(k)fluoranthene				5
Bis(2-chloroethoxy)methane				10
Bis(2-chloroethyl)ether				10
Bis(2-chloroisopropyl)ether				10
Bis(2-ethylhexyl)phthalate				10
4-Bromophenyl phenyl ether				10
Butylbenzyl phthalate				10
2-Chloronaphthalene				10
4-Chlorophenyl phenyl ether				10
Chrysene				5
Dibenzo(a,h)anthracene				5
1,2-Dichlorobenzene [o-Dichlorobenzene]				10
1,3-Dichlorobenzene [m-Dichlorobenzene]				10
1,4-Dichlorobenzene [p-Dichlorobenzene]				10

Pollutant	Average (µg/L)*	Maximum (µg/L)*	No. of Samples	MAL (µg/L)
3,3'-Dichlorobenzidine				5
Diethyl phthalate				10
Dimethyl phthalate				10
Di-n-butyl phthalate				10
2,4-Dinitrotoluene				10
2,6-Dinitrotoluene				10
Di-n-octyl phthalate				10
1,2-Diphenylhydrazine (as Azobenzene)				20
Fluoranthene				10
Fluorene				10
Hexachlorobenzene				5
Hexachlorobutadiene				10
Hexachlorocyclopentadiene				10
Hexachloroethane				20
Indeno(1,2,3-cd)pyrene				5
Isophorone				10
Naphthalene				10
Nitrobenzene				10
N-Nitrosodimethylamine				50
N-Nitrosodi-n-propylamine				20
N-Nitrosodiphenylamine				20
Phenanthrene				10
Pyrene				10
1,2,4-Trichlorobenzene				10

Table 11 for Outfall No.: N/A: Pesticides

Samples are (check one): ☐ **Composites** ☐ **Grabs**

Pollutant	Average (µg/L)*	Maximum (µg/L)*	No. of Samples	MAL (µg/L)
Aldrin				0.01
alpha-BHC [alpha-Hexachlorocyclohexane]				0.05
beta-BHC [beta-Hexachlorocyclohexane]				0.05
gamma-BHC [gamma-Hexachlorocyclohexane]				0.05
delta-BHC [delta-Hexachlorocyclohexane]				0.05
Chlordane				0.2
4,4'-DDT				0.02
4,4'-DDE				0.1
4,4'-DDD				0.1
Dieldrin				0.02
Endosulfan I (alpha)				0.01
Endosulfan II (beta)				0.02

Pollutant	Average (µg/L)*	Maximum (µg/L)*	No. of Samples	MAL (µg/L)
Endosulfan sulfate				0.1
Endrin				0.02
Endrin aldehyde				0.1
Heptachlor				0.01
Heptachlor epoxide				0.01
PCB 1242				0.2
PCB 1254				0.2
PCB 1221				0.2
PCB 1232				0.2
PCB 1248				0.2
PCB 1260				0.2
PCB 1016				0.2
Toxaphene				0.3

* Indicate units if different from µg/L

TABLE 12 (DIOXINS/FURAN COMPOUNDS)

Complete Table 12 as directed. Table 12 is not required for internal outfalls. (Instructions, Pages 57-58)

a. Are any of the following compounds manufactured or used in a process at the facility?

☐ Yes ☒ No

If **yes**, indicate which compound(s) are manufactured or used at the facility and provide a brief description of the conditions of its/their presence at the facility.

☐	2,4,5-trichlorophenoxy acetic acid	(2,4,5-T)	CASRN 93-76-5
☐	2-(2,4,5-trichlorophenoxy) propanoic acid	(Silvex, 2,4,5-TP)	CASRN 93-72-1
☐	2-(2,4,5-trichlorophenoxy) ethyl 2,2-dichloropropionate	(Erbon)	CASRN 136-25-4
☐	0,0-dimethyl 0-(2,4,5-trichlorophenyl) phosphorothioate	(Ronnel)	CASRN 299-84-3
☐	2,4,5-trichlorophenol	(TCP)	CASRN 95-95-4
☐	hexachlorophene	(HCP)	CASRN 70-30-4

Description:

Click here to enter text.

b. Do you know or have any reason to believe that 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) or any congeners of TCDD may be present in your effluent?

☐ Yes ☒ No

If yes, provide a brief description of the conditions for its presence.

Click here to enter text

c. If you responded **yes** to either Item a **or** b, complete Table 12 as instructed.

Table 12 for Outfall No.: N/A

Samples are (check one): ☐ **Composites** ☐ **Grabs**

Compound	Toxicity Equivalent Factors	Wastewater Concentration (ppq)	Wastewater Toxicity Equivalents (ppq)	Sludge Concentration (ppt)	Sludge Toxicity Equivalents (ppt)	MAL (ppq)
2,3,7,8-TCDD	1					10
1,2,3,7,8-PeCDD	0.5					50
2,3,7,8-HxCDDs	0.1					50
1,2,3,4,6,7,8-HpCDD	0.01					50
2,3,7,8-TCDF	0.1					10
1,2,3,7,8-PeCDF	0.05					50
2,3,4,7,8-PeCDF	0.5					50
2,3,7,8-HxCDFs	0.1					50
2,3,4,7,8-HpCDFs	0.01					50
OCDD	0.0003					100
OCDF	0.0003					100
PCB 77	0.0001					500
PCB 81	0.0003					500
PCB 126	0.1					500
PCB 169	0.03					500
Total						

TABLE 13 (HAZARDOUS SUBSTANCES)

Complete Table 13 as directed. Not required for internal outfalls. (Instructions, Pages 58-59)

a. Are there any pollutants listed in the instructions (page 60) believed present in the discharge?

☐ Yes ☒ No

b. Are there pollutants listed in Item 1.d. on page 1 of this technical report which are believed present in the discharge and have not been analytically quantified elsewhere in this application?

☐ Yes ☒ No

If you responded **yes** to **either** Item a **or** b, complete Table 13 as instructed.

Table 13 for Outfall No.: N/A
Samples are (check one): ☐ **Composites** ☐ **Grabs**

Pollutant	CASRN	Average (µg/L)	Maximum (µg/L)	No. of Samples	Analytical Method

WORKSHEET 3.0
LAND APPLICATION OF EFFLUENT

This worksheet **is required** for all renewal, amendment, and new applications for a permit to dispose of wastewater by land application.

1. TYPE OF DISPOSAL SYSTEM (Instructions, Page 67)

Indicate the type of land disposal being proposed.

- ☐ Irrigation
- ☐ Evaporation
- ☐ Evapotranspiration beds
- ☐ Drip irrigation system
- ☐ Subsurface application
- ☐ Subsurface soils absorption
- ☐ Surface application
- ☐ Other (describe below in detail):

Click here to enter text

2. LAND APPLICATION AREA (Instructions, Page 67)

Land Application Area Information

Effluent Application (gallons/day)	Irrigation Acreage (acres)	Describe land use & indicate type(s) of crop(s)	Public Access? (Y/N)

3. ANNUAL CROPPING PLAN (Instructions, Page 67)

Attach the required cropping plan that includes each of the following:

- Cool and warm season plant species
- Crop growing season
- Harvesting method/number of harvests
- Minimum/maximum harvest height
- Crop yield goals
- Soils map
- Break down of acreage and percent of total acreage for each crop
- Nitrogen requirements per crop
- Additional fertilizer requirements
- Supplemental watering requirements
- Crop salt tolerances
- Justification for not removing existing vegetation to be irrigated

Attachment: Click here to enter text

4. STORMWATER MANAGEMENT (Instructions, Page 68)

Is stormwater runoff a component of the effluent disposed of via land application?

☐ Yes ☐ No

If **yes**, provide the following information:

Stormwater Management Disposal Areas

Disposal Area	Area Contributing Runoff (acres)	Primary Soil Type	Cover Type (i.e. pasture, row crop land, concrete slab, etc.)

If **no**, provide a description of tailwater controls and stormwater run-on controls used for the disposal area.

Click here to enter text.

5. WELL AND MAP INFORMATION (Instructions, Page 68)

Indicate that the following information is shown and labeled on the USGS map:

☐ The boundaries of the land application site(s)

☐ On-site buildings

☐ Waste-disposal or treatment facilities

☐ All water wells within ½-mile radius of the disposal site or property boundaries

☐ All springs and seeps onsite and within 500 feet of the property

☐ All surface waters in the state onsite and within 500 feet of the property

☐ Effluent storage and tailwater control facilities

☐ Buffer zones

List and cross reference all water wells located on or within 500 feet of the disposal site or property boundaries in the following table. Attach additional pages as necessary to include all of the wells.

Well Map Information

Well ID	Well Use	Producing? Y/N	Open, cased, capped, or plugged?	Proposed Best Management Practice

Do you plan to install groundwater monitoring wells or lysimeters around the land application site?

☐ Yes ☐ No

If **yes**, provide the proposed location of the monitoring wells or lysimeters on a site map.

6. SOIL MAP AND SOIL INFORMATION (Instructions, Page 69)

Indicate that the following information was provided:

☐ USDA Soil Survey map that indicates the area to be used for land application with the locations identified by fields and crops

☐ Breakdown of acreage and percent of total acreage for each soil type

☐ Copies of laboratory soil analyses

7. LABORATORY ACCREDITATION CERTIFICATION (Instructions, Page 70)

Effective July 1, 2008, all laboratory tests performed must meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification* with the following general exemptions:

a. The laboratory is an in-house laboratory and is:

   1. periodically inspected by the TCEQ; or
   2. located in another state and is accredited or inspected by that state; or
   3. performing work for another company with a unit located in the same site; or
   4. performing pro bono work for a governmental agency or charitable organization.

b. The laboratory is accredited under federal law.

c. The data are needed for emergency-response activities, and a laboratory accredited under the Texas Laboratory Accreditation Program is not available.

d. The laboratory supplies data for which the TCEQ does not offer accreditation.

The applicant should review *30 TAC Chapter 25* for specific requirements. The following certification statement shall be signed and submitted with every application. See Instructions, Page 32, for a list of designated representatives who may sign the certification.

I,_____, certify that all laboratory tests submitted with this application meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification*.

8. EFFLUENT MONITORING DATA (Instructions, Page 70)

Completion of Table 14 **is required** for all renewal and amendment applications. Provide monitoring data for the previous two years for all parameters regulated in the permit. A table with blank headers has been provided for parameters that are not listed in the first table.

Table 14 for Site No.: Click here to enter text.

Samples are (check one): ☐ **Composites** ☐ **Grabs**

Date (mo/yr)	Daily Avg Flow (gpd)	BOD5 (mg/L)	TSS (mg/L)	Nitrogen (mg/L)	Conductivity (mmhos/cm)	Total acres irrigated	Hydraulic Application rate (acre-feet/month)

Attach an explanation of all persistent excursions to permitted parameters and corrective actions taken.

Attachment: Click here to enter text.

Use this table to provide effluent analysis for parameters not listed in the table above.

Additional Parameter Effluent Analysis

Date (mo/yr)							

Attach an explanation of all persistent excursions to permitted parameters and corrective actions taken.

Attachment: Click here to enter text.

9. POLLUTANT ANALYSIS (Instructions, Page 70)

Completion of Tables 15 and 16 i**s required** for all permit applications for the authorization of land application of effluent.

Table 15 for Site No.: Click here to enter text.

Samples are (check one): ☐ **Composites** ☐ **Grabs**

Pollutant	Sample 1 (mg/L)	Sample 2 (mg/L)	Sample 3 (mg/L)	Sample 4 (mg/L)	Average (mg/L)
BOD (5-day)					
CBOD (5-day)					
Chemical oxygen demand					
Total organic carbon					
Ammonia nitrogen					
Total suspended solids					
Nitrate nitrogen					
Total organic nitrogen					
Total phosphorus					
Oil and grease					
Total residual chlorine					
Total dissolved solids					
Sulfate					
Chloride					
Fluoride					
Fecal Coliform (cfu/100 mL)					
Specific conductance (mmhos/cm)					
pH (standard units; min/max)					
Soluble sodium					
Soluble calcium					
Soluble magnesium					
SAR (unitless)					

Table 16: for Site No.: Click here to enter text.

Samples are (check one): ☐ **Composites** ☐ **Grabs**

Pollutant	Sample 1 (µg/L)	Sample 2 (µg/L)	Sample 3 (µg/L)	Sample 4 (µg/L)	Average (µg/L)	MAL (µg/L)
Aluminum, total						2.5
Antimony, total						5
Arsenic, total						0.5
Barium, total						3
Beryllium, total						0.5
Boron, total						20
Cadmium, total						1
Chromium, total						3
Chromium, hexavalent						3
Chromium, trivalent						N/A
Copper, total						2
Cyanide						2/10
Lead, total						0.5
Mercury, total						0.005/0.0005
Nickel, total						2
Selenium, total						5
Silver, total						0.5
Thallium, total						0.5
Zinc, total						5.0

WORKSHEET 3.1
SURFACE LAND APPLICATION AND EVAPORATION

This worksheet **is required** for all renewal, amendment, and new applications for a permit to dispose of wastewater by surface land application.

1. SURFACE SPRAY (Instructions, Page 71)

Area under irrigation (acres): Click here to enter text.

Design application rate (acre-ft/acre/yr): Click here to enter text.

Design application frequency (hours/day): Click here to enter text.

Design application frequency (days/week): Click here to enter text.

Design total nitrogen loading rate (lbs nitrogen/acre/year): Click here to enter text.

Average slope of the application area (percent): Click here to enter text.

Maximum slope of the application area (percent): Click here to enter text.

Irrigation efficiency (percent): Click here to enter text.

Effluent conductivity (mmhos/cm): Click here to enter text.

Soil conductivity (mmhos/cm): Click here to enter text.

Curve number: Click here to enter text.

Method of Application: Click here to enter text.

Attach a detailed engineering report with water balance, storage volume calculations, and nitrogen balance.

Attachment: Click here to enter text.

2. EVAPORATION PONDS (Instructions, Page 72)

Daily average effluent flow into ponds: Click here to enter text. gallons per day

Attach a separate engineering report with water balance and storage volume calculations.

Attachment: Click here to enter text.

3. EVAPOTRANSPIRATION BEDS (Instructions, Page 72)

Number of beds: Click here to enter text.

Area of bed(s) (acres): Click here to enter text.

Depth of bed(s) (feet): Click here to enter text.

Void ratio of soil in the beds: Click here to enter text.

Storage volume within the beds (include units): Click here to enter text.

Attach a certification by a licensed Texas professional engineer that the liner meets TCEQ requirements.

Attachment: Click here to enter text.

Attach a separate engineering report with water balance, storage volume calculations, and description of the liner.

Attachment: Click here to enter text.

4. OVERLAND FLOW (Instructions, Page 72)

Area used for application (acres): Click here to enter text.

Slopes for application area (percent): Click here to enter text.

Design application rate (gpm/foot of slope width): Click here to enter text.

Slope length (feet): Click here to enter text.

Design BOD5 loading rate (lbs BOD5/acre/day): Click here to enter text.

Design application frequency (hours/day): Click here to enter text.

Design application frequency (days/week): Click here to enter text.

Attach a separate engineering report with the method of application and design requirements according to *30 TAC § 217.212*.

Attachment: Click here to enter text.

5. EDWARDS AQUIFER RECHARGE AREA (Instructions, Page 72)

Is the facility subject to *30 TAC Chapter 213, Edwards Aquifer Rules*?

☐ Yes ☐ No

Attach a report that describes the surface geological units present in the proposed land application site and identify the location and extent of any significant regard areas in the land application site.

Attachment: Click here to enter text.

WORKSHEET 3.2
SUBSURFACE IRRIGATION SYSTEMS (NON-DRIP)

This worksheet **is required** for all renewal, amendment, and new applications for a permit to dispose of wastewater by subsurface land application.

This worksheet **is not required** for systems that meet the definition of a Subsurface Area Drip Dispersal System as defined in *30 TAC Chapter 222*.

☐ Indicate with an 'x' in the box that the Class V Injection Well Inventory/Authorization Form (Worksheet 9.0) for this type of disposal system has been submitted to the TCEQ UIC Permits Team as directed.

1. SUBSURFACE APPLICATION (Instructions, Page 73)

Indicate the type of subsurface land disposal system you use or are proposing to use:

☐ Conventional drainfield, beds, or trenches

☐ Low pressure dosing

☐ Other: Click here to enter text.

Provide the following information:

Application area (acres): Click here to enter text.

Area of drainfield (square feet): Click here to enter text.

Application rate (gal/square ft/day): Click here to enter text.

Depth to groundwater (feet): Click here to enter text.

Area of trench (square feet): Click here to enter text.

Dosing duration per area (hours): Click here to enter text.

Number of beds: Click here to enter text.

Dosing amount per area (inches/day): Click here to enter text.

Soil infiltration rate (inches/hour): Click here to enter text.

Storage volume (gallons): Click here to enter text.

Area of bed(s) (square feet): Click here to enter text.

Soil classification: Click here to enter text.

Attach a separate engineering report with all necessary information and a description of the schedule of dosing basin rotation.

Attachment: Click here to enter text.

2. EDWARDS AQUIFER RECHARGE AREA (Instructions, Page 73)

a. Is the subsurface system located on the Edwards Aquifer Recharge Zone, as mapped by the TCEQ?

☐ Yes ☐ No

b. Is the subsurface system located on the Edwards Aquifer Transition Zone, as mapped by the TCEQ?

☐ Yes ☐ No

If **yes** to **either** question, the subsurface system may be prohibited by *30 TAC § 213.8*. Please call the Industrial Permits Team to schedule a pre-application meeting.

WORKSHEET 3.3
SUBSURFACE AREA DRIP DISPERSAL SYSTEMS

This worksheet **is required** for all renewal, amendment, and new applications for a permit to dispose of wastewater using a subsurface area drip dispersal system.

☐ Indicate with an 'x' in the box that the Class V Injection Well Inventory/Authorization Form (Worksheet 9.0) for this type of disposal system has been submitted to the TCEQ UIC Permits Team as directed.

1. ADMINISTRATIVE INFORMATION (Instructions, Page 74)

a. Provide the legal name of all corporations or other business entities managed, owned, or otherwise closely related to the owner of the treatment facility.

Click here to enter text.

b. Is the owner of the land where the treatment facility is located the same as the owner of the treatment facility?

☐ Yes ☐ No

If **no**, provide the legal name of all corporations or other business entities managed, owned, or otherwise closely related to the owner of the land where the treatment facility is located.

Click here to enter text.

c. Owner of the subsurface area drip dispersal system:

Click here to enter text.

d. Is the owner of the subsurface area drip dispersal system the same as the owner of the wastewater treatment facility or the site where the wastewater treatment facility is located?

☐ Yes ☐ No

If **no**, identify the names of all corporations or other business entities managed, owned, or otherwise closely related to the entity identified in Item 1.c.

Click here to enter text.

e. Owner of the land where the subsurface area drip dispersal system is located:

Click here to enter text

f. Is the owner of the land where the subsurface area drip dispersal system is located the same as owner of the wastewater treatment facility, the site where the wastewater treatment facility is located, or the owner of the subsurface area drip dispersal system?

☐ Yes ☐ No

If **no**, identify the name of all corporations or other business entities managed, owned, or otherwise closely related to the entity identified in item 1.e.

Click here to enter text

2. SUBSURFACE AREA DRIP DISPERSAL SYSTEM (Instructions, Page 75)

a. Check the type of system you use or are proposing to use:

☐ Subsurface drip/trickle irrigation

☐ Surface drip irrigation

☐ Other: Click here to enter text

b. Provide the following information:

Application area (acres): Click here to enter text

Soil infiltration rate (inches/hour): Click here to enter text

Average slope of the application area: Click here to enter text

Maximum slope of the application area: Click here to enter text

Storage volume (gallons): Click here to enter text

Major soil series: Click here to enter text

Depth to groundwater (feet): Click here to enter text

Effluent conductivity (mmhos/cm): Click here to enter text

c. Is the facility located west of the boundary shown in *30 TAC § 222.83* and using a vegetative cover of non-native grasses overseeded with cool-season grasses?

☐ Yes ☐ No

If **yes**, the facility may propose a hydraulic application rate not to exceed 0.1 gal/square foot/day.

d. Is the facility located east of the boundary shown in *30 TAC § 222.83* or is the facility proposing any crop other than non-native grasses?

☐ Yes ☐ No

If **yes**, the facility must use the formula in *30 TAC § 222.83* to calculate the maximum hydraulic application rate.

e. Do you plan to submit an alternative method to calculate the hydraulic application rate for approval by the executive director?

☐ Yes ☐ No

If yes, provide the following information:

- Hydraulic application rate (gal/square foot/day): Click here to enter text.
- Nitrogen application rate (gal/square foot/day): Click here to enter text.

f. Provide the following dosing information:

Number of doses per day: Click here to enter text.

Dosing duration per area (hours): Click here to enter text.

Rest period between doses: Click here to enter text.

Dosing amount per area (inches/day): Click here to enter text.

Number of zones: Click here to enter text.

Is the proposed system is a surface drip irrigation system proposing to use existing native vegetation as a crop?

☐ Yes ☐ No

If **yes**, attach the following:

- a vegetation survey by a certified arborist describing the percent canopy cover and relative percentage of major overstory and understory plant species.

  Attachment: Click here to enter text.

- a separate engineering report with all necessary information and a description of the schedule of dosing basin rotation.

  Attachment: Click here to enter text.

3. REQUIRED PLANS (Instructions, Page 76)

a. Attach a Recharge Feature Plan with all information required in *30 TAC § 222.79*.

Attachment: Click here to enter text.

b. Attach a Soil Evaluation with all information required in *30 TAC § 222.73*.

Attachment: Click here to enter text.

c. Attach a Site Preparation Plan with all information required in *30 TAC § 222.75*.

Attachment: Click here to enter text.

d. Provide soil sampling and testing with all information required in *30 TAC § 222.157*.

Attachment: Click here to enter text.

4. FLOOD AND RUN-ON PROTECTION (Instructions, Page 76)

a. Is the existing/proposed subsurface area drip dispersal system located within the 100-year frequency flood level?

☐ Yes ☐ No

Source: Click here to enter text.

If **yes**, describe how the site will be protected from inundation.

Click here to enter text.

b. Is the existing/proposed subsurface area drip dispersal system within a designated floodway?

☐ Yes ☐ No

☐ If **yes**, indicate with an 'x' in the box that either the FEMA flood map or alternate information used to make this determination is included with the application. Include the attachment number.

Attachment: Click here to enter text.

5. SUBSURFACE WATERS IN THE STATE (Instructions, Page 77)

a. Buffer Map

Attach a map showing appropriate buffers on surface waters in the state, water wells, and springs/seeps.

Attachment: Click here to enter text.

b. Buffer variance request

Do you plan to request a buffer variance from water wells or waters in the state?

☐ Yes ☐ No

If **yes**, then attach the additional information required in *30 TAC § 222.81(c)*.

Attachment: Click here to enter text.

6. EDWARDS AQUIFER RECHARGE AREA (Instructions, Page 77)

a. Is the subsurface area drip dispersal system located on the Edwards Aquifer Recharge Zone, as mapped by the TCEQ?

☐ Yes ☐ No

b. Is the subsurface area drip dispersal system located on the Edwards Aquifer Transition Zone, as mapped by the TCEQ?

☐ Yes ☐ No

If **yes** to **either** question, the subsurface area drip dispersal system may be prohibited by *30 TAC § 213.8*. Please call the Industrial Permits Team to schedule a pre-application meeting.

WORKSHEET 4.0
RECEIVING WATERS

This worksheet **is required** for all renewal, amendment, and new TPDES permit applications.

1. DOMESTIC DRINKING WATER SUPPLY (Instructions, Page 78)

Is there a surface water intake for domestic drinking water supply located within 5 (five) miles downstream from the point/proposed point of discharge?

☐ Yes ☒ No

If **yes**, identify owner of the drinking water supply, the distance and direction to the intake, and locate and identify the intake on the USGS map.

☐ Indicate with an 'x' in the box that the requested information is provided.

2. DISCHARGE INTO TIDALLY INFLUENCED WATERS (Instructions, Page 78)

a. Width of the receiving water at the outfall? ~~Discharge is into an open water channel~~ feet Approximately 1,200 feet

b. Are there oyster reefs in the vicinity of the discharge?

☐ Yes ☒ No

If **yes**, indicate approximate distance and direction from outfall(s):

Click here to enter text.

c. Are there any sea grasses within the vicinity of the point of discharge?

☐ Yes ☒ No

If **yes**, provide the distance and direction to the grasses:

Click here to enter text.

3. CLASSIFIED SEGMENT (Instructions, Page 78)

Is the discharge directly into (or within 300 feet of) a classified segment?

☒ Yes ☐ No

If **yes, stop here**. It is not necessary to complete Items 4 and 5, and it is not necessary to complete Worksheet 4.1.

If **no**, complete Items 4 and 5.

4. DESCRIPTION OF IMMEDIATE RECEIVING WATERS (Instructions, Page 79)

Name of the immediate receiving waters: Click here to enter text.

a. Check the appropriate description of the receiving waters

☐ Lake or Pond

Surface area (acres): Click here to enter text.

Average depth of the entire water body (feet): Click here to enter text.

Average depth of water body within a 500-foot radius of the discharge point (feet): Click here to enter text.

☐ Man-made Channel or Ditch

☐ Stream or Creek

☐ Freshwater Swamp or Marsh

☐ Tidal Stream, Bayou, or Marsh

☐ Open Bay

☐ Other: Click here to enter text.

If you checked "man-made channel or ditch" or "stream or creek" above, provide responses to items b - e below:

b. For existing discharges, check the description below that best characterizes the area upstream of the discharge.

For new discharges, check the description below that best characterizes the area downstream of the discharge.

☐ Intermittent (dry for at least one week during most years)

☐ Intermittent with Perennial Pools (enduring pools containing habitat to maintain aquatic life uses)

☐ Perennial (normally flowing)

Check the source(s) of the information used to characterize the area upstream (existing discharge) or downstream (new discharge):

☐ USGS flow records

☐ personal observation

☐ historical observation by adjacent landowner(s)

☐ others, specify: Click here to enter text.

c. List the names of all perennial streams that join the receiving water within three miles downstream of the discharge point:

Click here to enter text.

d. Do the receiving water characteristics change within three miles downstream of the discharge? (e.g., natural or man-made dams, ponds, reservoirs, etc.)

☐ Yes ☐ No

If yes, discuss how:

Click here to enter text.

e. Provide general observations of the water body during normal dry weather conditions:

Click here to enter text.

Date and time of observation: Click here to enter text.

Was water body influenced by stormwater runoff during observations?

☐ Yes ☐ No

5. GENERAL CHARACTERISTICS OF WATER BODY (Instructions, Page 79)

a. Is the receiving water upstream of the existing discharge or proposed discharge site influenced by (check as appropriate):

☐ oil field activities
☐ urban runoff
☐ agricultural runoff
☐ septic tanks
☐ upstream discharges
☐ others, specify: Click here to enter text.

b. Uses of water body observed or evidence of such uses (check as appropriate):

☐ livestock watering
☐ contact recreation
☐ navigation
☐ non-contact recreation
☐ fishing
☐ picnic park activities
☐ domestic water supply
☐ industrial water supply
☐ irrigation withdrawal
☐ others, specify: Click here to enter text.

c. Check the description (only one) that best describes the aesthetics of the receiving water and the surrounding area:

☐ Wilderness: outstanding natural beauty; usually wooded or unpastured area: water clarity exceptional

☐ Natural Area: trees or native vegetation common; some development evident (from fields, pastures, dwellings); water clarity discolored

☐ Common Setting: not offensive, developed but uncluttered; water may be colored or turbid

☐ Offensive: stream does not enhance aesthetics; cluttered; highly developed; dumping areas; water discolored

WORKSHEET 4.1
STREAM PHYSICAL CHARACTERISTICS

The following information **is required** for all new applications, all major facilities, and any applications requesting to add an outfall if the receiving waters are **perennial** or **intermittent with perennial pools**.

Date of study: Click here to enter text. Time of study: Click here to enter text.

Stream name: Click here to enter text.

Location: Click here to enter text.

Type of stream upstream of existing discharge or downstream of proposed discharges, (check one):

☐ **perennial** ☐ **intermittent with perennial pools**

Complete the transects downstream of the existing or proposed discharges.

1. DATA COLLECTION (Instructions, Pages 80-81)

No. of defined stream bends:

Well: Click here to enter text. Moderately: Click here to enter text. Poorly: Click here to enter text.

No. of riffles:

Evidence of Flow fluctuations (check one):

Minor: Click here to enter text. Moderate: Click here to enter text. Severe: Click here to enter text.

Indicate the observed stream uses and if there is evidence or flow fluctuations or channel obstructions/modifications:

Click here to enter text.

Stream Transect Data

Transect Location	Habitat Type*	Water Surface Width (ft)	Stream Depths (ft)**								

* riffle, run, glide, or pool
** channel bed to water surface

2. SUMMARIZE MEASUREMENTS (Instructions, Page 81)

Streambed slope of entire reach (from USGS map in ft. /ft.): Click here to enter text.

Approximate drainage area above the most downstream transect from USGS map or county highway map (square miles): Click here to enter text.

Length of stream evaluated (ft): Click here to enter text.

Number of lateral transects made: Click here to enter text.

Average stream width (ft): Click here to enter text.

Average stream depth (ft): Click here to enter text.

Average stream velocity (ft/sec): Click here to enter text.

Instantaneous stream flow (ft^3/sec): Click here to enter text.

Indicate flow measurement method (VERY IMPORTANT – type of meter, floating chip timed over a fixed distance, etc.): Click here to enter text.

Flow fluctuations (minor, moderate, severe): Click here to enter text.

Size of pools (large, small, moderate, none): Click here to enter text.

Maximum pool depth (ft): Click here to enter text.

Total number of stream bends: Click here to enter text.

- Number well defined: Click here to enter text.
- Number moderately defined: Click here to enter text.
- Number poorly defined: Click here to enter text.

Total number of riffles: Click here to enter text.

WORKSHEET 5.0
SEWAGE SLUDGE MANAGEMENT AND DISPOSAL

The following information **is required** for all TPDES permit applications that meet the conditions as outlined in Technical Report 1.0, Item 7.

1. SEWAGE SLUDGE SOLIDS MANAGEMENT PLAN (Instructions, Page 82)

a. Is this a new permit application or an amendment permit application?

☐ Yes ☐ No

b. Does the facility discharge in the Lake Houston watershed?

☐ Yes ☐ No

If yes to either Item a or b, attach a solids management plan.

Attachment:: Click here to enter text.

2. SEWAGE SLUDGE MANAGEMENT AND DISPOSAL (Instructions, Page 83)

a. Please check the current sludge disposal method(s). More than one method can be checked.

☐ Permitted landfill

☐ Marketing and distribution by the permittee

☐ Registered land application site

☐ Composted by the permittee

☐ Surface disposal site (sludge monofill)

☐ Transported to another WWTP (written statement or contractual agreement required)

☐ Beneficial land application as authorized in the existing permit

b. Disposal site name: Click here to enter text.

TCEQ Permit/Registration Number: Click here to enter text.

County where disposal site is located: Click here to enter text.

c. Method of transportation (truck, train, pipe, other): Click here to enter text.

Hauler Registration Number: Click here to enter text.

Sludge is transported as a:

☐ liquid

☐ semi-liquid

☐ semi-solid

☐ solid

Purpose of land application (check one): ☐ reclamation ☐ soil conditioning

Provide a written statement or copy of contractual agreements confirming that the wastewater treatment plant identified above will accept and be responsible for the sludge from the plant for the life of the permit (at least 5 years).

Attachment: Click here to enter text

d. If the existing permit contains authorization for sludge land application, composting, marketing and distribution of sludge, or sludge lagoons and authorization to renew the activity is being sought in the application, the appropriate sections of the Sewage Sludge Technical Report (form TCEQ-10056) must be provided.

3. PERMIT AUTHORIZATION FOR SEWAGE SLUDGE DISPOSAL (Instructions, Page 83)

Are you requesting new authorization to beneficially land apply sewage sludge at this site or a site under your direct control?

☐ Yes ☐ No

Are you requesting new authorization to market and distribute sewage sludge at this facility or a facility under your direct control?

☐ Yes ☐ No

Are you requesting new authorization to compost sewage sludge?

☐ Yes ☐ No

Are you requesting new authorization to surface dispose sewage sludge at this site or site under your direct control?

☐ Yes ☐ No

Are you requesting new authorization to incinerate sewage sludge at this site or site under your direct control?

☐ Yes ☐ No

If **yes** to **any** of the above items, provide the information required in the *Sewage Sludge Technical Report* (form TCEQ-10056).

Attachment: Click here to enter text

New authorization for beneficial land application, incineration, and sludge lagoons in the TPDES permit or TLAP **requires a major amendment to the permit**. New authorization for composting may require a major amendment to the permit. See the instructions for an explanation whether a major amendment is required or if authorization for composting can be added through the renewal process.

WORKSHEET 6.0
INDUSTRIAL WASTE CONTRIBUTION

1. ALL POTWS (Instructions, Page 84)

a. Provide the number of each of the following types of industrial users (IUs) that discharge to your POTW and the daily average flows from each. See Definitions for Categorical IU (CIU), Significant IU (SIU) – Non-Categorical, and Other IU.

Industrial User Information

Type of Industrial User	Number of Industrial Users	Daily Average Flow (gallons per day)
CIU		
SIU - Non-categorical		
Other IU		

b. In the past three years, has your POTW experienced treatment plant interference as defined in the Definition section of the instructions?

☐ Yes ☐ No

If **yes**, identify the date(s), duration, nature of interference, and probable cause(s) and possible source(s) of each interference event. Include the names of the IU(s) that may have caused the interference. Submit an attachment if necessary.

Click here to enter text

Attachment: Click here to enter text

c. In the past three years, has your POTW experienced pass through as defined in the Definitions relating to Pretreatment section of the instructions (see page 13)?

☐ Yes ☐ No

If **yes**, identify the date(s), duration, pollutants passing through the treatment plant, and probable cause(s) and possible source(s) of each pass through event. Include the names of the IU(s) that may have caused the pass through. Submit an attachment if necessary.

Click here to enter text

Attachment: Click here to enter text

d. Does your POTW have, or is it required to develop, an approved pretreatment program?

☐ Yes ☐ No

If **yes**, answer all questions in Item 2, but skip Item 3.

If **no**, skip Item 2 and answer all questions in Item 3 for each significant industrial user and categorical industrial user.

2. POTWS WITH APPROVED PROGRAMS OR THOSE REQUIRED TO DEVELOP A PROGRAM (Instructions, Pages 84-85)

a. Have there been any substantial modifications to the POTW's approved pretreatment program that have not been submitted to the Approval Authority (TCEQ) for approval according to *40 CFR § 403.18*?

☐ Yes ☐ No

If **yes**, identify on a separate attachment all substantial modifications that have not been submitted to the TCEQ, including the purpose of the modification.

Attachment: Click here to enter text.

b. Have there been any nonsubstantial modifications to the POTW's approved pretreatment program that have not been submitted to the Approval Authority (TCEQ)?

☐ Yes ☐ No

If **yes**, identify on a separate attachment all nonsubstantial modifications that have not been submitted to the TCEQ, including the purpose of the modification.

Attachment: Click here to enter text.

c. Effluent Parameters above the minimum analytical level (MAL).

List all parameters measured above the MAL in the POTW's effluent monitoring during the last three years.

Effluent Parameters Measured Above the MAL

Pollutant	Concentration	MAL	Units	Date

d. Has any SIU, CIU, or other IU caused or contributed to any other problems (excluding interference or pass through) at your POTW in the past three years?

☐ Yes ☐ No

If **yes**, provide a description of each episode, including date(s), duration, description of problems, and probable pollutants. Include the name(s) of the SIU(s)/CIU(s)/other IU(s) that may have caused or contributed to any of the problems.

Click here to enter text.

3. SIGNIFICANT INDUSTRIAL USER AND CATEGORICAL INDUSTRIAL USER INFORMATION (Instructions, Pages 85-86)

a. Company Name: Click here to enter text. SIC Code: Click here to enter text.

Telephone number: Click here to enter text. Fax number: Click here to enter text.

Contact name: Click here to enter text.

Physical Address: Click here to enter text. City: Click here to enter text.

State: Click here to enter text. Zip Code: Click here to enter text.

b. Describe the industrial processes or other activities that affect or contribute to the SIU(s) or CIU(s) discharge (i.e., process and non-process wastewater):

Click here to enter text.

c. Provide a description of the principal products(s) or service(s) performed:

Click here to enter text.

d. Flow rate information

Flow rate information

Effluent Type	Discharge (gallons per day)	Discharge Frequency (continuous, batch, or intermittent)
Process wastewater		
Non-process wastewater		

e. Pretreatment Standards

Is the SIU or CIU subject to technology-based local limits as defined in the application instructions?

☐ Yes ☐ No

Is the SIU subject to categorical pretreatment standards?

☐ Yes ☐ No

If the SIU is subject to categorical pretreatment standards, provide the category and subcategory or subcategories:

SIUs Subject To Categorical Pretreatment Standards

Category in 40 CFR	Subcategory in 40 CFR	Subcategory in 40 CFR	Subcategory in 40 CFR	Subcategory in 40 CFR

f. Has the SIU or CIU caused or contributed to any problem(s) (e.g., interferences, pass through, odors, corrosion, blockages) at your POTW in the past three years?

☐ Yes ☐ No

If **yes**, provide a description of each episode, including dates, duration, description of problems, and probable pollutants, and include the name(s) of the SIU(s)/CIU(s) that may have caused or contributed to the problem(s).

Click here to enter text.

WORKSHEET 7.0
STORMWATER RUNOFF

This worksheet is required for all TPDES permit applications requesting individual permit coverage for discharges of stormwater runoff.

1. APPLICABILITY (Instructions, Page 87)

Do discharges from any of the proposed or existing outfalls consist of stormwater runoff only or stormwater runoff and any of the listed non-stormwater discharges on page 88 of the Instructions?

☐ Yes ☐ No

If **yes**, proceed as directed.

If **no**, stop here.

2. STORMWATER OUTFALL COVERAGE (Instructions, Page 88)

Indicate which type of authorization covers or is proposed to cover discharges from each stormwater outfall.

Authorization coverage

Outfall	Authorized Under MSGP	Authorized Under Individual Permit
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐

If you have indicated that **all** existing or proposed stormwater outfalls are authorized under the MSGP, **stop here.**

If you have indicated that you are seeking authorization for any stormwater outfall under an individual permit, **proceed as directed**.

The following information **is required** for each outfall that discharges stormwater for which you are seeking individual authorization under this permit application.

3. SITE MAP (Instructions, Page 88)

Attach a site map or maps (drawn to scale) of the entire facility with the following information.

Attachment: Click here to enter text.

- the location of each stormwater outfall to be covered by the permit
- an outline of the drainage area that is within the facility's boundary and that contributes stormwater to each outfall to be covered by the permit
- connections or discharge points to municipal separate storm sewer systems
- locations of all structures (e.g. buildings, garages, storage tanks)
- structural control devices that are designed to reduce pollution in stormwater runoff
- process wastewater treatment units (including ponds)
- bag house and other air treatment units exposed to precipitation or runoff
- landfills; scrapyards; surface water bodies (including wetlands)
- vehicle and equipment maintenance areas
- physical features of the site that may influence stormwater runoff or contribute a dry weather flow
- locations where spills or leaks of reportable quality (as defined in *30 TAC § 327.4*) have occurred during the three years before this application was submitted to obtain coverage under an individual permit
- processing areas, storage areas, material loading/unloading areas, and other locations where significant materials are exposed to precipitation or runoff

☐ Indicate with an 'x' in the box that all the above information was provided on the facility site map(s).

4. FACILITY/SITE INFORMATION (Instructions, Pages 88-89)

a. Provide the area of impervious surface and the total area drained by each outfall that discharges stormwater for which you are seeking individual authorization under this permit application.

Impervious Surfaces

Outfall	Area of Impervious Surface (include units)	Total Area Drained (include units)

b. Provide the following local area rainfall information and the source of the information.

Wettest month: Click here to enter text.

Average rainfall for wettest month (total inches): Click here to enter text.

25-year, 24-hour rainfall (inches): Click here to enter text.

Source: Click here to enter text.

c. Provide an inventory, or list, of materials currently handled at the facility that may be exposed to precipitation.

Click here to enter text.

d. Provide narrative descriptions of the industrial processes and activities involving the materials in the above-listed inventory that occur outdoors or in some manner that may result in exposure of the materials to precipitation or runoff.

Click here to enter text.

e. Describe any best management practices and controls that you are using to prevent or effectively reduce pollution in stormwater discharges from the facility.

Click here to enter text.

5. POLLUTANT ANALYSIS (Instructions, Pages 89-91)

a. Complete Table 17 as directed on page 90 of the Instructions.

Table 17 Pollutant Analysis for Outfall No.: Click here to enter text.

Pollutant	Grab Sample* Maximum (mg/L)	Composite Sample** Maximum (mg/L)	Grab Sample* Average (mg/L)	Composite Sample** Average (mg/L)	Number of Storm Events Sampled	MAL (mg/L)
pH (standard units)	(max)	—	(min)	—		—
Total suspended solids						—
Chemical oxygen demand						—
Total organic carbon						—
Oil and grease						—
Arsenic, total						0.0005
Barium, total						0.003
Cadmium, total						0.001
Chromium, total						0.003
Chromium, trivalent						—
Chromium, hexavalent						0.003
Copper, total						0.002
Lead, total						0.0005
Mercury, total						0.000005
Nickel, total						0.002
Selenium, total						0.005
Silver, total						0.0005
Zinc, total						0.005

* Taken during first 30 minutes of storm event
** Flow-weighted composite sample

b. Complete Table 18 as directed on pages 90-92 of the Instructions.

Table 18 Pollutant Analysis for Outfall No.: Click here to enter text.

Pollutant	Grab Sample* Maximum (mg/L)	Composite Sample** Maximum (mg/L)	Grab Sample* Average (mg/L)	Composite Sample** Average (mg/L)	Number of Storm Events Sampled

* Taken during first 30 minutes of storm event
** Flow-weighted composite sample

6. STORM EVENT DATA (Instructions, Page 91)

Provide the following data for the storm event(s) which resulted in the maximum values for the analytical data submitted:

Date of storm event: Click here to enter text.

Duration of storm event (minutes): Click here to enter text.

Total rainfall during storm event (inches): Click here to enter text.

Number of hours between beginning of storm measured and end of previous measurable rain event (hours): Click here to enter text.

Maximum flow rate during rain event (gallons/minute): Click here to enter text.

Total stormwater flow from rain event (gallons): Click here to enter text.

Provide a description of the method of flow measurement or estimate: Click here to enter text.

WORKSHEET 8.0
AQUACULTURE

This worksheet is required for all TPDES permit applications requesting individual permit coverage for discharges of aquaculture wastewater.

1. FACILITY/SITE INFORMATION (Instructions, Pages 92-93)

a. Describe the production ponds, raceways, and fabricated tanks at the facility:

Production Pond Descriptions:

Number of Ponds	Dimensions (include units)	Area of Each Pond (include units)	Number of Ponds × Area of Ponds (include units)

Total surface area of all ponds: Click here to enter text.

Raceway Descriptions:

Number of Raceways	Dimensions (include units)

Fabricated Tank Descriptions:

Number of Tanks	Dimensions (include units)

b. Do you have a TPWD-approved emergency plan?

☐ Yes ☐ No

c. Do you have an aquatic plant transplant authorization?

☐ Yes ☐ No

If **yes**, please provide a copy of the authorization letter.

Attachment: Click here to enter text.

d. How many aquaculture facilities are located within a 25-mile radius of this facility? Click here to enter text.

2. SPECIES IDENTIFICATION (Instructions, Page 93)

Identify each species being raised, the source, origin, and the disease status of the stock. If applicable, identify and attach copies of current relevant authorizations or permits that authorize the species.

Stock Species Information

Species	Source of Stock	Origin of Stock	Disease Status	Authorizations

3. STOCK MANAGEMENT PLAN (Instructions, Pages 93-94)

Provide a detailed stock management plan including all information required on pages 94-95 of the Instructions. Provide an attachment if necessary (and include the attachment number).

Click here to enter text.

Attachment: Click here to enter text.

4. WATER TREATMENT AND DISCHARGE DESCRIPTION (Instructions, Page 94)

Provide a detailed description of the discharge practices and water treatment process including all information required on page 95 of the Instructions. Provide an attachment if necessary (and include the attachment number).

Click here to enter text.

Attachment: Click here to enter text.

5. SOLID WASTE MANAGEMENT (Instructions, Page 94)

Describe solid waste-disposal practices including all information required on page 95 of the Instructions. Provide an attachment if necessary (and include the attachment number).

Click here to enter text.

Attachment: Click here to enter text.

6. SITE ASSESSMENT REPORT AND SENSITIVE HABITAT REQUIREMENTS (Instructions, Pages 95-96)

Information in this section must be provided only by new and expanding commercial shrimp facilities located within the coastal zone.

Attach a detailed site assessment report including the following.

Attachment: Click here to enter text.

- Facility location
- Flushing rate
- Reefs
- Endangered or threatened species or species of concern
- Spawning
- Nesting
- Bird roosts
- Recreational use
- Nursery habitat
- Discharge characterization

WORKSHEET 9.0
CLASS V INJECTION WELL INVENTORY/AUTHORIZATION FORM

SUBMIT TO:		For TCEQ Use Only
TCEQ UIC Permits Team Radioactive Materials Division MC 233 PO Box 13087 Austin, Texas 78711-3087 512/239-6466	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY CLASS V INJECTION WELL INVENTORY/ AUTHORIZATION FORM	Reg. No. Date Received: Date Authorized:

Reg. No. 5

SECTION I GENERAL INFORMATION

Provide the information in Items 1 through 8 (Instructions, Page 98)

General Information
1. TCEQ Program Area (PST, VCP, IHW, etc.), Contact Name and Phone Number Click here to enter text
2. Agent/Consultant, Contact Name, Address (Street, City, State, and Zip Code), and Phone Number Click here to enter text
3. ☐ Owner ☐ Operator Owner/Operator, Contact Name, Address (Street, City, State, and Zip Code), and Phone Number Click here to enter text
4. Facility Name, Address (Street, City, County, State, and Zip Code) or location description (if no address is available) and Facility Contact Person and Phone Number Click here to enter text
5. Latitude and Longitude (degrees-minutes-seconds) and method of determination (GPS, TOPO, etc.) (Attach topographic quadrangle map as Attachment A) Click here to enter text
6. Type of Well Construction (Vertical Injection, Subsurface Fluid Distribution System, Infiltration Gallery, Temporary Injection Points, etc.) and Number of Injection Wells Click here to enter text
7. Detailed Description regarding purpose of Injection System. Attach a Site Map as Attachment B (Attach the Approved Remediation Plan [if appropriate]) Click here to enter text
8. Water Well Driller/Installer, Address (Street, City, State, and Zip Code), Phone Number, and License Number Click here to enter text

S-Application 000316

SECTION II PROPOSED DOWN HOLE DESIGN

Attach a diagram signed and sealed by a licensed engineer as Attachment C

Name of String	Size	Setting Depth	Sacks Cement/Grout - Slurry Volume - Top of Cement	Hole Size	Weight PVC/Steel (lbs/ft)
9. Casing					
10. Tubing					
11. Screen					

SECTION III PROPOSED TRENCH SYSTEM, SUBSURFACE FLUID DISTRIBUTION SYSTEM, OR INFILTRATION GALLERY

Attach a diagram signed and sealed by a licensed engineer as Attachment D

Proposed System Information	
12. System(s) Dimensions Click here to enter text	13. System(s) Construction Click here to enter text

SECTION IV SITE HYDROGEOLOGICAL AND INJECTION ZONE DATA

Provide the information in Items 14 through 31

Site Hydrogeological and Injection Zone Data
14. Name of Contaminated Aquifer Click here to enter text
15. Receiving Formation Name of Injection Zone Click here to enter text
16. Well/Trench Total Depth Click here to enter text
17. Surface Elevation Click here to enter text
18. Depth to Groundwater Click here to enter text
19. Injection Zone Depth Click here to enter text
20. Injection Zone vertically isolated geologically? ☐ Yes ☐ No Impervious Strata between Injection Zone and nearest Underground Source of Drinking Water Name: Click here to enter text Thickness: Click here to enter text

Site Hydrogeological and Injection Zone Data
21. Provide a list of contaminants and the levels (ppm) in contaminated aquifer Attach as Attachment E
22. Horizontal and Vertical extent of contamination and injection plume Attach as Attachment F
23. Formation (Injection Zone) Water Chemistry (Background levels) TDS, etc Attach as Attachment G
24. Injection Fluid Chemistry in PPM at point of injection Attach as Attachment H
25. Lowest Known Depth of Groundwater with < 10,000 PPM TDS Click here to enter text
26. Maximum injection Rate/Volume/Pressure Click here to enter text
27. Water wells within 1/4 mile radius (attach map as Attachment I) Click here to enter text
28. Injection wells within 1/4 mile radius (attach map as Attachment I) Click here to enter text
29. Monitor wells within 1/4 mile radius (attach drillers logs and map as Attachment I) Click here to enter text
30. Sampling frequency Click here to enter text
31. Known hazardous components in injection fluid Click here to enter text

SECTION V SITE HISTORY

Provide the information in Items 32 through 35

Site History
32. Type of Facility Click here to enter text
33. Contamination Dates Click here to enter text
34. Original Contamination (VOCs, TPH, BTEX, etc.) and Concentrations Attach as Attachment J
35. Previous Remediation Attach results of any previous remediation as Attachment K

NOTE: Authorization Form should be completed in detail and authorization given by the TCEQ before construction, operation, and/or conversion can begin. Attach additional pages as necessary.

CLASS V INJECTION WELL DESIGNATIONS

5A07 Heat Pump/AC return (IW used for groundwater to heat or cool buildings)

5A19 Industrial Cooling Water Return Flow (IW used to cool industrial process equipment)

5B22 Salt Water Intrusion Barrier (IW used to inject fluids to prevent the intrusion of salt water into an aquifer)

5D02 Stormwater Drainage (IW designed for the disposal of rain water)

5D04 Industrial Stormwater Drainage Wells (IW designed for the disposal of rain water associated with industrial facilities)

5F01 Agricultural Drainage (IW that receive agricultural runoff)

5R21 Aquifer Recharge (IW used to inject fluids to recharge an aquifer)

5S23 Subsidence Control Wells (IW used to control land subsidence caused by groundwater withdrawal)

5W09 Untreated Sewage

5W10 Large Capacity Cesspools (Cesspools that are designed for 5,000 gpd or greater)

5W11 Large Capacity Septic systems (Septic systems designed for 5,000 gpd or greater)

5W12 WTTP disposal

5W20 Industrial Process Waste-disposal Wells

5W31 Septic System (Well Disposal method)

5W32 Septic System Drainfield Disposal

5X13 Mine Backfill (IW used to control subsidence, dispose of mining byproducts, or fill sections of a mine)

5X25 Experimental Wells (Pilot Test) (IW used to test new technologies or tracer dye studies)

5X26 Aquifer Remediation (IW used to clean up, treat, or prevent contamination of a USDW)

5X27 Other Wells

5X28 Motor Vehicle Waste-disposal Wells (IW used to dispose of waste from a motor vehicle site - These are currently banned)

5X29 Abandoned Drinking Water Wells (waste disposal)

S-Application 000319

WORKSHEET 10.0
QUARRIES IN THE JOHN GRAVES SCENIC RIVERWAY

This worksheet **is required** for all TPDES permit and TLAP applications for individual permits for a municipal solid waste facilities or mining facilities located within a Water Quality Protection Area in the John Graves Scenic Riverway.

Review *30 TAC §§ 311.71-311.82* thoroughly prior to completing any portion of this worksheet.

1. EXCLUSIONS (Instructions, Pages 99-100)

Is this a municipal solid waste facility?

☐ Yes ☐ No

Has this quarry been in operation since January 1, 1994 without cessation of operation for more than 30 consecutive days and under the same ownership?

☐ Yes ☐ No

Is this a coal mine?

☐ Yes ☐ No

Is this a facility mining clay and shale for use in manufacturing structural clay products?

☐ Yes ☐ No

If **yes** to any of the above questions, **stop here**. You are required to maintain acceptable documentation, as outlined in *30 TAC § 311.72(c)*, at the facility to demonstrate the exclusion(s).

2. LOCATION OF THE QUARRY (Instructions, Page 100)

Indicate the distance between the quarry and the nearest navigable water body.

☐ < 200 feet

☐ 200 feet – 1,500 feet

☐ 1,500 feet – 1 mile

☐ > 1 mile

Note that the construction or operation of any new quarry or expansion of any existing quarry **is prohibited** within 200 feet of any water body located within a water quality protection area in the John Graves Scenic Riverway.

3. ADDITIONAL APPLICATION REQUIREMENTS (Instructions, Pages 100-101)

Use the table below to determine which additional application requirements apply to your facility, based on distance between the quarry and the nearest waterway.

Additional Application Requirements

Application Requirement	200 feet – 1,500 feet	1,500 feet – 1 mile	> 1 mile
Restoration Plan	Yes	Yes	Yes
Financial Assurance for Restoration	Yes	Yes	Yes
Technical Demonstration	Yes	Not required	Not required
Reclamation Plan	Yes	Not required	Not required
Financial Assurance for Reclamation	Yes	Not required	Not required

a. Restoration Plan

The Restoration Plan must address each of the following items as required by *30 TAC § 311.76*:

- Certified by a licensed Texas professional engineer or a licensed Texas professional geoscientist, within the appropriate area or discipline
- Identifies receiving waters at risk of an unauthorized discharge from the quarry and includes a proposed plan of action for restoration
- Describes the process(es) used in documenting existing physical, chemical, or biological background conditions of each of the receiving waters
- Provides a schedule for updating background conditions, as appropriate
- Identifies the goals and objectives of potential restoration actions
- Provides a reasonable range of restoration alternatives and identifies the preferred restoration alternative
- Describes the process for monitoring the effectiveness of the preferred restoration action. This includes identifying performance criteria used to determine the success of the restoration or need for interim site stabilization.
- Identifies a process for public involvement in the selection of the restoration alternative
- Provides a detailed cost estimate of the maximum probable costs required to complete a restoration action based on the costs to a third party conducting the action without a financial interest or ownership in the quarry

b. Financial Assurance for Restoration

Indicate the amount of financial assurance provided and the financial assurance mechanism used.

Amount of Financial Assurance ($): Click here to enter text.

Mechanism: Click here to enter text.

c. Technical Demonstration

The Technical Demonstration must address/include each of the following items as required by *30 TAC § 311.77*:

- Certification by a licensed Texas professional engineer or a licensed Texas professional geoscientist, within the appropriate area or discipline
- A time schedule for the quarry from initiation to termination of operations, including reclamation
- A detailed description of the type of quarrying to be conducted and the processes/methods employed
- A geological description of the quarry area, including the material deposit: type, geographical extent, depth, and volume; and a description of the general area geology
- A detailed description of any other operations on-site, include raw-material processing and secondary products processing
- A topographic map representing the quarry operation and all of the following within the boundaries of the quarry
    - water bodies
    - existing and proposed roads including quarry access roads
    - existing and proposed railroads
    - the 100 year floodplain boundaries
    - structures
    - the location of all know wells including water wells, oil wells, and unplugged and abandoned wells
    - active, post, and reclaimed quarry areas
    - buffer area
    - raw material, intermediate material, final product, waste product, byproduct, or ancillary material storage and processing areas
    - chemical and fuel storage areas
    - vehicle/equipment maintenance, cleaning, and fueling areas
    - vehicle/equipment loading and unloading areas
    - baghouses and other air treatment units exposed to precipitation
    - waste-disposal areas
- Surface Water Drainage and Water Accumulation Plan (SWDAP) that
    - describes the use and monitoring of structural controls and best management practices designed to control erosion, siltation, and runoff
    - provides a topographic map, at a scale appropriate to represent the quarry operation and all of the following within the boundaries of the quarry
        - the location of each process wastewater and stormwater outfall
        - an outline of the drainage area that contributes stormwater to each outfall
        - treatment, detention, and water storage tanks and ponds
        - structural controls for managing stormwater and process wastewater
        - physical features of the site that would influence stormwater runoff or contribute a dry weather flow

- Best Available Technology Evaluation (BATE) that
  - assesses the use of structural controls and best management practices
  - evaluates performance criteria outlined at *30 TAC § 311.79* and *§311.80*
  - includes structural control design and construction that is certified by a licensed Texas professional engineer. Design and construction plan/specification must be maintained on site.
- A procedure and schedule for reviewing the Technical Demonstration for consistency with quarry operations and site conditions and effectiveness in controlling erosion, siltation, and runoff.

d. Reclamation Plan

The Reclamation Plan must address/include each of the following items as required by *30 TAC § 311.78*:

- Certification by a licensed Texas professional engineer or a licensed Texas professional geoscientist, within the appropriate area or discipline
- A description of the proposed use for the disturbed area following reclamation
- A site-specific standard for reclamation appropriate to the end use that addresses the following items:
  - removal or final stabilization of all raw material, intermediate material, final product, waste product, byproduct, and ancillary material
  - removal of waste or closure of all waste-disposal areas
  - removal of structures, where appropriate
  - removal and reclamation of all temporary roads and railroads
  - backfilling, regarding, and recontouring
  - slope stability for remaining highwalls and detention ponds
  - revegetation of the reclaimed area giving consideration to species diversity and the use of native species
  - establishment of wildlife habitat
  - establishment of drainage patterns
  - establishments of permanent control structures, where necessary, to address erosion, siltation, and runoff from post quarrying and reclaimed areas
  - removal of all equipment
- A description of how reclamation will be conducted and a timetable for the completion of reclamation activities

e. Financial Assurance for Reclamation

Indicate the amount of financial assurance provided and the financial assurance mechanism used.

Amount of Financial Assurance ($): Click here to enter text.

Mechanism: Click here to enter text.

WORKSHEET 11.0
COOLING WATER INTAKE INFORMATION

This worksheet **is required** for all new, renewal, and amendment TPDES permit applications that meet the conditions outlined in Technical Report 1.0, Item 12.

1. COOLING WATER SYSTEM DATA (Instructions, Pages 102-103)

a. Complete the following table with information regarding the cooling water system.

Cooling Water System Data

Total DIF	
Total AIF	
Intake Flow Uses (%)	
Contact cooling	
Non-contact cooling	
Process uses	
Other	

b. Provide the following information as an attachment.

Attachment: Click here to enter text.

1. A narrative description of the design and annual operation of the facility's cooling water system and its relationship to the CWIS(s).
2. A scaled map depicting the location of each CWIS, impoundment, intake pipe, and canals, pipes, or waterways used to convey cooling water to, or within, the cooling water system. Provide the latitude and longitude for each CWIS and any intake pipe(s) on the map. Indicate the position of the intake pipe within the water column.
3. A description of water reuse activities, if applicable.
4. Design and engineering calculations prepared by a qualified professional and data to support the information provided in above item a.
5. Previous year (a minimum of 12 months) of AIF data.
6. A narrative description of existing or proposed impingement and entrainment technologies or operation measures and a summary of their performance, including, but not limited to, reductions in impingement mortality and entrainment due to intake location and reductions in total water withdrawals and usage.

2. COOLING WATER INTAKE STRUCTURE(S) DATA (Instructions, Page 103)

a. Complete the following table with information regarding each cooling water intake structure (this includes primary and make-up CWIS(s)).

Cooling Water Intake Structure(s) Data

CWIS ID				
DIF				
AIF				
Intake Flow Uses (%)				
Contact cooling				
Non-contact cooling				
Process uses				
Other				
Latitude				
Longitude				

b. Provide the following information as an attachment

Attachment: Click here to enter text.

1. A narrative description of the configuration of each CWIS, annual and daily operation, including any seasonal changes, and where it is located in the water body and in the water column.
2. Engineering calculations for each CWIS.

3. SOURCE WATER PHYSICAL DATA (Instructions, Page 104)

a. Complete the following table with information regarding the CWIS(s) source waterbody (this includes primary and make-up CWIS(s)).

Source Waterbody Data

CWIS ID				
Source waterbody				
Mean annual flow				
Source				

b. Provide the following information as an attachment.

Attachment: Click here to enter text.

1. A narrative description of the source water for each CWIS, including areal dimensions, depths, salinity and temperature regimes, and other documentation that supports your determination of the water body type where each cooling water intake structure is located.
2. A narrative description of the source waterbody's hydrological and geomorphological features.
3. Scaled drawings showing the physical configuration of all source water bodies used by the facility, including the source waterbody's hydrological and geomorphological features. Note: The source waterbody's hydrological and geomorphological features may be included on the map submitted for item 1.b.ii of this worksheet.
4. A description of the methods used to conduct any physical studies to determine your intake's area of influence within the waterbody and the results of such studies.

4. OPERATIONAL STATUS (Instructions, Pages 104-105)

a. Is this application is for a power production or steam generation facility?

☐ Yes ☐ No

If **yes**, provide the following information as an attachment; otherwise, proceed to item b.

Attachment: Click here to enter text

1. Describe the operating status of each individual unit, including age of each unit, capacity utilization rate (or equivalent), for the previous five years (a minimum of 60 months), and any seasonal changes in operation.
2. Describe any extended or unusual outages that significantly affect current data for flow, impingement, entrainment, or other factors.
3. Identify any operating unit with a capacity utilization rate of less than 8 percent averaged over a contiguous period of two years (a minimum of 24 months).
4. Describe any major upgrades completed within the last 15 years, including but not limited to boiler replacement, condenser replacement, turbine replacement, or changes to fuel type.

b. Process Units

1. Is this application for a facility which has process units that use cooling water other than for power production or steam generation?

   ☐ Yes ☐ No

   If **yes**, continue; otherwise, proceed to item c.

2. Does the facility use or intend to use reductions in flow or changes in operations to meet the requirements of *40 CFR § 125.94(c)*?

   ☐ Yes ☐ No

   If **yes**, provide descriptions of the following information as an attachment, otherwise proceed to item c.

   Attachment: Click here to enter text

   - Individual production processes and product lines
   - The operating status, including age of each line and seasonal operation
   - Any extended or unusual outages that significantly affect current data for flow, impingement, entrainment, or other factors
   - Any major upgrades completed within the last 15 years and plans or schedules for decommissioning or replacement of process units or production processes and product lines.

c. Is this an application for a nuclear power production facility?

☐ Yes ☐ No

If **yes**, include a description of completed, approved, or scheduled upgrades and Nuclear Regulatory Commission relicensing status of each unit at the facility as an attachment; otherwise, proceed to item d.

Attachment: Click here to enter text

d. Is this an application for a manufacturing facility?

☐ Yes ☐ No

If **yes**, include descriptions of current and future production schedules and any plans or schedules for any new units planned within the next five years (a minimum of 60 months) as an attachment; otherwise proceed to Worksheet 11.1.

Attachment: Click here to enter text

WORKSHEET 11.1
IMPINGEMENT MORTALITY

This worksheet **is required** for all new, renewal, and amendment TPDES permit applications that meet the conditions outlined in Technical Report 1.0, Item 12. Complete one copy of this worksheet for each individual CWIS the facility uses or proposes to use.

CWIS ID: Click here to enter text

1. IMPINGEMENT COMPLIANCE TECHNOLOGY OPTION SELECTION (Instructions, Page 106)

Indicate the method of compliance with the Impingement Mortality Standard selected by the facility with an 'x' in the appropriate box.

- ☐ Closed-cycle recirculating system(CCRS) [*40 CFR § 125.94(c)(1)*]
- ☐ 0.5 ft/s Through-Screen Design Velocity [*40 CFR § 125.94(c)(2)*] – Proceed to Worksheet 11.2
- ☐ 0.5 ft/s Through Screen Actual Velocity [*40 CFR § 125.94(c)(3)*]
- ☐ Existing offshore velocity cap [*40 CFR § 125.94(c)(4)*] – Proceed to Worksheet 11.2
- ☐ Modified traveling screens [*40 CFR § 125.94(c)(5)*]
- ☐ System of technologies [*40 CFR § 125.94(c)(6)*]
- ☐ Impingement mortality performance standard [*40 CFR § 125.94(c)(7)*]
- ☐ De minimis rate of impingement [*40 CFR § 125.94(c)(11)*]
- ☐ Low capacity utilization power-generation facilities [*40 CFR § 125.94(c)(12)*]

If you selected 0.5 ft/s Through-Screen Design Velocity [*40 CFR § 125.94(c)(2)*] or existing offshore velocity cap [*40 CFR § 125.94(c)(4)*], proceed to Worksheet 11.2. Otherwise, continue.

2. IMPINGEMENT COMPLIANCE TECHNOLOGY INFORMATION (Instructions, Pages 106-108)

Complete the following sections based on the selection made for item 1 above.

a. CCRS [*40 CFR § 125.94(c)(1)*]

☐ Indicate with an 'x' in the box if the CWS meets the definition of CCRS located at *40 CFR § 125.91(c)* and provide a response to the following questions.

1. Does the facility use or propose to use a CWIS to replenish water losses to the CWS?

   ☐ Yes ☐ No

   If **no**, proceed to **item ii**. If **yes**, provide the following information as an attachment and continue.

   Attachment: Click here to enter text

   i. CWIS ID

   ii. 12 months of intake flow data for any CWIS used for make-up intake flows to replenish cooling water losses, excluding intakes for losses due to blowdown, drift, or evaporation.

   iii. A narrative description of any physical or operational measures taken to minimize make-up withdraws.

   Note: You do not need to complete a separate Worksheet 11.1 for a make-up CWIS.

2. Does the facility use or propose to use cooling towers?

☐ Yes ☐ No

If **no**, proceed to Worksheet 11.2. If **yes**, provide the following information and proceed to Worksheet 11.2.

i. Average number of COCs prior to blowdown: Click here to enter text

Average COCs prior to blowdown

Cooling Tower ID				
COCs				

Provide COC monitoring data for each cooling tower from the previous year (a minimum of 12 months) as an attachment.

Attachment: Click here to enter text

ii. Maximum number of COCs each cooling tower can accomplish based on design of the system.

Calculated COCs prior to blowdown

Cooling Tower ID				
COCs				

iii. Describe conditions that may limit the number of COCs prior to blowdown, if any, including but not limited to permit conditions.

Click here to enter text

b. 0.5 ft/s Through Screen Actual Velocity [*40 CFR § 125.94(c)(3)*]

Provide daily intake flow measurement monitoring data from the previous year (a minimum of 12 months) as an attachment and proceed to Worksheet 11.2.

Attachment: Click here to enter text

c. Modified traveling screens [*40 CFR § 125.94(c)(5)*]

Provide the following information as an attachment and proceed to Worksheet 11.2.

Attachment: Click here to enter text

1. A description of the modified traveling screens and associated equipment.
2. A site-specific impingement technology performance optimization study that includes a narrative description of the biological data collection methods
3. Biological sampling data from the previous two years (a minimum of 24 months).

d. System of technologies [*40 CFR § 125.94(c)(6)*] or impingement mortality performance standard [*40 CFR § 125.94(c)(7)*]

Provide the following information as an attachment and proceed to Worksheet 11.2.

Attachment: Click here to enter text

i. A description of the system of technologies used or proposed for use by the facility to achieve compliance with the impingement mortality standard.

ii. A site-specific impingement technology performance optimization study that includes a narrative description of the biological data collection methods.

iii. Biological sampling data from the previous two years (a minimum of 24 months).

e. De minimis rate of impingement [*40 CFR § 125.94(c)(11)*]

Provide the following information and proceed to Worksheet 11.2.

1. Include monitoring data from the previous year (a minimum of 12 months) of intake flow measured at a frequency of 1/day on days of operation as an attachment.

   Attachment: Click here to enter text.

2. If the rate of impingement caused by the CWIS is extremely low (at an organism or age-one equivalent count), include supplemental information to Worksheet 11.0, item 1.b.vi. to support as an attachment.

   Attachment: Click here to enter text.

f. Low capacity utilization power-generation facilities [*40 CFR § 125.94(c)(12)*]

Provide monthly utilization data from the previous 2 years (a minimum of 24 months) for each operating unit as an attachment and proceed to Worksheet 11.2.

Attachment: Click here to enter text.

WORKSHEET 11.2
SOURCE WATER BIOLOGICAL DATA

This worksheet **is required** for all new, renewal, and amendment TPDES permit applications that meet the conditions outlined in Technical Report 1.0, Item 12. Complete one copy of this worksheet for each source waterbody of a CWIS for which a facility has selected an Impingement Mortality Technology Option described at *40 CFR §§ 125.94(c)(1)-(7)*.

Name of source waterbody: Click here to enter text.

1. SPECIES MANAGEMENT (Instructions, Page 109)

a. The facility has obtained an incidental take permit for its cooling water intake structure(s) from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

☐ Yes ☐ No

If **yes**, any information submitted in order to obtain that permit may be used to supplement the permit application information requirements of paragraph *40 CFR § 125.95(f)*. If included, provide the attachment number.

Attachment: Click here to enter text.

b. Is the facility requesting a waiver from application requirements at *40 CFR § 122.21(r)(4)* in accordance with *40 CFR § 125.95* for any CWIS(s) that withdraw from a man-made reservoir that is stocked and managed by a state or federal natural resources agency or the equivalent?

☐ Yes ☐ No

If yes, include a copy of the most recent managed fisheries report to TPWD, or equivalent, as an attachment.

Attachment: Click here to enter text.

c. There are no federally listed threatened or endangered species or critical habitat designations within the source water body.

☐ True ☐ False

2. SOURCE WATER BIOLOGICAL DATA (Instructions, Pages 109-110)

New Facilities (Phase I, Track I and II)

- Provide responses to all items in this section and stop.

Existing Facilities (Phase II)

- If the answer to **1.b.** above was **no**, provide responses to all items in this section and proceed to Worksheet 11.3.
- If the answer to **1.b.** was **yes** and **1.c.** was **true,** do not complete any items in this section and proceed to Worksheet 11.3.
- If the answer to **1.b**. was **yes** and **1.c.** was **false**, provide a response for any item in this section that is not contained within the most recent TPWD, or equivalent, report as an attachment to the application and enter the attachment number in the space provided. Proceed to Worksheet 11.3.

Attachment: Click here to enter text.

a. A list of the data requested at *40 CFR § 122.21(r)(4)(ii)* through *(vi)* that are not available and efforts made to identify sources of the data.

b. Provide a list of species (or relevant taxa) in the vicinity of the CWIS and identify the following information regarding each species listed.

   1. all life stages and their relative abundance,
   2. identification of all species and life stages that would be most susceptible to impingement and entrainment,
   3. forage base,
   4. significance to commercial fisheries,
   5. significance to recreational fisheries,
   6. primary period of reproduction,
   7. larval recruitment, and
   8. period of peak abundance for relevant taxa.

c. Data representative of the seasonal and daily activities (e.g., feeding and water column migration) of biological organisms in the vicinity of the cooling water intake structure.

d. Identify all threatened, endangered, and other protected species that might be susceptible to impingement and entrainment at your cooling water intake structures.

e. Documentation of any public participation or consultation with federal or state agencies undertaken and provide an attachment number.

The following is required for existing facilities only. Include the following information with the above listed attachment.

f. Identify any protective measures and stabilization activities that have been implemented, and provide a description of how these measures and activities affected the baseline water condition in the vicinity of the intake.

g. A list of fragile species, as defined at *40 CFR § 125.92(m)*, at the facility. The applicant need only identify those species not already identified as fragile at *40 CFR § 125.92(m)*.

   Note: New units at an existing facility are not required to resubmit this information if the cooling water withdrawals for the operation of the new unit are from an existing intake.

WORKSHEET 11.3
COMPLIANCE WITH ENTRAINMENT MORTALITY STANDARD

This worksheet **is required** for all new, renewal, and amendment TPDES permit applications that meet the conditions outlined in Technical Report 1.0, Item 12. Complete one copy of this worksheet for each individual CWIS the facility uses or proposes to use.

CWIS ID: Click here to enter text

1. APPLICABILITY (Instructions, Page 111)

Is the AIF of the CWIS identified above greater than, or equal to, 125 MGD?

☐ Yes ☐ No

- If **no** or the facility has selected **CCRS** [*40 CFR § 125.94(c)(1)*] for the impingement mortality compliance method, complete item 2 and stop here.
- If **yes** and the facility is **seeking a waiver** from application requirements in accordance with *40 CFR § 125.95* for any CWIS(s) that withdraw from a man-made reservoir that is stocked and managed by a state or federal natural resources agency or the equivalent, complete item 2 and stop.
- If **yes** and the facility is **not seeking a waiver** from application requirements in accordance with *40 CFR § 125.95*, complete item 2 and provide any required and completed studies listed in item 3. For any required studies in item 3 that are not complete, provide a detailed explanation for the delay and an anticipated schedule for completion and submittal.

2. EXISTING ENTRAINMENT PERFORMANCE STUDIES (Instructions, Page 111)

Previously conducted studies or studies obtained from other facilities addressing technology efficacy, through-facility entrainment survival, and other entrainment studies with the application.

Attachment: Click here to enter text

3. FACILITY ENTRAINMENT PERFORMANCE STUDIES (Instructions, Pages 111-112)

a. Provide an entrainment characterization study, as described at *40 CFR § 122.21(r)(9)*, as an attachment.

Attachment: Click here to enter text

b. Provide a comprehensive feasibility study, as described as *40 CFR § 122.21(r)(10)*, as an attachment.

Attachment: Click here to enter text

c. Provide a benefits valuation study, as described as *40 CFR § 122.21(r)(11)*, as an attachment.

Attachment: Click here to enter text

d. Provide a non-water quality environmental and other impacts study, as described as *40 CFR § 122.21(r)(12)*, as an attachment.

Attachment: Click here to enter text

e. Provide a peer review analysis, as described as *40 CFR § 122.21(r)(13)*, as an attachment.

Attachment: Click here to enter text

ATTACHMENT 8

Process Design Basis and Narrative

Process Design Basis and Narrative
Port of Corpus Christi Industrial Seawater Desalination
Harbor Island

December 2017

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Table of Contents

		Page
1.	Introduction	1
2.	Project Objective	1
3.	Proposed Pre-Treatment and Treatment Unit Processes	1
4.	Process Narrative	2
5.	Flow Basis and Material Balance	3
6.	Outfall	3
7.	Modeling	3
8.	Natural Salinity Variaition	4

List of Figures

Figure 1 – Process Flow Diagram
Figure 2 – Approximate Outfall Location
Figure 3 –Typical Diffuser Layout
Figure 4 – Variability of Salinity Level Over Time

List of Tables

Table 1 – 50 MGD Desalinantion Facility Water Balance
Table 2 – 50 MGD Desalination Facility Design Basis Source Water and Effluent Constituent Concentrations

List of Appendices

Appendix A – Brine Discharge Mixing Analysis

Appendix B – EPA Salinity Variation Q&A

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Process Design Basis and Narrative
Port of Corpus Christi Industrial Seawater Desalination
Harbor Island

Introduction

The Port of Corpus Christi Authority (PCCA) is developing a project to provide a sustainable supply of potable water for the Corpus Christi area that is not dependent upon rainwater. The proposed system will provide up to 50 million gallons per day (MGD) of permeate through the process of desalination. The purpose of this project is to develop a basis of design in sufficient detail to complete the Texas Commission on Environmental Quality (TCEQ) Industrial Wastewater (TPDES) Permit Application. The proposed facility will have discharges of the following effluents:

- Reject from the membrane desalination process, which is high in Total Dissolved Solids (TDS); and
- Supernatant and filtrate from sediment and sludge dewatering.

The proposed facility will be located on Harbor Island. The plant intake will consist of seawater pumped from the Gulf of Mexico. ~~one of the adjacent channels.~~ Pre-treatment will include removing sediment in the form of total suspended solids (TSS). The plant will use several clarification and filtration pretreatment processes for this purpose. The final treatment step will be membrane desalination using Reverse Osmosis. The low TDS permeate will then be treated to reduce corrosiveness, chlorinated, and distributed for potable water use. The suspended solids will be concentrated into a dried sludge for offsite disposal. The dewatering filtrate, thickener supernatant and the membrane reject are the subject of the Industrial Wastewater Permit Application**.**

Project Objective

The overall Project Objective is to develop a sustainable supply of potable water for the Corpus Christi area that is not dependent upon rainwater. This Process Design Basis and Narrative provides information in support of the TPDES Industrial Wastewater Permit application.

Proposed Pre-Treatment and Treatment Unit Processes

The following unit processes will be utilized in the desalination facility:

- Intake screens to remove large particulate from seawater
- Intake clarification with chemical coagulation to remove algae and suspended solids
- Strainers to remove fine debris
- Ultrafiltration to remove fine TSS
- Reverse Osmosis to remove TDS
- Calcite filters to add alkalinity to the permeate to reduce its corrosiveness
- Chlorination
- Distribution pumping

- Energy recovery
- Discharge of the membrane brine or reject under a TPDES permit
- Thickening of the clarifier underflow
- Consolidation of the ultrafiltration membrane backwash solids with thickened clarifier underflow
- Dewatering of consolidated sludge streams
- Discharge of the thickener supernatant and dewatering filtrate under a TPDES permit

Process Narrative

Seawater will be drawn into the plant from the Gulf of Mexico ~~a channel adjacent to Harbor Island~~ through coarse screens that will keep large material from entering the pre-treatment processes. The screen will reject captured solids as industrial solid waste into a dumpster. Sodium Hypochlorite (NaOCl) will be added as required to clear marine growth from the screens. The water will enter a rapid mixing unit where one or more treatment chemicals are added. It will then enter the Clarifier Center well, where flocculent is added. It will then flow into the main clarifier tank, where suspended solids will settle. The settled solids will be removed periodically as underflow to the Sludge Thickener. The clarifier effluent will flow to the Settled Water Clearwell, where NaOCl may also be added for oxidation of manganese and for partial disinfection.

From the Settled Water Clearwell, flow will pass into the strainer where solids and debris will be removed as necessary to protect the Ultrafiltration (UF) membranes. The Strainers will be backwashed to the Sludge Thickener. NaOCl may also be added to the strainers, as required. Particles exceeding a diameter greater than 0.001 µm will then be removed by passing the water under high pressure through the UF membranes. This process is semi-continuous, with some UF units in forward flow and others in Backwash or Cleaning mode. Backwash flows will be sent to the UF Reject Tank and then stored for processing in the Sludge Thickener. UF Permeate will be sent to a Clearwell where NaOCl will be added, if required.

From the Clearwell, water will be pumped through Cartridge Filters, the last unit to protect the Desalination reverse osmosis (RO) skids. The RO units will then remove particles larger than 0.1 nm. Pumps taking suction from the Clearwell will apply high pressure to force the seawater through the RO membranes, leaving the TDS behind. The process will be semi-continuous, with some RO units in forward flow and others in Reject or Cleaning mode. RO Permeate will be passed through a calcite filter to add alkalinity and reduce the corrosivity of the product water. The water will then be chlorinated and placed into one of two Permeate Storage Tanks for distribution as potable water. The RO reject will be discharged to a Brine Tank, and then pumped to Outfall 001.

Solids and sludge from the Clarifiers, Strainers, and UF Reject will be passed into a Mix Tank where Coagulant may be added, as required, to increase the diameter of the solids and then into a Sludge Thickener. A Flocculent may be added to the center well of the Thickener to enhance solids separation. The Supernatant overflow will pass over the Thickener weirs to the Outfall Storage Tank. Underflow from the thickener will be pumped into a Belt Filter press (BFP) for dewatering. Solids will be taken off site via truck. BFP Filtrate flow will flow to the Outfall Storage Tank where it will combine with the Thickener Supernatant for discharge to Outfall 001.

If chlorine is required for use in the process and if a chlorine residual is present in the final Outfall 001, then a dechlorination step will be conducted prior to the final discharge to the diffuser. If any additional compounds are present at unacceptable levels for discharge, PCCA will add treatment technology to reduce the concentration to acceptable levels prior to discharge.

A Block Flow Diagram of the process is shown in **Figure 1**. The corresponding water balance is shown in **Table 1**. The water balance shows that the intake of the facility will be 150.7MGD to produce 50 MGD of Permeate. The water balance is based on the following design assumptions:

- 5% sludge removal in the clarifier;
- 3% backwash at the strainers;
- 90% permeate recovery in the UF system;
- 55% of RO feed routed through energy recovery;
- 40% permeate recovery in the RO system;
- 50% decant from the thickener; and
- 60% filtrate recovery from the filter press.

Flow Basis and Material Balance

A summary of the projected Wastewater Stream Concentration is show in **Table 2** below. The projected effluent concentrations are based on Parsons sampling in the Gulf of Mexico ~~published sample data for Corpus Christi Bay~~ and the design assumptions identified previously for the water balance. Constituent concentrations for average effluent conditions are derived by assuming 40% recovery of RO permeate, while maximum constituent concentrations are derived by assuming 50% RO permeate recovery. Note that the treatment system is designed to remove suspended solids and associated total organic carbon.

Outfall 001 Diffuser modeling information replaced with attached modeling memo.

~~**Diffuser**~~
~~Outfall 001 will consist of a diffuser oriented parallel to the shoreline, approximately 300 ft away. The design basis assumes a 48-inch buried HDPE discharge pipe will feed the diffuser from the on-shore pump station. The approximate diffuser location is shown in **Figure 2.** While the exact design details of the diffuser have yet to be finalized, a typical diffuser configuration is shown in **Figure 3.** The characteristics of diffuser will be defined during system design to achieve target mixing performances.~~

~~**Modeling**~~
~~Diffuser performance was modelled using CORMIX (version 10.0GT). A report describing the modeling program is included as **Appendix A**. Modeling results demonstrate a significant factor in achieving good mixing is locating the diffuser at sufficient water depth. Models were run at water depths of approximately 63 feet.~~

~~Significantly better effluent mixing is predicted by the model for 50% RO recovery than for 40% RO recovery for varying diffuser designs. This difference is likely due to the increased density of the effluent at higher recovery rates. Diffuser performance can change significantly across a range~~

~~of flows for a particular set of design parameters. CORMIX shows that good mixing performance can be achieved when the diffuser effluent is characterized by a certain flow profile, referred to by the CORMIX model as "flow class". As shown in the modeling report, the modeled effluent at the boundaries of the mixing zones for the various diffuser designs achieved percentages below 2.5% at the ZID, 1.5% at the aquatic life mixing zone, and 1.0% at the human health mixing zone. The diffuser will be designed to achieve these target levels of mixing performance as determined through modeling across the range of flow rates.~~

~~Natural Salinity Variation~~

~~The following discussion about the variability of salinity levels in Corpus Christi Bay is based on the U.S. Environmental Protection Agency document included in **Appendix B.**~~

~~Natural salinity levels within the Bay system vary widely and are largely controlled by sources of freshwater inflows entering into the bays and estuaries consisting of rain, groundwater, and the largest contributor, surface water from rivers and streams. The Nueces River is one of the largest contributors of freshwater into the local bays and estuaries.~~

~~Natural fluctuations in freshwater inflows into the Bay can have an immense impact on organisms within the Bay system. For example, if a long drought persists and creates a situation of very little freshwater inflow into the Bay, it may cause hypersaline (high salt) conditions that in turn affect bay shrimp catches which need a certain salinity range in order to mature in healthy numbers. On the other extreme, there may be an abundance of freshwater inflow after an extended heavy rain event that causes eutrophication (high nutrient conditions), triggers large algal blooms that deplete oxygen and light within the water column, and negatively affect fish and plants living in the Bay system.~~

~~Data obtained from the TCEQ for Buoy 16492 (located in Corpus Christi Bay) demonstrate this natural variation in ambient salinity. This data set, shown in **Figure 4** below, shows a historic salinity variation between 3.06 and 40.9 parts per thousand. Since the proposed effluent modeling demonstrates the system effluent will increase the ambient concentration less than 1% beyond the aquatic life mixing zone, this increase is considered insignificant versus the natural variation and will not lead to the degradation of local water quality.~~

Table 1: 50 MGD Desalination Facility Water Balance Based on 40% Recovery Rate

Stream #	Stream Description	Design Flow (MGD)
01	Seawater Intake	150.7
02	Screened Seawater	150.7
03	Clarifier Feed	150.7
04	Settled Seawater from Clarifier	143.2
05	Clarifier Sludge to Thickener	7.5
06	Settled Seawater to Strainers	143.2
07	UF Feed from Strainers	138.9
08	Strainer Backwash to Thickener	4.3
09	UF Permeate	125
10	UF Reject	13.9
11	UF Permeate Feed to RO	125
12	RO Feed HP Pump Flow	56.3
13	RO Permeate	50
14	RO Permeate from Calcite Filters	50
15	Water to Distribution Pumps	50
16	RO Reject Thru ERU	75
17	RO Feed Thru ERU	68.8
18	RO Reject to Disposal	75
19	Waste from UF Reject Tank	13.9
20	Combined Wastes to Rapid Mixer	25.7
21	Combined Wastes to Thickener	25.7
22	Thickener Decant to Outfall Tank	12.9
23	Thickener Slurry to Filter Presses	12.9
24	Filter Press Filtrate to Outfall Tank	7.7
25	Filter Cake Solids to Landfill	5.1
26	Outfall to Disposal	20.6

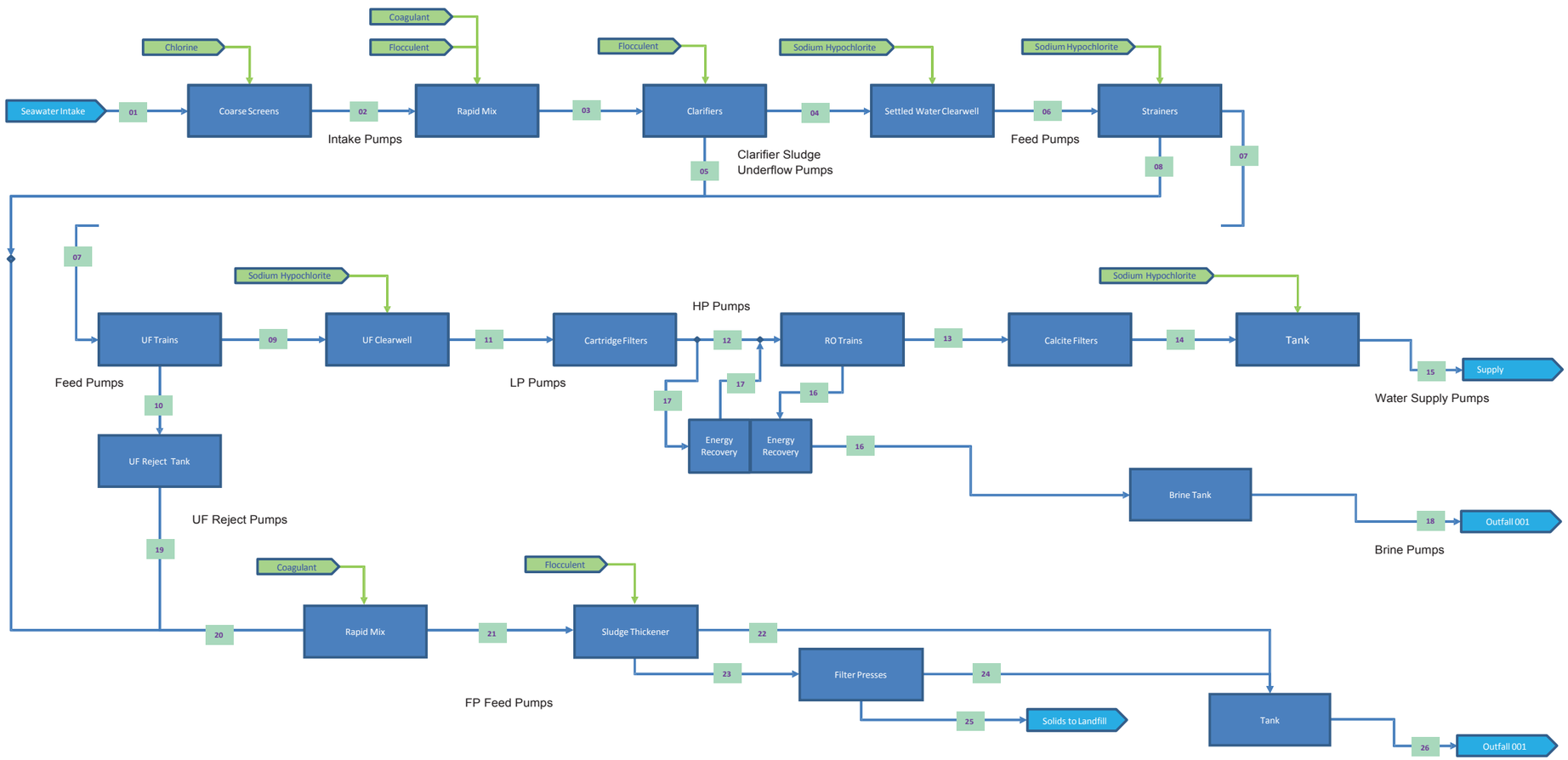
Table 2: 50 MGD Desalination Facility Design Basis Source Water and Effluent Constituent Concentrations.

Parameter		Source Water Quality Design Basis[1]	40% Recovery ~~Average~~ Outfall 001 Effluent[2]	50% Recovery ~~Max~~ Outfall 001 Effluent[3]
Flow, mgd		150.7	Average and Maximum outfall values are provided based on data collected on proposed intake location and range of RO recovery rates of 40 and 50%.	
Sodium (Na)	mg/L	11,600		
Calcium (Ca)	mg/L	1,700		
Magnesium (Mg)	mg/L	1,400		
Potassium (K)	mg/L	368		
Barium (Ba)	mg/L	0.04		
Strontium (Sr)	mg/L	6.8		
Iron (Fe)	mg/L	1.5		
Bicarbonate (HCO3)	mg/L	145		
Chloride (Cl)	mg/L	23,000		
Sulfate (SO4)	mg/L	3,000		
Nitrate (NO3)	mg/L	2.0		
Fluoride (F)	mg/L	2.0		
Silicon Dioxide (SiO2)	mg/L	5.0		
Boron	mg/L	6.0		
Total Dissolved Solids (TDS)	mg/L	41,252		
pH	S.U.	7.5		
Temperature	°C	14-32		
Total Organic Carbon (TOC)	mg/L	4		
Total Suspended Solids (TSS)	mg/L	30		

Note:

1. ~~The source water quality design basis data are based on sample data for Corpus Christi Bay listed in the Freese and Nichols report, "Variable Salinity Desalination Demonstration Project: Technical Memorandum No. 2, VSD Plant Siting Analysis", April 26, 2016.~~ The source water quality design basis data are from intake area Gulf of Mexico sampling.
2. ~~Average~~ Constituent values based on 40% RO permeate recovery.
3. ~~Maximum~~ Constituent values based on 50% RO permeate recovery and the production of 62.5 MGD permeate.

Process Flow Diagram



Port of Corpus Christi
Proposed Desalination Plant
Harbor Island Site
Corpus Christi, Texas

PROCESS FLOW DIAGRAM

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FIGURE
1

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Port of Corpus Christi
Proposed Desalination Plant
Harbor Island Site
Corpus Christi, Texas

APPROXIMATE DIFFUSER LOCATION

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FIGURE
2

S-Application 000343

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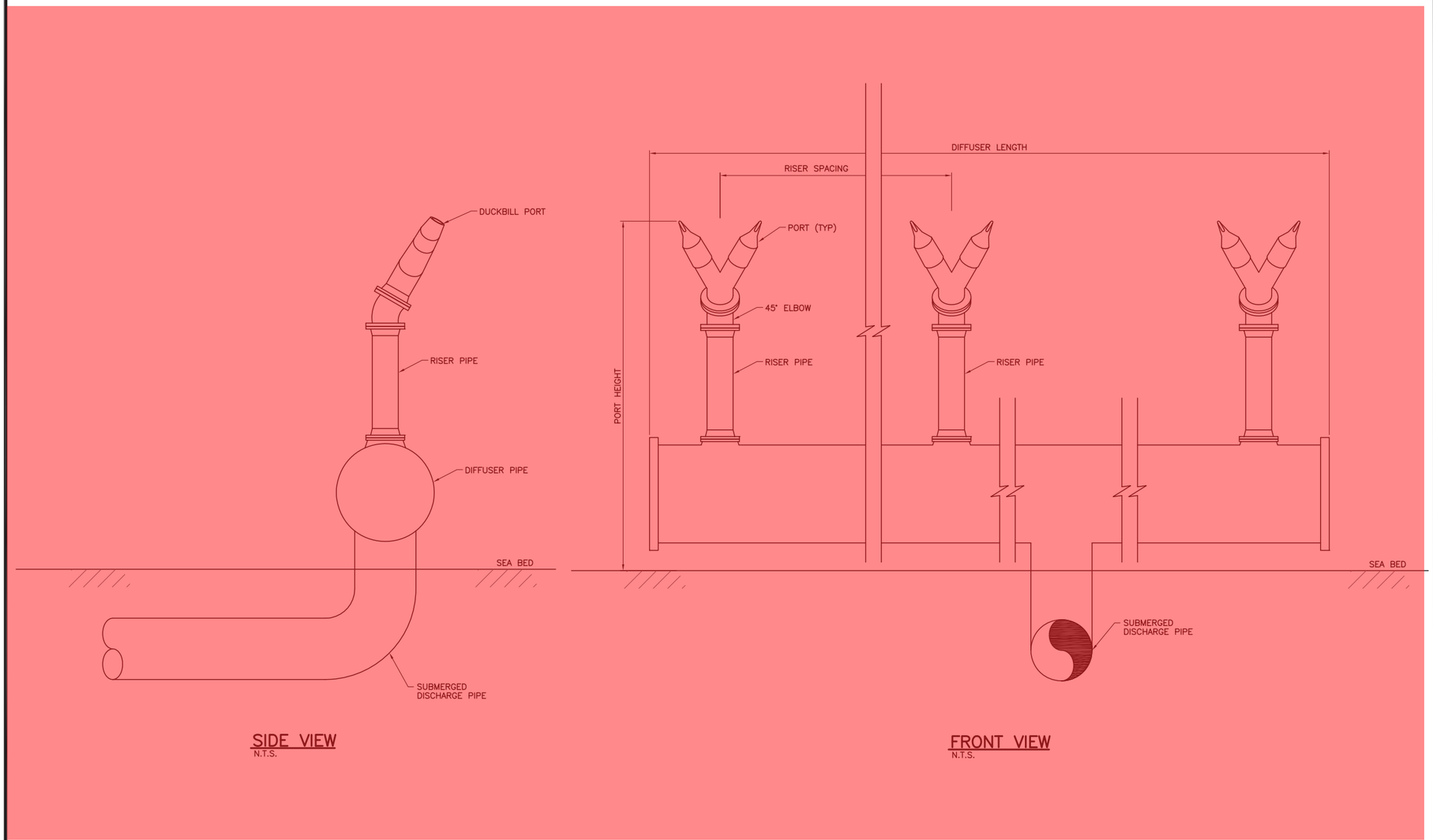

PORT OF CORPUS CHRISTI
PROPOSED DESALINATION PLANT
CORPUS CHRISTI, TEXAS

TYPICAL DIFFUSER LAYOUT

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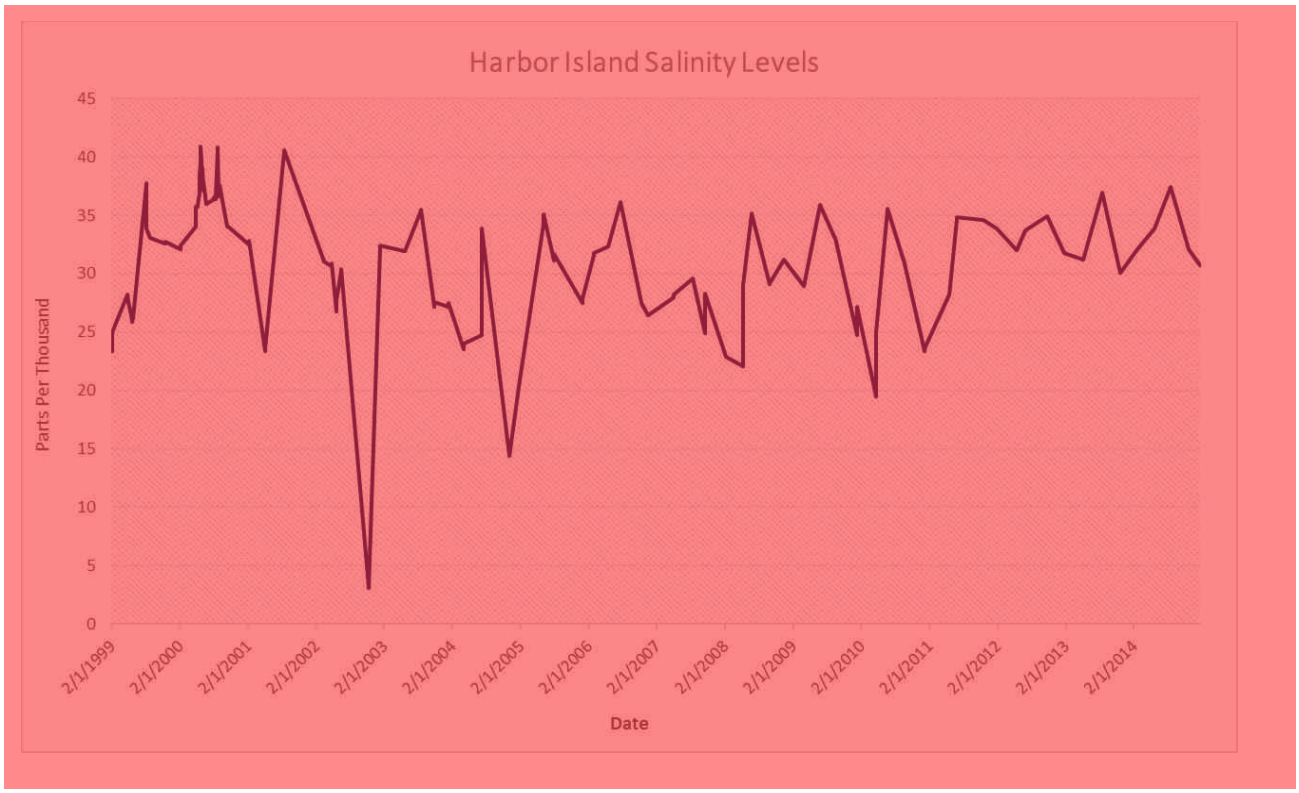
FIGURE
3

Figure deleted.

~~**Figure 4 – Variability of Salinity Levels Over Time**~~



~~Note: Data from Buoy 16492~~

Appendix A

~~Brine Discharge Mixing Analysis~~

See updated Discharge Mixing Analysis

Deleted pages S-Application 000347 to S-Application 000369

Brine Discharge Mixing Analysis

Proposed Harbor Island Desalination Facility

December 2017

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Table of Contents

Page

1. Introduction 3

2. CORMIX Analysis and Required Inputs 4

2.1 Ambient Conditions 4

2.1.1 Density 4

2.1.2 Water Velocity 6

2.1.3 Slope 6

2.1.4 Summary of Ambient Conditions 7

2.2 General Design Assumptions 8

3. Mixing Performance Under Varying Conditions 9

3.1 Step 1: Establish Diffuser Location 10

3.2 Step 2: Diffuser Design at 50% RO Recovery 10

3.3 Step 3: Analysis at Different Ambient Conditions 12

3.4 Step 4: Test the Selected Diffuser Design under Different Discharge Flow Rates at 40% RO Recovery 14

3.5 Step 5: Diffuser Design Change at 40% RO Recovery Under Different Flow Rates 16

4. Summary and Conclusions 20

5. References 22

List of figures

Figure 1 – Harbor Island 3
Figure 2 – SWQM Station 16492 Location 5
Figure 3 – Cross Section Near Proposed Harbor Facility Diffuser 7
Figure 4 – Proposed Location for Harbor Island Facility Diffuser 10
Figure 5 – Discharge Flow vs. ZID Percent Effluent for the Specified Diffuser Design Alternative 16
Figure 6 – ZID Percent Effluent vs. Effluent Discharge Rate for the Specified Design Alternative at 40% RO Recovery 20

List of tables

Table 1 – Ambient Density Values for Each Temperature and Salinity Combination in Summer and Winter at 50% RO Recovery 5
Table 2 – Ambient Density Values for Each Temperature and Salinity Combination in Summer and Winter at 40% RO Recovery 6
Table 3 – Harbor Island Base Scenario for Ambient Parameters 7

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~~Table 4 – Design Alternative for Harbor Island Plant Diffuser at 50% RO Recovery~~ ~~11~~
~~Table 5 – Effluent Percentages at Mixing Zone Boundaries for Different Design Alternatives in Harbor Island Plant Diffuser at 50% RO Recovery~~ ~~12~~
~~Table 6 – Effluent Percentage and Concentration at the Three Mixing Zones for Design Alternative 3 and 50% RO Permeate Recovery at Different Ambient Conditions~~ ~~12~~
~~Table 7 – Effluent Percentage and Concentration at the Three Mixing Zones for Design Alternative 3 at Different Discharge Flow Rates for 40% RO Recovery~~ ~~14~~
~~Table 8 – Design Alternatives for 50 MGD Plant at 40% RO Recovery~~ ~~16~~
~~Table 9 – Effluent Percentages and Concentrations at the Three Mixing Zones for 50 MGD Plant at Different Design Alternatives with 40% RO Recovery~~ ~~17~~
~~Table 10 – Effluent Percentages at Three Mixing Zones for Design Alternative H6 at Different Flow Rate at 40% Recovery~~ ~~18~~

~~List of Attachments~~

~~Attachment A: Mixing Analysis using CORMIX~~

~~Attachment B: Reported Corpus Christi Bay Ambient Properties~~

~~Attachment C: Flow Classes Definition by CORMIX~~

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1. Introduction

The Port of Corpus Christi Authority (PCCA) proposes to construct a desalination plant at the Harbor Island site (Figure 1) near Corpus Christi, Texas. This facility is expected to produce up to 50 MGD of product water with an anticipated discharge flow of 96 MGD based on 40% recovery of permeate water during reverse osmosis (RO) processing. The desalination facility will utilize RO to produce water. The proposed diffuser from this facility will discharge into the Corpus Christi Channel.

Figure 1: Harbor Island

Because the impact of the discharge on salinity levels in Corpus Christi Bay was unknown, the Texas Commission on Environmental Quality (TCEQ) requested that the PCCA conduct an assessment of the discharge using CORMIX and present the findings in a report submitted with the TPDES permit application. CORMIX is a proprietary program widely used for mixing zone analysis. CORMIX provides estimates of the effluent concentration percentages at varying distances from a point discharge source from which any associated downstream concentration can be estimated. The comparison between various CORMIX analyses were conducted based on the effluent concentrations at the edge of the zone of initial dilution (ZID), aquatic life mixing zone (MZ), and human health mixing zone (HH MZ).

This report describes the modeling that was conducted using CORMIX, including the model inputs that were used. Results of the model runs are provided, and achievable mixing zone targets are proposed based on the CORMIX modeling output. If approved by the TCEQ, the PCCA proposes to design a diffuser for the effluent discharge that would meet the target effluent concentrations as determined through CORMIX modeling.

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~~2. CORMIX Analysis and Required Inputs~~

~~CORMIX (version 10.0GT) software and current modeling guidelines provided by the TCEQ were used to analyze the mixing of the Harbor Island desalination plant discharge. The TCEQ modeling guidelines are included as **Attachment A**. The required and selected modeling input including the receiving water properties, effluent properties, and diffuser properties are described in this section.~~

~~2.1 Ambient Conditions~~

~~In this section, the basis and estimates for the ambient parameters are presented. The main CORMIX parameters for ambient condition include: ambient density, water velocity, bed slopes, and wind velocity. The ambient data were obtained from different sources as explained in the following sections. Although not used in the modeling study, additional ambient properties associated with Corpus Christi Bay are included in **Attachment B**.~~

~~2.1.1 Density~~

~~The TCEQ modeling guidelines require modeling to be performed at varying water densities during the summer and winter months. The water density is a function of both salinity and temperature. Specifically, the guidelines require modeling with the densities associated with the 5th and 95th percentiles of both temperature and salinity during the summer and winter months. The various densities associated with these temperature and salinity combinations can be expressed as:~~

~~$\rho(T_5, S_5)$, $\rho(T_5, S_{95})$, $\rho(T_{95}, S_5)$, and $\rho(T_{95}, S_{95})$~~

~~The equation used to calculate ambient density as a function of temperature and salinity can be found in the modeling guidelines in **Attachment A**.~~

~~Salinity and temperature data from 1999 to 2015 were obtained from Surface Water Quality Monitoring (SWQM) station 16492. The station location is shown in **Figure 2**.~~

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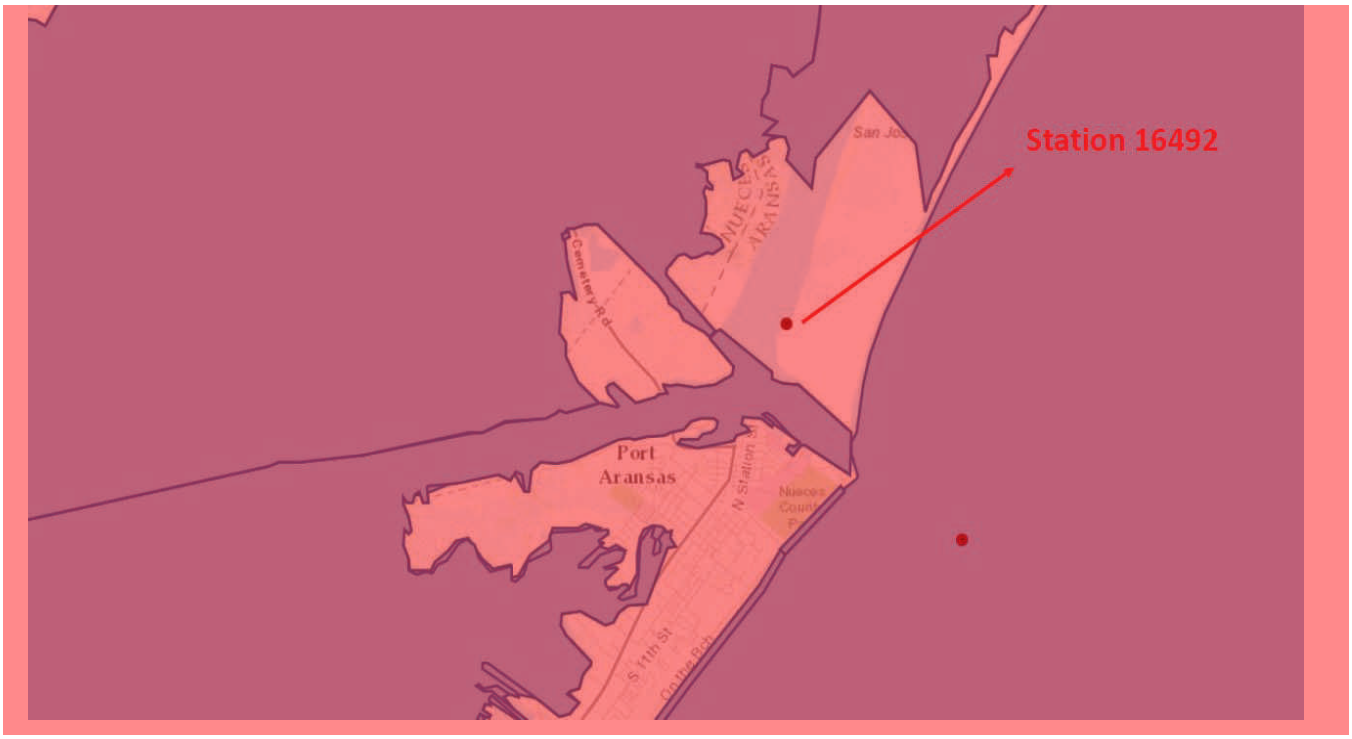

Figure 2: SWQM Station 16492 Location

The calculated ambient density and effluent density for the Harbor Island site (Winter and Summer) for RO recovery rates of 50% and 40% are demonstrated in **Table 1** and **Table 2,** respectively**.** In **Table 1, t**he effluent density was calculated at twice the ambient salinity based on the design assumption that 50% recovery of permeate will be achieved at the RO unit. In **Table 2**, **t**he effluent density was calculated at 1.6 times the ambient salinity based on the design assumption that 40% recovery of permeate will be achieved at the RO unit. In both RO rates, the entire salinity would be assumed to be rejected by the RO membranes and would be discharged with the effluent through the diffuser.

Table 1: Ambient Density Values for Each Temperature and Salinity Combination in Summer and Winter at 50% RO Recovery

Condition	Summer			Winter		
	Ambient Density (kg/m^3)	Discharge Density (kg/m^3)	Δ Density (kg/m^3)	Ambient Density (kg/m^3)	Discharge Density (k/m^3)	Δ Density (kg/m^3)
ρ (T_5, S_5)	1013.65	1030.77	17.12	1020.67	1041.64	20.96
ρ (T_5, S_{95})	1025.51	1054.49	28.98	1027.68	1055.65	27.97
ρ (T_{95}, S_5)	1012.49	1029.45	16.96	1019.00	1039.47	20.47
ρ (T_{95}, S_{95})	1024.24	1052.94	28.70	1025.84	1053.15	27.31

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~~**Table 2:** Ambient Density Values for Each Temperature and Salinity Combination in Summer and Winter at 40% RO Recovery~~

~~Condition~~	~~Summer~~			~~Winter~~		
	~~Ambient Density (kg/m^3)~~	~~Discharge Density (kg/m^3)~~	~~Δ Density (kg/m^3)~~	~~Ambient Density (kg/m^3)~~	~~Discharge Density (k/m^3)~~	~~Δ Density (kg/m^3)~~
~~ρ (T5, S5)~~	~~1013.65~~	~~1023.92~~	~~10.27~~	~~1020.67~~	~~1033.25~~	~~12.58~~
~~ρ (T_5, S_{95})~~	~~1025.51~~	~~1042.89~~	~~17.39~~	~~1027.68~~	~~1044.46~~	~~16.78~~
~~ρ (T_{95}, S_5)~~	~~1012.49~~	~~1022.67~~	~~10.18~~	~~1019.00~~	~~1031.28~~	~~12.28~~
~~ρ (T_{95}, S_{95})~~	~~1024.24~~	~~1041.46~~	~~17.22~~	~~1025.84~~	~~1042.23~~	~~16.38~~

~~-~~

~~2.1.2 Water Velocity~~

~~The TCEQ modeling guidelines state that a small water velocity should be assumed for modeling discharges into bays. TCEQ personnel suggested a value of 0.05 m/s, which was used in the modeling analyses.~~

~~2.1.3 Slope~~

~~CORMIX analysis for brine discharge requires determining the near- and far-shore slopes. CORMIX specifies both the near- and far-shore bottom slope to be greater than zero. According to the CORMIX definition, the near-shore slope is steeper than the far-shore one. The point at which the near- and far-shore slope intersect is the slope break point.~~

~~For the anticipated Harbor Island facility diffuser location, the break was estimated to be at 200 feet from the shoreline (based on bathymetry maps). At the break point, the water depth is approximately 59 ft (the nearshore slope is approximately 30%). The cross -section slope reduces at this break point and the far-shore slope is 4% (between 200-400 ft from the shoreline). These slopes reflect the northern edge of the Corpus Christi Channel. The near- and far-shore slopes are shown in **Figure 3**.~~

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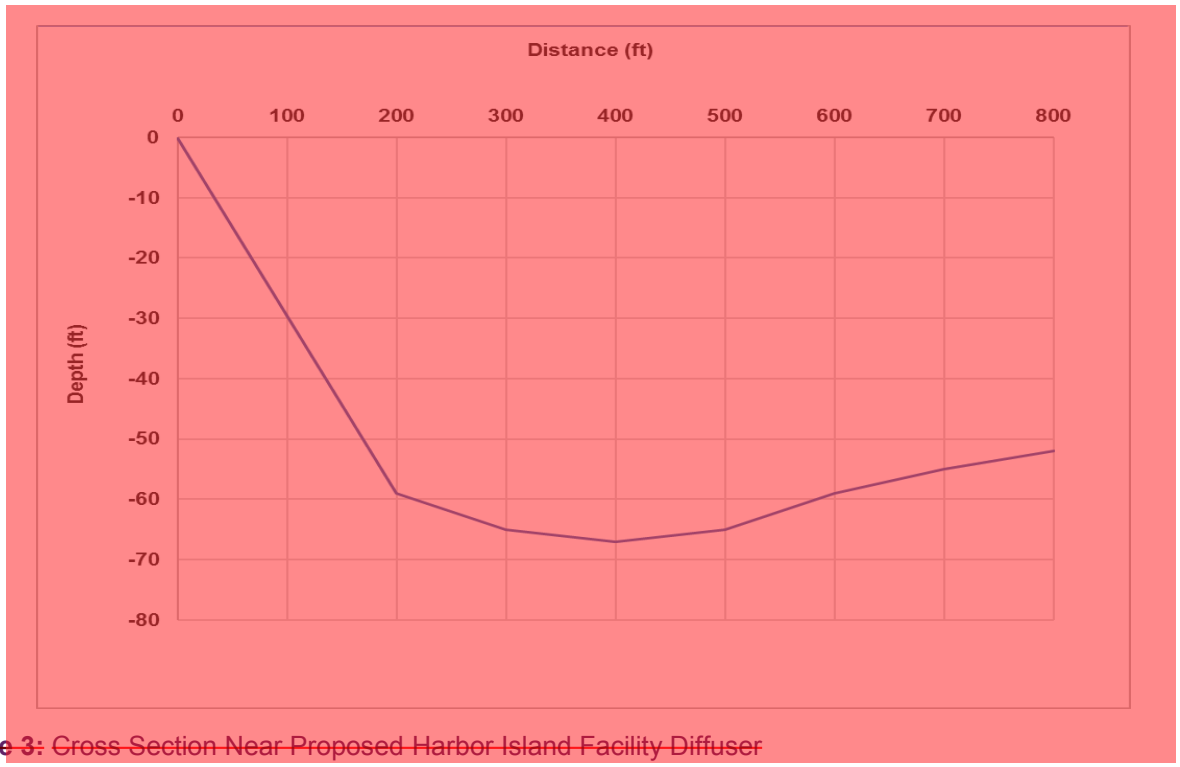

~~**Figure 3:** Cross Section Near Proposed Harbor Island Facility Diffuser~~

~~2.1.4 Summary of Ambient Conditions~~

~~The summary of ambient conditions utilized in modeling, with the ambient densities presented in **Table 1** and **Table 2**, is presented in **Table 3**.~~

~~**Table 3:** Harbor Island Base Scenario for Ambient Parameters~~

~~Parameter~~	~~Unit~~	~~Value~~	~~Basis~~
~~Wind Speed~~	~~m/s~~	~~2~~	~~TCEQ CORMIX Guidance~~
~~Water Velocity~~	~~m/s~~	~~0.05~~	~~TCEQ CORMIX Guidance~~
~~Manning Constant (n)~~	~~-~~	~~0.0183~~	~~Calculated based on 0.025 Darcy Constant~~
~~Near Shore Bottom Slope (%)~~		~~29.5~~	~~Bathymetry and COMRIX manual definition on slope~~
~~Distance Shoreline to Break~~	~~meter~~	~~61~~	~~Bathymetry and COMRIX manual definition on slope~~
~~Far Shore Bottom Slope (%)~~		~~4~~	~~Bathymetry and COMRIX manual definition on slope~~

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~~2.2 General Design Assumptions~~

~~To design the outfall system for brine discharge, the relevant literature was reviewed to specify the important design parameters such as diffuser type, discharge velocity, diffuser diameter, and diffuser angles that result in better initial mixing. Shoreline discharge (i.e., absent a diffuser) of negatively buoyant concentrate will result in a density current that runs down the bottom slope. The dilution is very small for this discharge since the resulting density stratification inhibits vertical mixing. Therefore, submerged discharge through pipes and port(s) has been an effective method for discharging brine. The discharge could be through a single port for a small discharge or a multiport diffuser for larger discharges [1-4]. Multiport diffusers have been shown more effective in rapid salinity dilution as the waste stream discharges with high velocity which will allow more rapid initial jet mixing of the plant effluent in the ambient seawater. This rapid mixing provides enhanced initial dilution while having a limited effect on aquatic organisms as the relatively small zone of high velocity gradients occurs near the port and only lower settling velocities occur near the ocean bottom. However, entrained ambient water pulled up from under the upward discharging ports creates some limited potential for scour; therefore, the height of the ports above the sea bed should be considered. In addition, due to the presence of the Ship Channel, appropriate measures should be considered to protect the diffuser and ports.~~

~~2.2.1 Diffuser Alignment~~

~~Normally with multiport diffuser mixing, it is better if the diffuser is oriented transverse to the ambient current. Transverse co-flowing minimizes the overlapping of individual port plumes. However, for easier installation, the diffuser was assumed parallel to the shore. Therefore, the Gamma angle (diffuser line to Tidal flow) was set to zero in all cases analyzed. Vertical port angle of discharge (Theta) of 60° has been reported as the optimum discharge angle for most brine discharges. This angle was shown to provide maximum rise level of jet trajectory among other tested vertical angles [1-4]. Therefore, a 60° angle was used for brine discharge in all analyses.~~

~~The following configuration angles were selected in all of the CORMIX analyses.~~

- ~~Port Angle from Horizontal (THETA) = 60 degree – The existing literature considered a THETA of 60 degrees to be the optimum angle for most brine discharge cases~~
- ~~Port Angle to Tidal Flow (SIGMA) = 270 degree – This value is determined to discharge off-shore toward deeper water.~~
- ~~Diffuser Line to Tidal Flow (GAMMA) = 0 degree – This value is used because the diffuser is placed in parallel to the ambient flow in order to keep the diffuser out of the ship channel.~~
- ~~Port Angle to Diffuser Line (BETA) = 90 degree – Having selected that alignment (GAMMA=0), then the best port orientation in the x-y plane is perpendicular to the oscillating ambient current.~~

~~2.2.2 ZID and Mixing Zones~~

~~A mixing zone is defined as a limited area or volume within the coastal water where the impacts to marine life are deemed minimal. This negotiated area or control volume usually is restricted to an area around the outfall where the initial dilution happens. Acute marine criteria are applied at the edge of the zone of initial dilution (ZID), chronic marine criteria are applied at the edge of the aquatic life mixing zone (MZ), and chronic human health protection criteria are applied at the edge of the human heath mixing zone (HH MZ). Applicable mixing zone distances are specified in the TCEQ Procedures to Implement the Texas Surface Water Quality Standards as follows:~~

- ~~The ZID is defined as a volume within a radius of 50 feet from the point where the discharge enters the receiving water.~~

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- ~~The MZ for this discharge is defined as a volume within a radius of 200 feet from the point where the discharge enters the receiving water.~~
- ~~The HH MZ is defined as a volume within 400 feet from the point where the discharge enters the receiving water.~~

~~Based on the TCEQ modeling guidelines for multi-port diffusers, the ZID and other mixing zones are considered rectangular in shape with an equivalent area to the corresponding specified standard circular mixing zones. As the diffuser is unidirectional with all ports directed off-shore, the equivalent rectangle is shifted to the off-shore side with one side along the axis of the diffuser.~~

~~2.2.3 Other Modeling Inputs~~

~~The following effluent and diffuser model inputs were varied as described in Section 3:~~

- ~~Effluent Density~~
- ~~Discharge Flow~~
- ~~Discharge Depth~~
- ~~Diffuser Length~~
- ~~Number of Ports~~
- ~~Port Height~~
- ~~Discharge Velocity~~
- ~~Port Diameter~~

~~3. Mixing Performance Under Varying Conditions~~

~~CORMIX analysis was performed under both 40% and 50% permeate recovery at the RO unit, which impacted both effluent density and effluent flow rate. While it is possible that the proposed desalination plant will operate at 50% permeate recovery, 40% permeate recovery is more likely. Given the uncertainty in this operating condition, both conditions were modeled. In the analysis, effluent salinity was assumed to be twice the concentration of ambient for the design condition in which 50% of flow to the RO unit is recovered as permeate. Effluent was approximated as 60% more concentrated in salinity compared with ambient salinity for the 40% permeate recovery operating condition.~~

~~The work process for the CORMIX analysis, under both 40% and 50% RO recovery, included five steps. First, the diffuser location was established based on the bathymetry characteristics. Second, different diffuser designs were examined at 50% RO recovery. Third, the selected design was examined under the eight ambient conditions at 50% RO recovery to determine the critical ambient condition. Fourth, for the selected design at the critical ambient condition, the flow rate was changed at 40% RO recovery to evaluate mixing at a lower recovery rate. Fifth, multiple designs were examined at various flow rates (for the critical ambient condition) and at 40% RO recovery to identify achievable mixing performance across a range of flow rates. In analysis steps one and two, the ambient density associated with the 95th percentile temperature and 95th percentile salinity (ρ (T95, S95)) in the summer months was used for the analysis at 50% RO recovery since the critical ambient condition (ambient condition which resulted in poorest mixing) was not identified until step~~

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~~3. The analysis for 40% RO recovery was thereafter performed for the identified critical ambient condition in steps four and five.~~

~~3.1 Step 1: Establish Diffuser Location~~

~~The diffuser location for the Harbor Island facility is proposed to be placed at 300 ft from the shoreline on the south side of Harbor Island and east of the Ferry (**Figure 4**). The water depth at the proposed location is approximately 63 ft. Since the change in water depth between 300-600 ft from the shoreline is insignificant, if the diffuser is placed in any location east-west or north south at this range, the results of CORMIX analysis would be expected to be similar. Thus, the study evaluated mixing performance at one location relative to the shoreline.~~

~~**Figure 4:** Proposed Location for Harbor Island Facility Diffuser~~

~~3.2 Step 2: Diffuser Design at 50% RO Recovery~~

~~For the selected diffuser location and a design production rate of 50 MGD (66 MGD effluent at 50% RO Recovery), different diffuser design alternatives were tested (Alternatives 1-5 in **Table 4**) using the 95% condition for temperature and salinity. In the analysis of design alternatives, the discharge depth and diffuser angles were kept constant. Design parameters that vary in different alternatives include:~~

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- ~~Discharge Velocity~~
- ~~Port Height~~
- ~~Number of Ports~~
- ~~Number of Ports Per Riser~~
- ~~Port Diameter~~
- ~~Diffuser Length~~

~~For the Harbor Island facility, design Alternative 1 represents the initial run alternative with a discharge velocity of 11 ft/s, port height of 12.6 ft, and port diameter of 12 inches. These design parameters were varied in other design alternatives (i.e., Alternatives 2-5) to access impact on mixing performances at the ZID as shown in **Table 4**. The results of the alternatives analysis, summarized in **Table 4**, showed that increasing port height (Alternative 2) has no effect on the dilution. In Alternative 3, the number of ports was decreased, and accordingly, diffuser length was reduced compared to the initial alternative. The results showed similar effluent concentration at ZID and increase in effluent concentration at MZ compared with Alternative 1. In Alternative 4, the number of ports was decreased to six with port diameters of 18 inches (and subsequent diffuser length of 82 ft). The results showed similar effluent concentration at ZID and increase in effluent concentration at MZ compared with Alternative 1. In Alternative 5, parameter values from Alternatives 2 and 4 were combined, resulting in similar performance as Alternative 3. Based on the effluent percentage at ZID all of the configurations show similar performance. Hence, Alternative 3 was selected for further analysis in the subsequent steps. **Table 5** provides a summary of effluent percentages at the boundaries of the three mixing zones.~~

~~**Table 4:** Design Alternative for Harbor Island Plant Diffuser at 50% RO Recovery~~

~~Design Alternative ID~~	~~Discharge Depth (ft)~~	~~Discharge Velocity (ft/s)~~	~~Port Height (ft)~~	~~# of Port~~	~~Riser Spacing (ft)~~	~~Port Diameter (inch)~~	~~Diffuser Length (ft)~~	~~# of Ports Per Riser~~	~~Variation~~	~~Effluent at ZID (%)~~
~~1~~	~~63~~	~~11~~	~~12.6~~	~~12~~	~~16.4~~	~~12~~	~~82~~	~~2~~	~~Base~~	~~1.01~~
~~2~~	~~63~~	~~11~~	~~15.75~~	~~12~~	~~16.4~~	~~12~~	~~82~~	~~2~~	~~Port height increase~~	~~1.01~~
~~3~~	~~63~~	~~13~~	~~12.6~~	~~10~~	~~16.4~~	~~12~~	~~65.6~~	~~2~~	~~Higher discharge velocity/ Less ports/Shorter diffuser~~	~~1.01~~
~~4~~	~~63~~	~~11~~	~~12.6~~	~~6~~	~~16.4~~	~~18~~	~~98.4~~	~~2~~	~~Larger Port Diameter~~	~~1.01~~
~~5~~	~~63~~	~~13~~	~~15.75~~	~~10~~	~~16.4~~	~~12~~	~~65.6~~	~~2~~	~~Higher discharge~~	~~1.01~~

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									velocity, higher port height	

Table 5: Effluent Percentages at Mixing Zone Boundaries for Different Design Alternatives in Harbor Island Plant Diffuser at 50% RO Recovery

Design Alternative	Effluent Percentage at ZID, MZ and HH Mixing Zones (%)		
	ZID	MZ	HH
1	1.01	0.534	0.467
2	1.01	0.536	0.467
3	1.01	0.575	0.504
4	1.01	0.541	0.472
5	1.01	0.575	0.504

3.3 Step 3: Analysis at Different Ambient Conditions

Since the most limiting combination of effluent receiving water conditions cannot be reliably predicted in advance of running the model, a range of modeling scenarios were performed in order to determine protective effluent dilution. Due to seasonal variability in the effluent density, eight standard effluent/ambient density combinations were analyzed (**Table 1**) at 66 MGD effluent flow rate for 50% RO recovery in accordance with the TCEQ modeling guidelines in **Attachment A**.

In considering the effect of stratification in these analyses, the salinity and temperature values at the top and bottom of the water column were paired. Given the available ambient data set from the TCEQ, the top depth was based on salinity data at a depth of 0.3 meters. The bottom depths were based on 12.19 meters. The average density differences between the top and bottom of the water column at these depths were calculated to be 0.01 kg/m^3 for Harbor Island. Because the differences in density are less than 0.1 kg/m^3, stratification does not need to be considered in the model in accordance with CORMIX guidance.

Table 6 shows the effluent percentages for different ambient cases for diffuser design Alternative 3 at 50% RO permeate recovery. The largest percent effluent at each of the three mixing zone boundaries was observed during summer conditions at the 95th percentile of temperature and 5th percentile of salinity, making this set of conditions the critical ambient condition.

Table 6: Effluent Percentage and Concentration at the Three Mixing Zones for Design Alternative 3 and 50% RO Permeate Recovery at Different Ambient Conditions

Ambient	Effluent at ZID (%)	Ambient Salinity (ppt)	Effluent Salinity (ppt)	ZID (ppt)	Percentage Above Ambient
Summer, (T_5, S_5)	1.440	22.90	45.8	23.56	2.88%
Summer, (T_5, S_{95})	1.00	38.76	77.52	38.84	2.00%

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~~Summer, (T_{95}, S_5)~~	**~~1.450~~**	**~~22.90~~**	**~~45.8~~**	**~~23.56~~**	**~~2.90%~~**
~~Summer, (T_{95}, S_{95})~~	~~1.010~~	~~38.76~~	~~77.52~~	~~39.54~~	~~2.02%~~
~~Winter, (T_5, S_5)~~	~~1.260~~	~~26.70~~	~~53.4~~	~~27.37~~	~~2.52%~~
~~Winter, (T_5, S_{95})~~	~~1.030~~	~~35.63~~	~~71.25~~	~~36.36~~	~~2.06%~~
~~Winter, (T_{95}, S_5)~~	~~1.280~~	~~26.70~~	~~53.4~~	~~27.38~~	~~2.56%~~
~~Winter, (T_{95}, S_{95})~~	~~1.040~~	~~35.63~~	~~71.25~~	~~36.37~~	~~2.08%~~

~~Ambient~~	~~Effluent at MZ (%)~~	~~Ambient Salinity (ppt)~~	~~Effluent Salinity (ppt)~~	~~MZ (ppt)~~	~~Percentage Above Ambient~~
~~Summer, (T_5, S_5)~~	~~0.687~~	~~22.90~~	~~45.8~~	~~23.21~~	~~1.37%~~
~~Summer, (T_5, S_{95})~~	~~0.574~~	~~38.76~~	~~77.52~~	~~39.20~~	~~1.15%~~
~~Summer, (T_{95}, S_5)~~	**~~0.689~~**	**~~22.90~~**	**~~45.8~~**	**~~23.22~~**	**~~1.38%~~**
~~Summer, (T_{95}, S_{95})~~	~~0.575~~	~~38.76~~	~~77.52~~	~~39.21~~	~~1.15%~~
~~Winter, (T_5, S_5)~~	~~0.641~~	~~26.70~~	~~53.4~~	~~27.04~~	~~1.28%~~
~~Winter, (T_5, S_{95})~~	~~0.581~~	~~35.63~~	~~71.25~~	~~36.04~~	~~1.16%~~
~~Winter, (T_{95}, S_5)~~	~~0.646~~	~~26.70~~	~~53.4~~	~~27.04~~	~~1.29%~~
~~Winter, (T_{95}, S_{95})~~	~~0.586~~	~~35.63~~	~~71.25~~	~~36.04~~	~~1.17%~~

~~Ambient~~	~~Effluent at HH (%)~~	~~Ambient Salinity (ppt)~~	~~Effluent Salinity (ppt)~~	~~HH (ppt)~~	~~Percentage Above Ambient~~
~~Summer, (T_5, S_5)~~	~~0.599~~	~~22.9~~	~~45.8~~	~~23.17~~	~~1.20%~~
~~Summer, (T_5, S_{95})~~	~~0.503~~	~~38.76~~	~~77.52~~	~~39.15~~	~~1.01%~~
~~Summer, (T_{95}, S_5)~~	**~~0.601~~**	**~~22.9~~**	**~~45.8~~**	**~~23.18~~**	**~~1.20%~~**
~~Summer, (T_{95}, S_{95})~~	~~0.504~~	~~38.76~~	~~77.52~~	~~39.15~~	~~1.01%~~
~~Winter, (T_5, S_5)~~	~~0.561~~	~~26.7~~	~~53.4~~	~~27.00~~	~~1.12%~~
~~Winter, (T_5, S_{95})~~	~~0.509~~	~~35.625~~	~~71.25~~	~~35.99~~	~~1.02%~~
~~Winter, (T_{95}, S_5)~~	~~0.565~~	~~26.7~~	~~53.4~~	~~27.00~~	~~1.13%~~
~~Winter, (T_{95}, S_{95})~~	~~0.513~~	~~35.625~~	~~71.25~~	~~35.99~~	~~1.03%~~

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~~3.4 Step 4: Test the Selected Diffuser Design under Different Discharge Flow Rates at 40% RO Recovery~~

~~In this step, the design Alternative 3 selected in Step 2 (determined based on RO recovery of 50% under critical ambient condition) was tested under a range of target product and corresponding discharge flow rates at 40% RO recovery. All the runs in this section were conducted at the critical ambient condition (Summer, (T_{95}, S_5)) with the ambient and effluent density of 1012.49 kg/m3 and 1029.45 kg/m3, respectively. These runs evaluated different plant capacities for the previously determined diffuser design alternative, now for the RO recovery of 40%. For effluent flow ranging from 38 MGD (20 MGD product water) to 96 MGD (50 MGD product water), the analysis showed that good mixing (ZID: 1.75% - 1.92%) can be achieved only for discharge flows between 38 MD (20 MGD product water) and 54 MGD (28 MGD product water) at critical ambient condition. **Figure 5** shows discharge flow vs. ZID for the specified diffuser design alternative. The variations in the ZID percentages under different discharge flow rates is significantly influenced by the "flow class" as defined by the CORMIX model. The flow classification from the CORMIX manual is demonstrated in **Attachment C.** The model results for each model run is shown in **Table 7** along with the flow class.~~

~~**Table 7:** Effluent Percentage and Concentration at the Three Mixing Zones for Design Alternative 3 at Different Discharge Flow Rates for 40% RO Recovery~~

~~Plant Capacity(MGD)~~	~~Discharge Flow (MGD)~~	~~Condition~~	~~Effluent at ZID (%)~~	~~Ambient Salinity (ppt)~~	~~Effluent Salinity(ppt)~~	~~ZID (ppt)~~	~~Percentage above Ambient~~	~~Flow Class~~
~~50~~	~~96~~	~~RO 40%~~	~~7.71~~	~~22.9~~	~~36.64~~	~~25.72~~	~~12.34%~~	~~MNU8~~
~~40~~	~~76~~	~~RO 40%~~	~~8.37~~	~~22.9~~	~~36.64~~	~~25.97~~	~~13.39%~~	~~MNU8~~
~~35~~	~~67~~	~~RO 40%~~	~~8.8~~	~~22.9~~	~~36.64~~	~~26.12~~	~~14.08%~~	~~MNU8~~
~~30~~	~~57~~	~~RO 40%~~	~~24.7~~	~~22.9~~	~~36.64~~	~~31.95~~	~~39.52%~~	~~MNU9~~
~~28~~	~~54~~	~~RO 40%~~	~~1.92~~	~~22.9~~	~~36.64~~	~~23.60~~	~~3.07%~~	~~MNU3~~
~~25~~	~~48~~	~~RO 40%~~	~~1.87~~	~~22.9~~	~~36.64~~	~~23.59~~	~~2.99%~~	~~MNU3~~
~~20~~	~~38~~	~~RO 40%~~	~~1.75~~	~~22.9~~	~~36.64~~	~~23.54~~	~~2.80%~~	~~MNU3~~

~~Plant Capacity~~	~~Discharge Flow (MGD)~~	~~Condition~~	~~Effluent at MZ (%)~~	~~Ambient Salinity (ppt)~~	~~Effluent Salinity(ppt)~~	~~MZ (ppt)~~	~~Percentage above Ambient~~	~~Flow Class~~
~~50 MGD~~	~~96~~	~~RO 40%~~	~~5.46~~	~~22.9~~	~~36.64~~	~~24.90~~	~~8.74%~~	~~MNU8~~
~~40 MGD~~	~~76~~	~~RO 40%~~	~~6.1~~	~~22.9~~	~~36.64~~	~~25.14~~	~~9.76%~~	~~MNU8~~
~~35 MGD~~	~~67~~	~~RO 40%~~	~~6.5~~	~~22.9~~	~~36.64~~	~~25.28~~	~~10.40%~~	~~MNU8~~
~~30 MGD~~	~~57~~	~~RO 40%~~	~~13.1~~	~~22.9~~	~~36.64~~	~~27.70~~	~~20.96%~~	~~MNU9~~

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~~28 MGD~~	~~54~~	~~RO 40%~~	~~0.734~~	~~22.9~~	~~36.64~~	~~23.17~~	~~1.17%~~	~~MNU3~~
~~25 MGD~~	~~48~~	~~RO 40%~~	~~0.704~~	~~22.9~~	~~36.64~~	~~23.16~~	~~1.13%~~	~~MNU3~~
~~20 MGD~~	~~38~~	~~RO 40%~~	~~0.624~~	~~22.9~~	~~36.64~~	~~23.13~~	~~1.00%~~	~~MNU3~~

~~Plant Capacity(MGD)~~	~~Discharge Flow (MGD)~~	~~Condition~~	~~Effluent at HH (%)~~	~~Ambient Salinity (ppt)~~	~~Effluent Salinity(ppt)~~	~~HH (ppt)~~	~~Percentage above Ambient~~	~~Flow Class~~
~~50~~	~~96~~	~~RO 40%~~	~~4.44~~	~~22.9~~	~~36.64~~	~~24.53~~	~~7.10%~~	~~MNU8~~
~~40~~	~~76~~	~~RO 40%~~	~~4.99~~	~~22.9~~	~~36.64~~	~~24.73~~	~~7.98%~~	~~MNU8~~
~~35~~	~~67~~	~~RO 40%~~	~~5.34~~	~~22.9~~	~~36.64~~	~~24.86~~	~~8.54%~~	~~MNU9~~
~~30~~	~~57~~	~~RO 40%~~	~~6.59~~	~~22.9~~	~~36.64~~	~~25.31~~	~~10.54%~~	~~MNU9~~
~~28~~	~~54~~	~~RO 40%~~	~~0.633~~	~~22.9~~	~~36.64~~	~~23.13~~	~~1.01%~~	~~MNU3~~
~~25~~	~~48~~	~~RO 40%~~	~~0.606~~	~~22.9~~	~~36.64~~	~~23.12~~	~~0.97%~~	~~MNU3~~
~~20~~	~~38~~	~~RO 40%~~	~~0.535~~	~~22.9~~	~~36.64~~	~~23.10~~	~~0.86%~~	~~MNU3~~

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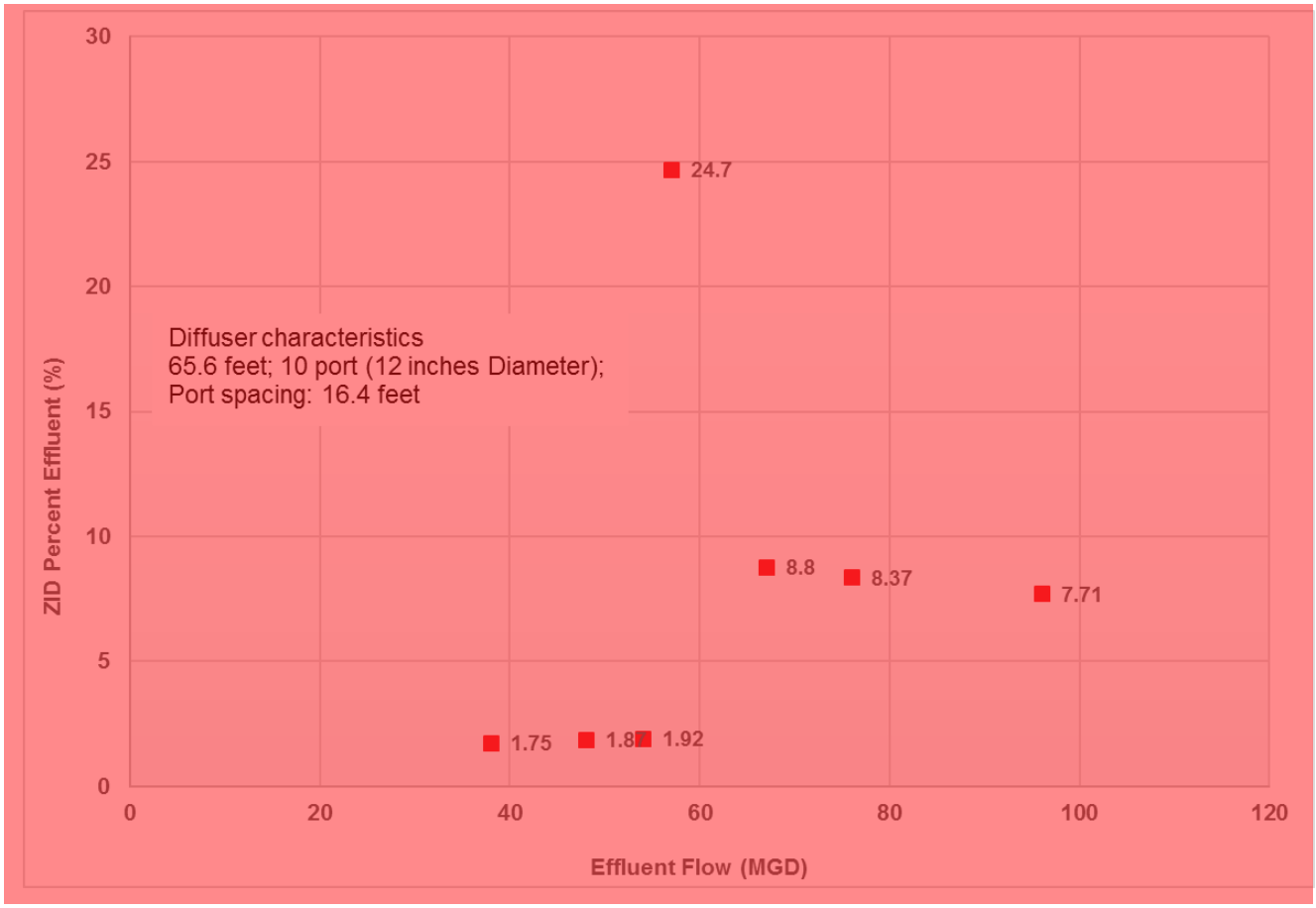

~~**Figure 5:** Discharge Flow vs. ZID Percent Effluent for the Specified Diffuser Design Alternative~~

~~3.5 Step 5: Diffuser Design Change at 40% RO Recovery Under Different Flow Rates~~

~~In this step, diffuser design features were modified to examine whether good mixing can be achieved for a plant capacity of 50 MGD (at 40% RO recovery). Different design alternatives were tested as shown in **Table 8**. This analysis showed that increasing the diffuser diameter leads to better mixing. Design alternative H6 yields a good mixing performance with ZID= 2.25%, MZ=0.94%, and HH=0.8% as shown in **Table 9.** Hence, a diffuser with the following properties would achieve the target mixing performance: **111.5 feet diffuser with 10 ports (24 inches diameters), 2 ports per riser, riser spacing 27.8 feet.**~~

~~**Table 8:** Design Alternatives for 50 MGD Plant at 40% RO Recovery~~

~~Design for Flow~~	~~Design~~	~~Discharge Velocity (ft/s)~~	~~Discharge Depth~~	~~Port Height (ft)~~	~~Number of Port~~	~~Port Spacing (ft)~~	~~Port Diameter (inches)~~	~~Diffuser Length (ft)~~	~~Number of Port Per Riser~~	~~Variation~~	~~Effluent at ZID (%)~~
~~50 MGD~~	~~H1~~	~~18.73~~	~~63~~	~~12.6~~	~~10~~	~~16.4~~	~~12~~	~~65.6~~	~~2~~	~~Base~~	~~8.~~37

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~~50 MGD~~	~~H2~~	~~18.73~~	~~63~~	~~12.6~~	~~10~~	~~16.4~~	~~12~~	~~147.6~~	~~1~~	~~Single port per riser~~	~~6.58~~
~~50 MGD~~	~~H3~~	~~4.72~~	~~63~~	~~12.6~~	~~10~~	~~16.4~~	~~24~~	~~65.6~~	~~2~~	~~Port diameter increased~~	~~2.27~~
~~50 MGD~~	~~H4~~	~~4.72~~	~~63~~	~~12.6~~	~~10~~	~~24.6~~	~~24~~	~~98.4~~	~~2~~	~~Port diameter increased/port spacing increased to 7.5 meter~~	~~2.11~~
~~50 MGD~~	~~H5~~	~~4.72~~	~~63~~	~~12.6~~	~~10~~	~~26.248~~	~~24~~	~~104.992~~	~~2~~	~~Port diameter increased/port spacing increased to 8 meters~~	~~2.09~~
~~50 MGD~~	**~~H6~~**	**~~4.72~~**	**~~63~~**	**~~12.6~~**	**~~10~~**	**~~27.8885~~**	**~~24~~**	**~~111.554~~**	**~~2~~**	**~~Port diameter increased/port spacing increased to 8.5 meters~~**	**~~2.06~~**
~~50 MGD~~	~~H7~~	~~4.73~~	~~63~~	~~12.6~~	~~16~~	~~16.4~~	~~14~~	~~114.8~~	~~2~~	~~Port diameter increased+ number of ports increased~~	~~2.25~~
~~50 MGD~~	~~H8~~	~~4.73~~	~~63~~	~~12.6~~	~~22~~	~~16.4~~	~~16.18~~	~~164~~	~~2~~	~~Port diameter increased/port spacing increased to 8.5 meter~~	~~2.08~~

~~Table 9:~~ ~~Effluent Percentages and Concentrations at the Three Mixing Zones for 50 MGD Plant at Different Design Alternatives with 40% RO Recovery~~

~~Design~~	~~Plant~~	~~Discharge Flow~~	~~Condition~~	~~Effluent at ZID (%)~~	~~Ambient Salinity (ppt)~~	~~Effluent Salinity(ppt)~~	~~ZID (ppt)~~	~~Percentage above Ambient~~	~~Flow Class~~
~~H1~~	~~50 MGD~~	~~96MGD~~	~~RO 40%~~	~~8.37~~	~~22.9~~	~~36.64~~	~~25.97~~	~~13.39%~~	~~MU8~~
~~H2~~	~~50 MGD~~	~~96MGD~~	~~RO 40%~~	~~6.58~~	~~22.9~~	~~36.64~~	~~25.31~~	~~10.53%~~	~~MU9~~
~~H3~~	~~50 MGD~~	~~96MGD~~	~~RO 40%~~	~~2.27~~	~~22.9~~	~~36.64~~	~~23.73~~	~~3.63%~~	~~MU3~~
~~H4~~	~~50 MGD~~	~~96MGD~~	~~RO 40%~~	~~2.11~~	~~22.9~~	~~36.64~~	~~23.67~~	~~3.38%~~	~~MU3~~
~~H5~~	~~50 MGD~~	~~96MGD~~	~~RO 40%~~	~~2.09~~	~~22.9~~	~~36.64~~	~~23.67~~	~~3.34%~~	~~MU3~~
~~H6~~	**~~50 MGD~~**	**~~96MGD~~**	**~~RO 40%~~**	**~~2.06~~**	**~~22.9~~**	**~~36.64~~**	**~~23.65~~**	**~~3.30%~~**	**~~MU3~~**
~~H7~~	~~50 MGD~~	~~96MGD~~	~~RO 40%~~	~~2.25~~	~~22.9~~	~~36.64~~	~~23.72~~	~~3.60%~~	~~MU3~~
~~H8~~	~~50 MGD~~	~~96MGD~~	~~RO 40%~~	~~2.08~~	~~22.9~~	~~36.64~~	~~23.66~~	~~3.33%~~	~~MU3~~

~~Design~~	~~Plant~~	~~Discharge Flow~~	~~Condition~~	~~Effluent at MZ (%)~~	~~Ambient Salinity (ppt)~~	~~Effluent Salinity(ppt)~~	~~MZ(ppt)~~	~~Percentage above Ambient~~
~~H1~~	~~50 MGD~~	~~76MGD~~	~~RO 40%~~	~~6.1~~	~~22.9~~	~~36.64~~	~~25.14~~	~~9.76%~~
~~H2~~	~~50 MGD~~	~~76MGD~~	~~RO 40%~~	~~4.58~~	~~22.9~~	~~36.64~~	~~24.58~~	~~7.33%~~

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H3	50 MGD	76MGD	RO 40%	1.14	22.9	36.64	23.32	1.82%
H4	50 MGD	76MGD	RO 40%	0.921	22.9	36.64	23.24	1.47%
H5	50 MGD	76MGD	RO 40%	0.888	22.9	36.64	23.23	1.42%
H6	**50 MGD**	**76 MGD**	**RO 40%**	**0.86**	**22.9**	**36.64**	**23.22**	**1.38%**
H7	50 MGD	76MGD	RO 40%	0.937	22.9	36.64	23.24	1.50%
H8	50 MGD	76 MGD	RO 40%	0.77	22.9	36.64	23.18	1.23%

Design	Plant	Discharge Flow	Condition	Effluent at HH (%)	Ambient Salinity (ppt)	Effluent Salinity(ppt)	HH (ppt)	Percentage above Ambient
H1	50 MGD	76 MGD	RO 40%	4.99	22.9	36.64	24.73	7.98%
H2	50 MGD	76 MGD	RO 40%	4.59	22.9	36.64	24.58	0.82%
H3	50 MGD	76 MGD	RO 40%	0.98	22.9	36.64	23.26	0.82%
H4	50 MGD	76 MGD	RO 40%	0.789	22.9	36.64	23.19	0.82%
H5	50 MGD	76 MGD	RO 40%	0.761	22.9	36.64	23.18	0.82%
H6	**50 MGD**	**76 MGD**	**RO 40%**	**0.735**	**22.9**	**36.64**	**23.17**	**1.18%**
H7	50 MGD	76 MGD	RO 40%	0.802	22.9	36.64	23.19	0.82%
H8	50 MGD	76 MGD	RO 40%	0.66	22.9	36.64	23.14	1.06%

The design alternative obtained from the previous step was tested under different discharge flow rates for RO recovery of 40%. The analysis results, shown in **Table 10**, Show that good mixing can be achieved for discharge flow rates of 67 MGD (35 MGD product water) to 96 MGD (50 MGD product water). **Figure 6** shows discharge flow vs. ZID percent effluent for the specified diffuser design alternative. The variations in the ZID percentages under different discharge flow rates is significantly influenced by the "flow class" as defined by the CORMIX model. The flow class for each model run is shown in **Table 10**.

Table 10: Effluent Percentages at the Three Mixing Zones for Design Alternative H6 at Different Flow Rate at 40% Recovery

Design	Plant	Discharge Flow (MGD)	Condition	Effluent at ZID (%)	Ambient Salinity (ppt)	Effluent Salinity(ppt)	ZID (ppt)	Percentage above Ambient	Flow Class
H6	50 MGD	96	RO 40%	2.06	22.9	36.64	23.65	3.30%	MNU3
H6	40 MGD	76	RO 40%	1.91	22.9	36.64	23.60	3.06%	MNU3
H6	35 MGD	67	RO 40%	1.82	22.9	36.64	23.57	2.91%	MNU3

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~~H6~~	~~30 MGD~~	~~57~~	~~RO 40%~~	~~22.18~~	~~22.9~~	~~36.64~~	~~31.03~~	~~35.49%~~	~~MNU1~~
~~H6~~	~~28 MGD~~	~~54~~	~~RO 40%~~	~~22.43~~	~~22.9~~	~~36.64~~	~~31.12~~	~~35.89%~~	~~MNU1~~
~~H6~~	~~25 MGD~~	~~48~~	~~RO 40%~~	~~22.6~~	~~22.9~~	~~36.64~~	~~31.18~~	~~36.16%~~	~~MNU1~~
~~H6~~	~~20 MGD~~	~~38~~	~~RO 40%~~	~~23.5~~	~~22.9~~	~~36.64~~	~~31.51~~	~~37.60%~~	~~MNU1~~

~~Design~~	~~Plant~~	~~Discharge Flow (MGD)~~	~~Condition~~	~~Effluent at MZ (%)~~	~~Ambient Salinity (ppt)~~	~~Effluent Salinity(ppt)~~	~~MZ (ppt)~~	~~Percentage above Ambient~~
~~H6~~	~~50 MGD~~	~~96~~	~~RO 40%~~	~~0.86~~	~~22.9~~	~~36.64~~	~~23.22~~	~~1.38%~~
~~H6~~	~~40 MGD~~	~~76~~	~~RO 40%~~	~~0.753~~	~~22.9~~	~~36.64~~	~~23.18~~	~~1.20%~~
~~H6~~	~~35 MGD~~	~~67~~	~~RO 40%~~	~~0.7~~	~~22.9~~	~~36.64~~	~~23.16~~	~~1.12%~~
~~H6~~	~~30 MGD~~	~~57~~	~~RO 40%~~	~~16.48~~	~~22.9~~	~~36.64~~	~~28.94~~	~~26.37%~~
~~H6~~	~~28 MGD~~	~~54~~	~~RO 40%~~	~~16.56~~	~~22.9~~	~~36.64~~	~~28.97~~	~~26.50%~~
~~H6~~	~~25 MGD~~	~~48~~	~~RO 40%~~	~~16.63~~	~~22.9~~	~~36.64~~	~~28.99~~	~~26.61%~~
~~H6~~	~~20 MGD~~	~~38~~	~~RO 40%~~	~~17~~	~~22.9~~	~~36.64~~	~~29.13~~	~~27.20%~~

~~Design~~	~~Plant~~	~~Discharge Flow (MGD)~~	~~Condition~~	~~Effluent at HH (%)~~	~~Ambient Salinity (ppt)~~	~~Effluent Salinity(ppt)~~	~~HH (ppt)~~	~~Percentage above Ambient~~
~~H6~~	~~50 MGD~~	~~96~~	~~RO 40%~~	~~0.735~~	~~22.9~~	~~36.64~~	~~23.17~~	~~1.18%~~
~~H6~~	~~40 MGD~~	~~76~~	~~RO 40%~~	~~0.642~~	~~22.9~~	~~36.64~~	~~23.14~~	~~1.03%~~
~~H6~~	~~35 MGD~~	~~67~~	~~RO 40%~~	~~0.596~~	~~22.9~~	~~36.64~~	~~23.12~~	~~0.95%~~
~~H6~~	~~30 MGD~~	~~57~~	~~RO 40%~~	~~12.8~~	~~22.9~~	~~36.64~~	~~27.59~~	~~20.48%~~
~~H6~~	~~28 MGD~~	~~54~~	~~RO 40%~~	~~12.8~~	~~22.9~~	~~36.64~~	~~27.59~~	~~20.48%~~
~~H6~~	~~25 MGD~~	~~48~~	~~RO 40%~~	~~12.8~~	~~22.9~~	~~36.64~~	~~27.59~~	~~20.48%~~
~~H6~~	~~20 MGD~~	~~38~~	~~RO 40%~~	~~12.6~~	~~22.9~~	~~36.64~~	~~27.52~~	~~20.16%~~

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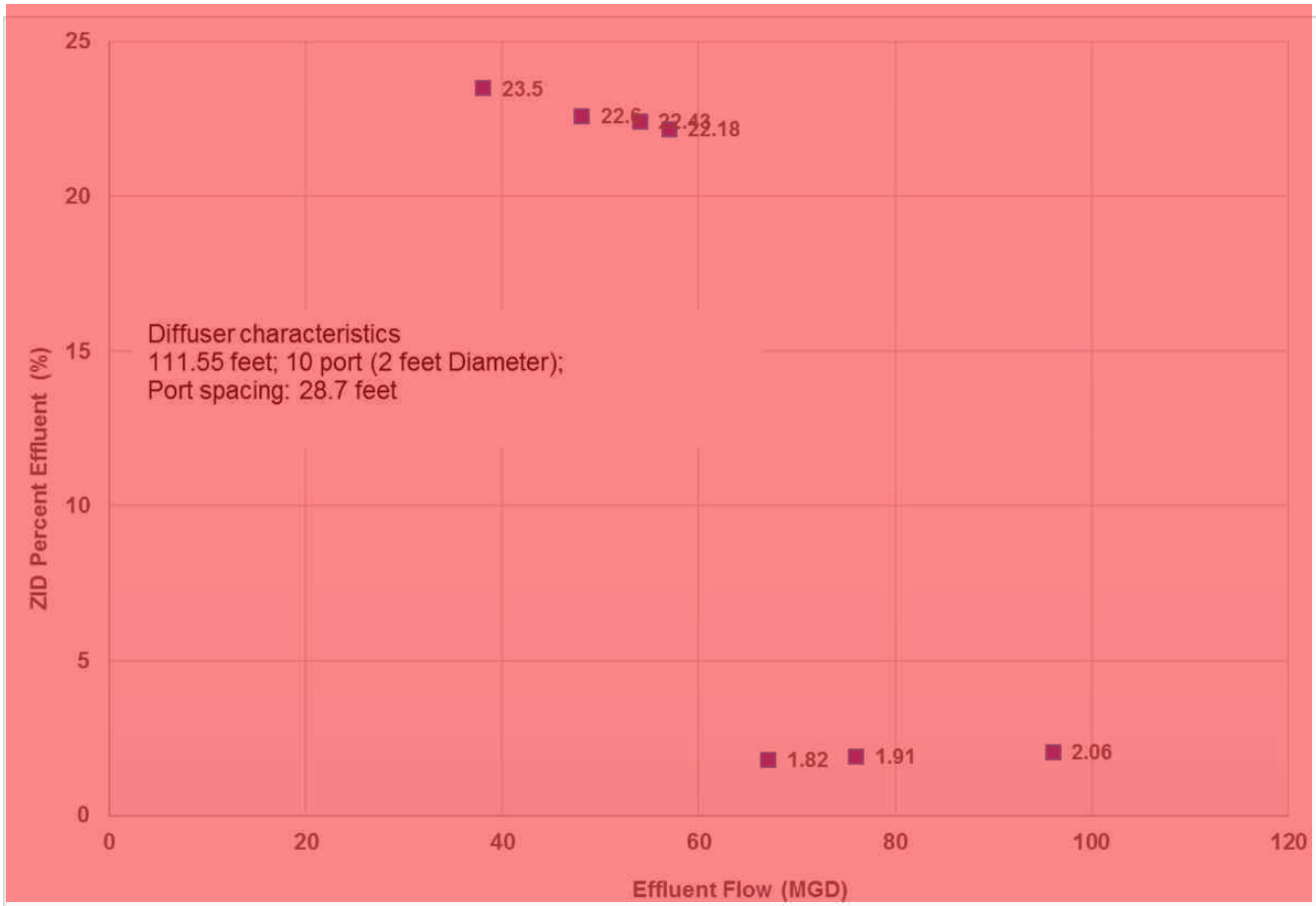

Figure 6: ZID Percent Effluent vs. Effluent Discharge Rate for the Specified Design Alternative at 40% RO Recovery

4. Summary and Conclusions

Conclusions from this modeling study include the following:

- Based on the modeling, the critical ambient condition for effluent mixing (ambient conditions which yield poorest mixing) occur at the 95th percentile of temperature and 5th percentile of salinity for the summer data.
- Significantly better effluent mixing is predicted by the model for 50% RO recovery than for 40% RO recovery for varying diffuser designs. This difference is likely due to the increased density of the effluent at higher salinity.
- At 40% RO recovery, mixing performance varied widely depending on diffuser design for effluent flows ranging from 38 MGD (20 MGD product water) to 96 MGD (50 MGD product water) at critical ambient conditions. Good mixing performance could be achieved for flows within this range (1.75% to 2.06% at the ZID, 0.7% to 0.86 at the aquatic life mixing zone, and 0.535% to 0.735 at the human health

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~~mixing zone) but necessitated changes in the diffuser design. The performance for a given diffuser design varied significantly depending on the flow rate.~~

- ~~A critical factor in achieving good mixing is the flow profile, which is referred to in the CORMIX model as "flow class". Mixing performance changes significantly when the flow class changes.~~
- ~~Across the range of flows modeled at 40% RO recovery, effluent targets of 2.5% at the ZID, 1 % at the aquatic life mixing zone, and 0.80 % at the human health mixing zone can readily be achieved with an appropriately designed diffuser.~~
- ~~For a production rate of 50 MGD, yielding an estimated effluent flow rate of 96 MGD at the critical ambient condition and 40% RO recovery rate, a diffuser with the following properties would achieve the target mixing performance: 111.5 feet diffuser with 10 ports (24 inches diameter), 2 ports per riser, riser spacing 27.8 feet.~~
- ~~The Port of Corpus Christi proposes to implement a diffuser which will achieve the target mixing performance at the selected design production rate and at the 40% RO recovery rate. Modeling suggests that if the RO recovery rate is increased, mixing performance for the selected design should improve.~~

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~~5. References~~

1. ~~Jenkins, Scott, et al. "Management of brine discharges to coastal waters recommendations of a science advisory panel." *Southern California coastal water research project. Costa Mesa, CA* (2012).~~
2. ~~Bleninger, Tobias, and Gerhard H. Jirka. "Modelling and environmentally sound management of brine discharges from desalination plants." *Desalination* 221.1-3 (2008): 585-597.~~
3. ~~Nash, Jonathan D., and Gerhard H. Jirka. "Buoyant surface discharges into unsteady ambient flows." *Dynamics of atmospheres and oceans* 24.1-4 (1996): 75-84.~~
4. ~~Jenkins, Scott, et al. "Management of brine discharges to coastal waters recommendations of a science advisory panel." *Southern California coastal water research project. Costa Mesa, CA* (2012).~~

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~~**ATTACHMENT A**~~

~~Mixing Analysis Using CORMIX~~

Attachment A is Deleted.

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~~Mixing Analyses Using CORMIX~~

~~*Introduction*~~

~~Detailed site-specific mixing analyses are an alternative to using default effluent percentages for developing permit requirements. The use of effluent diffusers and/or the strategic orientation of outfall pipes can enhance mixing of wastewater effluent with receiving waters and increase critical dilutions (reduce effluent percentages) used to develop permit conditions. The model most commonly used to design diffusers and evaluate mixing near outfalls is CORMIX. This model requires a substantial amount of information on the ambient receiving water conditions, detailed discharge and diffuser configuration information, and knowledge of regulatory mixing zone shapes and sizes. This document outlines the specific information needed to construct or review a CORMIX model and provides standardized methods for developing and interpreting critical cases.~~

~~In general, mixing should be evaluated under both summer and winter temperature conditions and at different combinations of effluent and receiving water densities. This is necessary because the most limiting combination of effluent and receiving water conditions cannot be reliably predicted prior to running the model. The highest effluent percentages at the edge of the aquatic life mixing zone and the zone of initial dilution (ZID) will be used to determine water-quality-based permit limits for the protection of aquatic life. Likewise, the highest effluent percentage at the edge of the human health mixing zone will be used to determine water-quality-based permit limits for the protection of human health.~~

~~*Ambient Data*~~

~~Widths and Depths~~

~~For bounded receiving waters (streams, rivers, and other narrow channels), the application should include information regarding water body width and depth near the proposed discharge location. For unbounded receiving waters (lakes, bays, wide tidal rivers), the application should include information on depths in the vicinity of the discharge point (200 foot radius for lakes, 400 foot radius for bays or wide tidal rivers).~~

~~Velocity~~

~~***Streams and Rivers.*** In flowing water bodies, use velocity calculated from the 7Q2 flow, the average width, and the average depth. If necessary, dilution estimates for human health protection can be developed using velocity calculated from harmonic mean flow. Calculate the 7Q2 and harmonic mean flows using methods outlined in the most current version of the *Procedures to Implement the Texas Surface Water Quality Standards*. Calculate the average width and depth using the data provided by the applicant.~~

~~***Lakes, Bays, and Wide Tidal Rivers.*** In lakes or tidal water bodies, the applicant may provide velocity information. Otherwise, assume a small velocity, but large enough so that the model does not predict dilutions greater than the limiting dilution. An ambient velocity of zero may be used to obtain results in the near field only.~~

~~Wind Speed~~

~~Use a wind speed of 2 m/s unless the applicant provides site-specific information that demonstrates the wind speed should be greater.~~

~~Density~~

~~Good characterization of ambient density is an extremely important component of the mixing analysis. Therefore, an effort should be made to maximize the use of available data in order to develop meaningful statistics.~~

~~Select the appropriate SWQM station or stations and extract the following parameters:~~

~~Parameter~~	~~Code~~
~~Temperature~~	~~00010~~
~~Conductivity~~	~~00094~~
~~Salinity~~	~~00480~~

~~Generally there is more conductivity data than salinity data available. If paired salinity and conductivity data are available, develop a regression (2nd order usually fits better than linear) for salinity as a function of conductivity. Use the regression equation to calculate salinity for those conductivity measurements without a corresponding reported salinity in order to bolster the salinity data set. If paired salinity and conductivity data are not available, use the conductivity values to calculate salinity from the following equations:~~

~~S(ppt) = 0.000589 × conductivity (µmhos/cm) (for conductivities < 17,000)~~
~~S(ppt) = (0.000682 × conductivity)-1.7 (µmhos/cm) (for conductivities ≥ 17,000)~~

~~Determine the 5th and 95th percentile temperatures and salinities, and calculate the density for each combination of temperature and salinity: $\rho(T_5, S_5)$, $\rho(T_5, S_{95})$, $\rho(T_{95}, S_5)$, and $\rho(T_{95}, S_{95})$. These percentiles need to be developed for both summer (June, July, and August) and winter (December, January, and February) seasons if the effluent exhibits seasonal density variation. Use the resulting salinities along with their corresponding temperatures to calculate densities using the following equation:~~

$$\rho_{s,t,0} = \left[1 + \left(0.001\left(\left(28.14 - 0.0735T - 0.00469T^2\right) + \left(0.802 - 0.002T\right)\left(S - 35\right)\right)\right)\right] \times 1000$$

~~where:~~ $\rho_{s,t,o}$ ~~=~~ ~~water density (kg/m³ or g/cm³)~~
T ~~=~~ ~~water temperature (°C)~~
S ~~=~~ ~~water salinity (ppt)~~

~~For some estuarine outfall locations, density stratification can have an important influence on mixing characteristics. To determine whether stratification should be factored into the analysis, a detailed evaluation of density profile data should be performed. For each date where profile data is available, calculate the density at each point in the water column and calculate the overall density difference from surface to bottom or to a depth equal to the average depth near the outfall, whichever is less. According to CORMIX guidance, if the density changes by more than 0.1 kg/m³ from surface to bottom, stratification should be considered in the model analysis. If the density does not change this much, the water column can be considered unstratified. If the~~

~~water column routinely exhibits stratification (more than 10% of the time), use the calculated surface-to-bottom density differences to determine the median density difference ($\Delta\rho_{median}$) to use later in the analysis.~~

~~*Discharge Data*~~

~~Diffuser Design and Orientation~~

~~The application should include drawings or schematics of the diffuser and its orientation relative to the receiving water. Distances and angles should be clearly marked. If not, contact the applicant and request this information.~~

~~Effluent Flow~~

~~Run the model using the following effluent flows as applicable:~~

- ~~Existing permitted flow (renewal or amendment)~~
- ~~Proposed permitted flow (new or amendment)~~
- ~~Most recent two-year median monthly average flow (renewal or amendment)~~

~~Effluent Density~~

~~The application should include effluent temperature and salinity information along with calculated effluent densities (ρ_{eff}). When running the model, be sure to maintain the seasonal relationship between ambient and effluent densities; that is, do not model a winter effluent density with a summer ambient density.~~

~~*Mixing Zone Definition*~~

~~Single-port Diffusers~~

~~For single-port diffuser discharges to saltwater bodies or freshwater lakes, effluent percentages will need to be determined at the intersection of the plume centerline with the radial mixing zone distances given in Table 1, where:~~

$$D = \sqrt{X^2 + Y^2}$$

~~and where:~~ ~~D = distance from outfall~~
~~X = CORMIX x-coordinate of plume centerline~~
~~Y = CORMIX y-coordinate of plume centerline~~

~~For discharges to flowing freshwater streams or rivers, effluent percentages will need to be determined in the x-coordinate direction at the upstream and downstream longitudinal distances given in Table 1.~~

~~Table 1. Standard regulatory mixing zone distances for various types of water bodies.~~

~~Water Body Type~~		~~ZID (m)~~	~~MZ (m)~~	~~HH MZ (m)~~
~~Wide Tidal River, Bay, Estuary~~		~~15.24*~~	~~60.96*~~	~~121.92*~~
~~Narrow Tidal River (width < 400')~~	~~upstream~~	~~6.10~~	~~30.48~~	~~30.48~~
	~~downstream~~	~~18.29~~	~~91.44~~	~~91.44~~
~~Freshwater Lake~~		~~7.62*~~	~~30.48*~~	~~60.96*~~
~~Freshwater Stream~~	~~upstream~~	~~6.10~~	~~30.48~~	~~30.48~~
	~~downstream~~	~~18.29~~	~~91.44~~	~~91.44~~

~~* Radial distance from outfall.~~

~~Multiport Diffusers~~

~~For multiport diffuser discharges, the ZID and both mixing zones typically will be rectangular in shape and equal in area to the standard ZID and mixing zone sizes. The ZID and mixing zones may be centered on or aligned along the diffuser barrel. The position of the ZID and mixing zones relative to the diffuser will depend on two things:~~

~~1) the nature of the receiving water (tidally reversing or one-direction flow)~~
~~2) the orientation of the diffuser ports to the receiving water current.~~

~~A schematic depicting the configuration of the mixing zones relative to the multiport diffuser should be drawn to aid in the interpretation of model results.~~

~~*Model Scenarios*~~

~~Since the most limiting combination of effluent and receiving water conditions cannot be reliably predicted in advance of running the model, a range of modeling scenarios should be performed in order to determine protective effluent dilutions. For consistency, set the model up to predict percent effluent.~~

~~For effluents with relatively constant density year round, the following standard effluent/ambient density combination model runs should be performed for~~ **~~each effluent flow case~~**~~:~~

- $\rho_{eff} / \rho(T_5, S_5)$
- $\rho_{eff} / \rho(T_5, S_{95})$
- $\rho_{eff} / \rho(T_{95}, S_5)$
- $\rho_{eff} / \rho(T_{95}, S_{95})$

~~For effluents with seasonal density variation, the following standard effluent/ambient density combination model runs should be performed for~~ **~~each effluent flow case~~**:

~~**Winter Conditions**~~

- ~~$\rho_{eff} / \rho(T_5, S_5)$~~
- ~~$\rho_{eff} / \rho(T_5, S_{95})$~~
- ~~$\rho_{eff} / \rho(T_{95}, S_5)$~~
- ~~$\rho_{eff} / \rho(T_{95}, S_{95})$~~

~~**Summer Conditions**~~

- ~~$\rho_{eff} / \rho(T_5, S_5)$~~
- ~~$\rho_{eff} / \rho(T_5, S_{95})$~~
- ~~$\rho_{eff} / \rho(T_{95}, S_5)$~~
- ~~$\rho_{eff} / \rho(T_{95}, S_{95})$~~

~~If stratification was determined to be a routine characteristic of the receiving waters, further model scenarios will need to be run and evaluated. The stratification model case(s) should be developed from the most critical case(s) identified from the standard cases described previously. For each standard case that produced a critical dilution estimate (max. % effluent) for any mixing zone type (ZID, MZ, HH MZ), rerun the critical standard case(s) after adjusting the ambient density in the following manner:~~

$$\rho_{surface} = \rho_{standard} - (0.5 \times \Delta\rho_{median})$$
$$\rho_{bottom} = \rho_{standard} + (0.5 \times \Delta\rho_{median})$$

~~Choose the Stratification Type A (linear stratification) model setting for all stratification case~~ scenarios.

~~**ATTACHMENT B**~~

~~Reported Corpus Christi Bay Ambient Properties~~

Attachments B and C and Appendix B are Deleted

Deleted pages S-Application 000376 to S-Application 000384

~~Reported Corpus Christi Bay Ambient Properties~~

~~Corpus Christi Bay is bordered on the North by Redfish Bay; on the south by the upper Laguna Madre; on the east by Mustang Island; and on the west by the City of Corpus Christi. The Corpus Christi Bay System has a total area of 124,796 acres with 127 miles of shoreline. The largest bay in this system is Corpus Christi Bay, which covers 95,997 acres.~~

~~The diurnal tide within Corpus Christi Bay has a typical range of approximately 3 ft along the coast, but the tidal amplitude is significantly reduced through the Aransas Pass inlet channel and lower portion of the ship canal, resulting in a typical tidal range of only approximately 1 ft in the main part of Corpus Christi Bay, including the proposed La Quinta site discharge location. There has been a seasonal component to the Corpus Christi Bay water level over the past 20 years, with the lowest average water level of approximately 0.3 ft NAVD during January and the high of approximately 1.4 ft during October.~~

~~Corpus Christi Bay is a relatively shallow bay with uniform depth (Nelson, 2012). Stratification is typically absent or small in shallow bays with mixing mechanisms. Ward and Armstrong (1997) state that there is no increase in salinity along the ship channel relative to the bay outside of the ship channel due to density currents. Salinity is variable, but the average is relatively constant over the Bay with a gradient transverse to the axis of the Bay. The salinity is typically highest near the southeast corner of the Bay near Laguna Madre. A hyper-saline gravity current originating in Oso Bay and extending into Corpus Christi Bay has been observed (Nelson, 2012). Nelson attributes the limited stratification observed within Laguna Madre and Oso Bay to be caused by winds, rather than other possible processes producing stratification. Ward and Armstrong (1997) state that the average weak stratification is relatively uniform and typically less than 0.5 parts per thousand (ppt) per meter (ppt/m) nearly everywhere and less than 0.3 ppt/m across half of the Corpus Christi Bay system. [1]~~

~~General circulation is described by the Texas Parks and Wildlife Department's Sea Center web page as being counter clockwise along the shoreline with a prevailing wind from the southeast being a primary factor for the circulation.~~

~~References:~~

1. ~~http://www.cbbep.org/publications/virtuallibrary/CCBNEP-23.pdfTCEQ. 2017, updated daily. Surface Water Quality Monitoring Information System, May 22, 1969 – May 11, 2017. Compiled by Data Management & Analysis Team. Austin, Texas USA. Data Request ID 322~~

~~**ATTACHMENT C**~~

~~Flow Classes Definition by COMRIX~~

Attachment C Is Deleted.

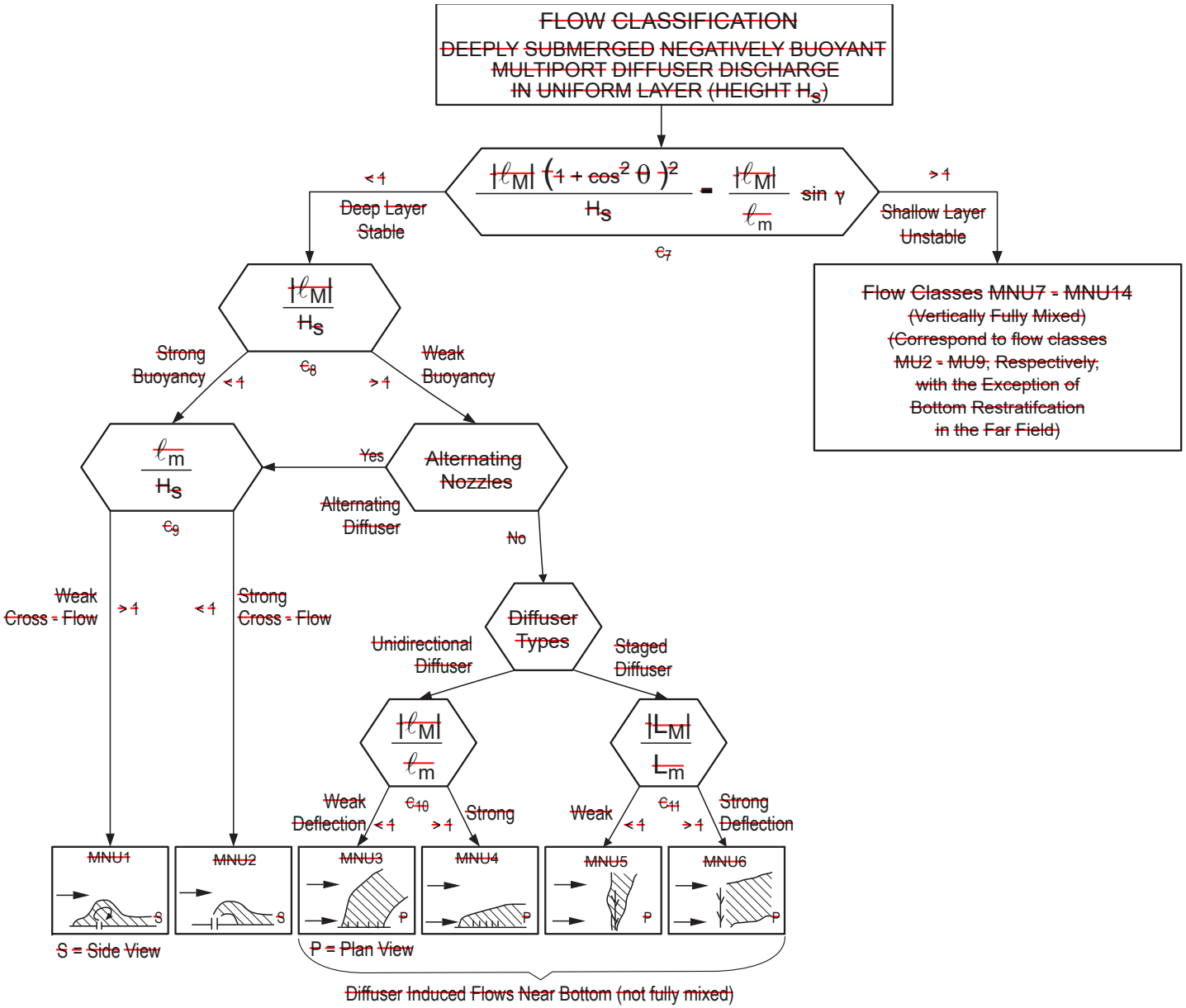


Figure A.7.a *CORMIX2 Classification: Behavior of negatively buoyant multiport diffuser discharges in uniform ambient layer flow (Flow classes MNU)*

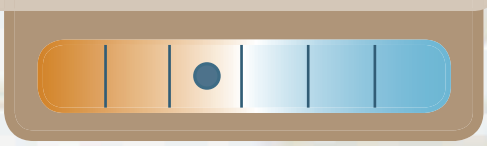
~~APPENDIX B~~

~~EPA Salinity Variation Q&A~~

Appendix B Is Deleted.

FOCUS QUESTION 6:

Are freshwater inflows adequate to maintain a healthy bay system?



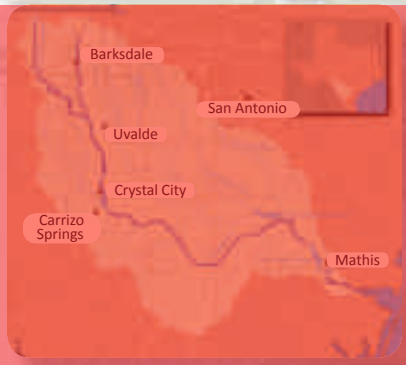
What was measured: Freshwater inflows and Corpus Christi Bay system salinity levels

Answer: Maybe, because the freshwater inflows have been altered and managed. Studies are underway to determine the health of the bays and estuaries based on inflows and salinity.

INDICATOR #18: Quantity and timing of freshwater inflows.
Condition/Trend: Good/Stable

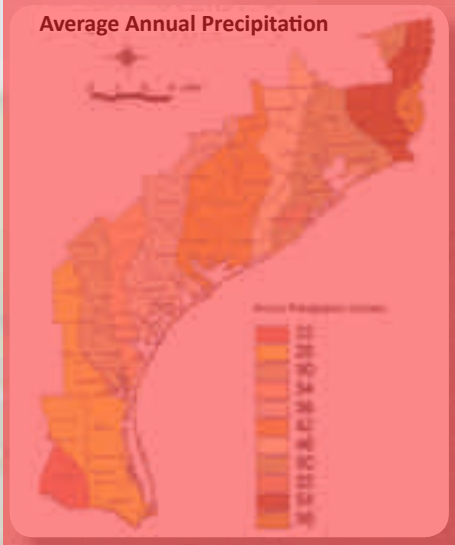
I. BACKGROUND

The flow of freshwater into a bay system from its watershed (drainage areas to a particular body of water) helps to ensure that necessary salinity, nutrient, and sediment loading are adequate in order to maintain productivity of economically and ecologically important species. Sources of freshwater inflows entering into the bays and estuaries consist of rain, groundwater, and the largest contributor, surface water from rivers and streams. The characteristic natural community living in and around the Texas Coastal Bend bay system is largely defined by the volume, timing, location, and quality of freshwater inflows.



Nueces River Watershed

The Nueces River is one of the largest contributors of freshwater into our local bays and estuaries. Because of the altered freshwater inflows into Nueces Bay due to the Choke Canyon and Lake Corpus Christi Reservoirs, it is necessary to regulate inflows with "pass through" requirements that allow a certain amount of freshwater flow into the Nueces River each month.



The City of Corpus Christi is responsible for distributing water to all necessary users and consumers, as well as ensuring all target pass through requirements to the Nueces Estuary are met. The Nueces River Authority (NRA), a governmental organization created in 1935, works closely with the City of Corpus Christi to preserve, protect, and develop surface water resources including flood control, irrigation, navigation, water supply, wastewater treatment, and water quality control within the Nueces River Basin.

II. CONCERNS

Natural fluctuations in freshwater inflows into the bay can have an immense impact on organisms within the bay system. For example, if a long drought persists and creates a situation of very little freshwater inflow into the bay, it may cause hypersaline (high salt) conditions that in turn affect bay shrimp catches which need a certain salinity range in order to mature in healthy numbers. On the other extreme, there may be an abundance of freshwater inflow after an extended heavy rain event that causes eutrophication (high nutrient conditions), triggers large algal blooms that deplete oxygen and light within the water column, and negatively effects fish and plants living in the bays.

III. LOCAL FRESHWATER INFLOW LEVELS

When looking at the distribution of freshwater inflow into the Coastal Bend bays, there is a definite trend of less rain from north to south. While scientific work continues to determine the amount and location of monthly inflows needed, recommendations were made in 1991 that developed the current target levels of annual freshwater inflows to the bay system. Since the "pass through targets" attempt to mimic the natural freshwater inflow cycle into the Corpus Christi Bay system, there is a greater chance of maintaining a healthy estuary for fish and wildlife, as well as its human inhabitants.

Pass Through Targets (AcFt)				
Month	Capacity<=70%	40%<= Capacity<=70%	30%<= Capacity<=40%	Capacity<=30%
January	2,500	2,500	1,200	0
February	2,500	2,500	1,200	0
March	3,500	3,500	1,200	0
April	3,500	3,500	1,200	0
May	25,500	23,500	1,200	0
June	25,500	23,000	1,200	0
July	6,500	4,500	1,200	0
August	6,500	5,000	1,200	0
September	28,500	11,500	1,200	0
October	20,000	9,000	1,200	0
November	9,000	4,000	1,200	0
December	4,500	4,500	1,200	0

Choke Canyon/Lake Corpus Christi Reservoirs pass through targets measured in Acre Feet for the Nueces River which the City of Corpus Christi is required to follow:

Wesley Seale Dam

Freshwater Inflow
- Quantity
- Timing
- Quality

→

Estuarine Conditions
- Salinity
- Sediment
- Dissolved Material
- Particulate Material

→

Estuarine Resources
- Species Composition, Abundance, Distribution
- Primary and Secondary Production

Freshwater Inflow cause and effect diagram.

IV. REFERENCES

- Asquith, W. H., Mosier, J.G., and P.W. Bush. 1997. Status, Trends, and Changes in Freshwater Inflows to Bays Systems in the Corpus Christi Bay National Estuary Program Study Area. Corpus Christi Bay National Estuary Program. 48 pp.
- City of Corpus Christi. 2007. Frequently Asked Questions About Water Related Issues In Corpus Christi. http://www.cctexas.com/?fuseaction=main.view&page=2841
- Nueces River Authority. 2007. Basin highlights report. Report prepared in cooperation with the Texas Commission on Environmental Quality Clean Rivers Program. Corpus Christi, 82 pp.

S-Application 000382

INDICATOR #19: Bay salinity levels (within desired target ranges).

Condition/Trend: Good/Stable

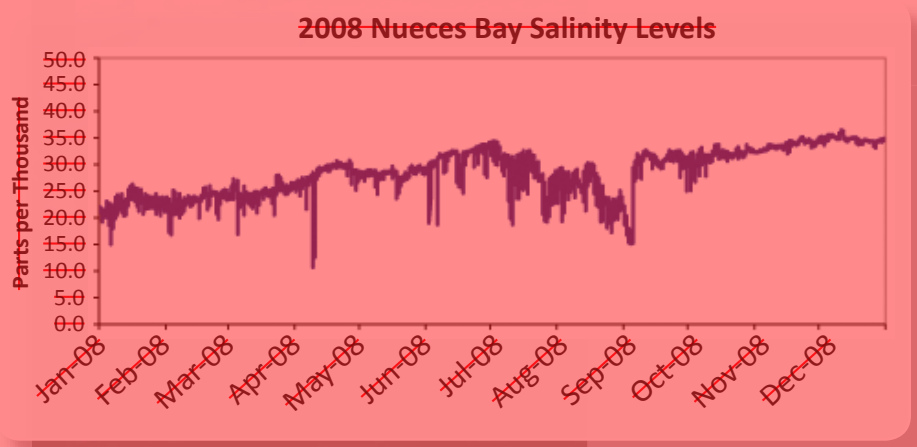
Improvement Needed

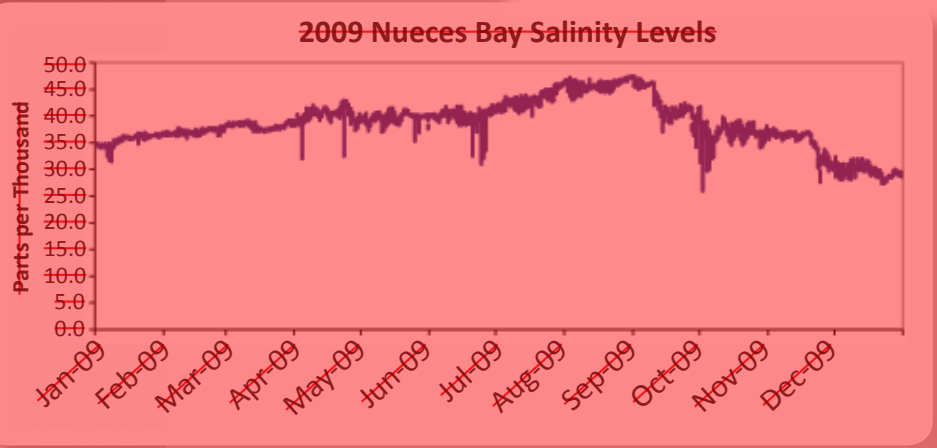
I. BACKGROUND

Salinity is a measure of how much sea salt is contained in a unit of water. The Gulf of Mexico coastal seawater is relatively constant at about 35 parts sea salt per thousand parts water by weight. Salinity of freshwater is near zero. Therefore, most of the salinity variations in the estuary are responses to river inflow, evaporation and mixing by winds and ocean tides.

The ability of resource agencies to manage fish, wildlife and freshwater supplies to the Corpus Christi Bay estuary requires an integrated knowledge of the relations between the organisms and their environment. The salinity of the water, and particularly its seasonality patterns, affect which aquatic species can survive. In short, salinity is a fundamental property of the estuary that determines its biological characteristics.

The Texas Water Development Board has been recording salinity levels since 1987 for the various bays around the Coastal Bend. The Conrad Blucher Institute's Division of Nearshore Research at Texas A&M University-Corpus Christi maintains salinity monitoring stations within the Corpus Christi Bay system and posts a salinity relief check page that is updated daily. The site can be accessed at http://lighthouse.tamucc.edu/Salinity/HomePage.





II. CONCERNS

Management of the freshwater supply is complicated in part because Lake Corpus Christi's freshwater supply serves two major purposes: human consumption and salinity control. When freshwater runoff from the Nueces Watershed is scarce, as in dry years, a proportionally greater amount of available freshwater from the estuary is needed for human use as well as for salinity control.

In order to relieve some salinity stress from within the estuary, salinity pass through targets were developed, based on historical salinity levels, in attempts to mimic natural salinity levels within the bay system. In simple terms, if salinity is too high, freshwater is released to lower salinity levels. When salinity is too low, the City of Corpus Christi gets a Salinity Relief Credit which allows for less freshwater pass through entering into the bay system, allowing salinity levels a chance to increase back to normal levels.

III. LOCAL LEVELS

Salinity gradients along the Texas Coastal Bend bays from the upper to lower regions are a normal feature. Salinity measured within each bay system such as the San Antonio Bay may be as low as zero parts per thousand (ppt), while values as high as 70 ppt may occur in Baffin Bay and the Upper Laguna Madre.

The Corpus Christi Bay system, which receives runoff from urban areas in addition to Nueces River inflow, experiences lower average salinities than the southern region of the Coastal Bend area with an average salinity in 2008 of around 28 ppt compared to an average salinity of 39 ppt in 2009 for Nueces Bay. Optimum salinity ranges vary for the Corpus Christi Bay system depending on proximity to the river and season, but in general, salinities can be between 1 to 30 ppt. By keeping salinities within this target range, fish, wildlife, and plants will be less stressed and more productive.

The City of Corpus Christi receives 500 acre feet per month return flow credit for all return flows into Nueces Bay and possibly one of the following: up to half of the monthly target from flows exceeding the freshwater inflow requirement of the previous month or the salinity relief credit when the salinity in Nueces Bay is low.

Salinity Relief Credit Chart

Months	Salinity Lower Bounds	Salinity Upper Bounds	Reduction for Average Salinity		
			5 psu below SUB	10 psu below SUB	15 psu below SUB
January	5	30	25%	50%	75%
February	5	30	25%	50%	75%
March	5	30	25%	50%	75%
April	5	30	25%	50%	75%
May	1	20	0%	25%	75%
June	1	20	0%	25%	75%
July	2	25	25%	50%	75%
August	2	25	25%	50%	75%
September	5	20	0%	25%	75%
October	5	30	0%	25%	75%
November	5	30	25%	50%	75%
December	5	30	25%	50%	75%

Measuring salinity using a refractometer.

IV. REFERENCES

- City of Corpus Christi. 2007. Frequently Asked Questions About Water Related Issues In Corpus Christi. http://www.cctexas.com/?fuseaction=main.view&page=2841
- Conrad Blucher Institute – Division of Nearshore Research. 2010. Nueces Bay Salinity. http://lighthouse.tamucc.edu/Salinity/HomePage

ATTACHMENT 9

Facility Map

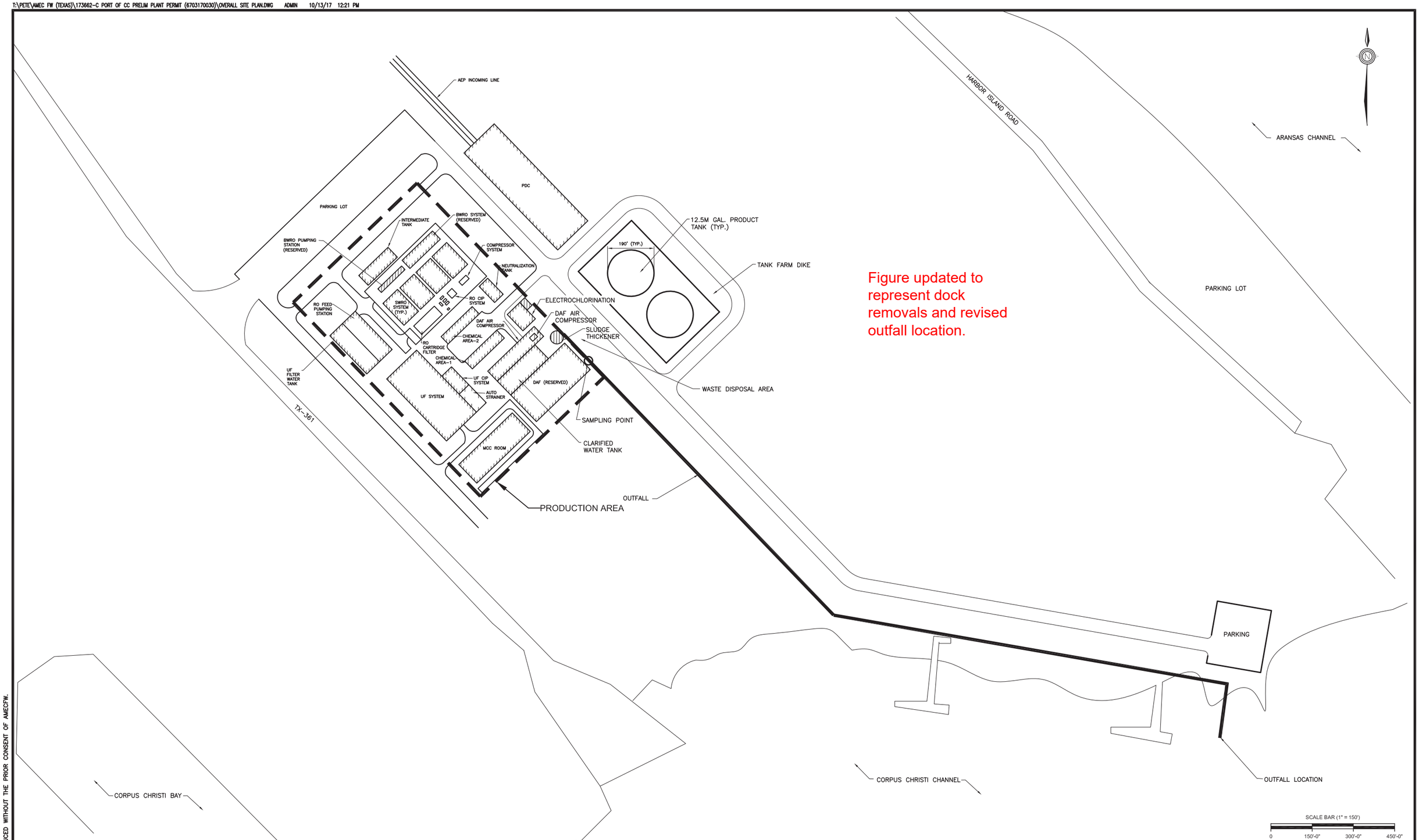


Figure updated to represent dock removals and revised outfall location.

NOTES:

NO.	REVISION	DATE	DRAWN	CHECKED	TA	HSE	APP'D	CLIENT	SEAL
			/	/					
			/	/					
			/	/					
			/	/					
			/	/					
			/	/					
			/	/					
			/	/					
			/	/					

amec foster wheeler

ENGINEER	M.S.	DATE OCT 2017	SCALE 1"=150'
DRAWN	J.Y.	DATE OCT 2017	SHEET OF
CHECKED		DATE	JOB NO. 6703170030
APPROVED		DATE	VPE NO.
CLIENT APPR		DATE	CLIENT
AMEC NO.			VERSION

PORT OF CORPUS CHRISTI
PROPOSED DESALINATION PLANT
HARBOR ISLAND, PORT ARANSAS
TEXAS 78373

FACILITY MAP

S-Application 000386

DRAWING NO. **ATTACHMENT 9** REV.

THIS DRAWING CANNOT BE REPRODUCED WITHOUT THE PRIOR CONSENT OF AMECFW.

Parameter Number	Count	Average
00010	**278**	**22.2**
TEMPERATURE, WATER (DEGREES CENTIGRADE)	278	22.2
00011	**24**	**68.5**
TEMPERATURE, WATER (DEGREES FAHRENHEIT)	24	68.5
00021	**24**	**72.3**
TEMPERATURE, AIR (DEGREES FAHRENHEIT)	24	72.3
00078	**69**	**1.4**
TRANSPARENCY, SECCHI DISC (METERS)	69	1.4
00094	**248**	**48442.4**
SPECIFIC CONDUCTANCE,FIELD (US/CM @ 25C)	248	48442.4
00300	**243**	**7.3**
OXYGEN, DISSOLVED (MG/L)	243	7.3
00400	**242**	**8.0**
PH (STANDARD UNITS)	242	8.0
00410	**76**	**120.4**
ALKALINITY, TOTAL (MG/L AS CACO3)	76	120.4
00480	**278**	**31.1**
SALINITY - PARTS PER THOUSAND	278	31.1
00530	**76**	**20.9**
RESIDUE, TOTAL NONFILTRABLE (MG/L)	76	20.9
00535	**75**	**5.1**
RESIDUE, VOLATILE NONFILTRABLE (MG/L)	75	5.1
00593	**15**	**0.3**
NO2 PLUS NO3-N, TOTAL, CALCULATED VALUE (MG/L)	15	0.3
00610	**75**	**0.1**
NITROGEN, AMMONIA, TOTAL (MG/L AS N)	75	0.1
00615	**6**	**1.0**
NITRITE NITROGEN, TOTAL (MG/L AS N)	6	1.0
00620	**7**	**0.9**
NITRATE NITROGEN, TOTAL (MG/L AS N)	7	0.9
00625	**73**	**0.4**
NITROGEN, KJELDAHL, TOTAL (MG/L AS N)	73	0.4
00630	**53**	**0.0**
NITRITE PLUS NITRATE, TOTAL ONE LAB DETERMINED VALUE (MG/L AS N)	53	0.0
00665	**70**	**0.1**
PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)	70	0.1
00671	**19**	**0.0**
ORTHOPHOSPHATE PHOSPHORUS,DISS,MG/L,FLDFILT<15MIN	19	0.0
00680	**70**	**1.8**
CARBON, TOTAL ORGANIC, NPOC (TOC), MG/L	70	1.8
00940	**72**	**18562.5**

CHLORIDE (MG/L AS CL)	72	18562.5
00945	**75**	**2684.1**
SULFATE (MG/L AS SO4)	75	2684.1
00951	**65**	**1.1**
FLUORIDE, TOTAL (MG/L AS F)	65	1.1
31616	**41**	**8.3**
FECAL COLIFORM,MEMBR FILTER,M-FC BROTH, #/100ML	41	8.3
31701	**56**	**15.6**
ENTEROCOCCI, ENTEROLERT, IDEXX, (MPN/100 ML)	56	15.6
32211	**28**	**8.4**
CHLOROPHYLL-A UG/L SPECTROPHOTOMETRIC ACID. METH	28	8.4
32213	**2**	**1.3**
PHEOPHYTIN-A UG/L FLUOROMETRIC METHOD	2	1.3
32218	**28**	**4.5**
PHEOPHYTIN-A UG/L SPECTROPHOTOMETRIC ACID. METH.	28	4.5
50060	**1**	**0.0**
CHLORINE, TOTAL RESIDUAL (MG/L)	1	0.0
70300	**47**	**32804.3**
RESIDUE,TOTAL FILTRABLE (DRIED AT 180C) (MG/L)	47	32804.3
70507	**28**	**0.4**
ORTHOPHOSPHATE PHOSPHORUS,DISS,MG/L,FILTER >15MIN	28	0.4
70953	**48**	**3.5**
CHLOROPHYLL-A, FLUOROMETRIC METHOD, UG/L	48	3.5
72053	**78**	**5.2**
DAYS SINCE PRECIPITATION EVENT (DAYS)	78	5.2
79835	**29**	**66.2**
FECAL COLIFORM MPN/100ML 5/2,3 DIL FERMENT METHO	29	66.2
82553	**24**	**0.1**
RAINFALL IN 1 DAY INCLUSIVE PRIOR TO SAMPLE (IN)	24	0.1
82554	**24**	**0.4**
RAINFALL IN 7 DAYS INCLUSIVE PRIOR TO SAMP. (IN)	24	0.4
82903	**45**	**9.7**
DEPTH OF BOTTOM OF WATER BODY AT SAMPLE SITE	45	9.7

Max	Min
31.3	**10.1**
31.3	10.1
82.0	**50.0**
82.0	50.0
88.0	**52.0**
88.0	52.0
5.0	**0.3**
5.0	0.3
62600.0	**26195.0**
62600.0	26195.0
16.0	**5.0**
16.0	5.0
8.5	**6.5**
8.5	6.5
142.0	**104.0**
142.0	104.0
42.2	**14.0**
42.2	14.0
105.0	**4.0**
105.0	4.0
19.0	**1.0**
19.0	1.0
0.6	**0.1**
0.6	0.1
0.3	**0.0**
0.3	0.0
1.3	**0.5**
1.3	0.5
1.3	**0.5**
1.3	0.5
2.2	**0.2**
2.2	0.2
0.1	**0.0**
0.1	0.0
0.7	**0.0**
0.7	0.0
0.1	**0.0**
0.1	0.0
5.0	**0.5**
5.0	0.5
28700.0	**7400.0**

28700.0	7400.0
7750.0	**1000.0**
7750.0	1000.0
10.0	**0.0**
10.0	0.0
140.0	**1.0**
140.0	1.0
190.0	**1.0**
190.0	1.0
10.0	**1.0**
10.0	1.0
1.8	**0.8**
1.8	0.8
8.7	**1.0**
8.7	1.0
0.0	**0.0**
0.0	0.0
51300.0	**14400.0**
51300.0	14400.0
1.5	**0.0**
1.5	0.0
12.2	**0.5**
12.2	0.5
7.0	**0.0**
7.0	0.0
1600.0	**2.0**
1600.0	2.0
1.8	**0.0**
1.8	0.0
2.9	**0.0**
2.9	0.0
22.0	**0.3**
22.0	0.3

Port of Corpus Christi Desalination Industrial Wastewater Permit Application
Intake Samples - Gulf of Mexico
Validated Result Summary for Samples Collected June 2021

				SAMPLE ID:	POCC - INTAKE-1		POCC - INTAKE-2		POCC - INTAKE-2-DUP	
				DATE SAMPLED:	6/9/2021		6/10/2021		6/10/2021	
				LAB SAMPLE ID:	HS21060521-01		HS21060616-01		HS21060616-02	
Analytical Method	**MAL [(1)]**	**Unit**	**CAS Number**	**Analyte**						
Worksheet 2 Table 1										
SM5210 B	--	mg/L	NA	BOD (5-day)	< 2.00		< 2.00		< 2.00	
SM5210 B	--	mg/L	NA	CBOD (5-day)	< 2.00		**2.18**		< 2.00	
E410.4	--	mg/L	NA	Chemical oxygen demand	**60.0**		**55.0**		**53.0**	
E415.1	--	mg/L	NA	Total organic carbon	**2.09**		**2.08**		**2.02**	
SM4500 NH3-B-F	--	mg/L	7664-41-7	Ammonia nitrogen	< 0.050		< 0.050		< 0.050	
M2540D	--	mg/L	NA	Total suspended solids	**8.40**		**6.70**		**7.00**	
E300	--	mg/L	14797-55-8	Nitrate nitrogen	< 10.0		< 5.00		< 5.00	
M4500-N C	--	mg/L	NA	Total organic nitrogen	< 0.50		< 0.50		< 0.50	
E365.3	--	mg/L	7723-14-0	Total phosphorus	< 0.0500		< 0.0500		< 0.0500	
E1664A	--	mg/L	NA	Oil and grease	**3.00**		**2.58**		< 2.00	
M2540C	--	mg/L	NA	Total dissolved solids	**33,400**		**33,800**		**34,000**	
E300	--	mg/L	14808-79-8	Sulfate	**2,340**		**2,350**		**2,360**	
E300	--	mg/L	16887-00-6	Chloride	**16,400**		**16,200**		**17,000**	
E300	--	mg/L	16984-48-8	Fluoride	< 10.0		< 5.00		< 5.00	
SM2320B	--	mg/L	NA	Total alkalinity (mg/L as CaCO3)	**118**		**119**		**120**	
Worksheet 2 Table 2										
E200.8	2.5	µg/L	7429-90-5	Aluminum, total	**74.6**	J	**122**		**183**	
E200.8	5.0	µg/L	7440-36-0	Antimony, total	< 5.30		< 5.30		< 5.30	
E200.8	0.50	µg/L	7440-38-2	Arsenic, total	**3.01**	J	< 2.50		**3.28**	J
E200.8	3.0	µg/L	7440-39-3	Barium, total	**19.9**	J	**20.8**	J	**21.0**	J
E200.8	0.50	µg/L	7440-41-7	Beryllium, total	< 0.910		< 0.910		< 0.910	
E200.8	1.0	µg/L	7440-43-9	Cadmium, total	< 0.770		< 0.770		< 0.770	
E200.8	3.0	µg/L	7440-47-3	Chromium, total	< 2.51		< 2.51		< 2.51	
M3500-Cr B	3.0	µg/L	18540-29-9	Chromium, hexavalent	< 20.0		< 20.0		< 20.0	
Calculation	--	µg/L	16065-83-1	Chromium, trivalent	< 10.0		< 10.0		< 10.0	
E200.8	2.0	µg/L	7440-50-8	Copper, total	**1.82**	J	**1.80**	J	**2.34**	J
OIA 1677-09	2.0/10	µg/L	NA	Cyanide, available	< 2.0		< 2.0		< 2.0	
E200.8	0.50	µg/L	7439-92-1	Lead, total	< 1.20		< 1.20		< 1.20	
E1631E	0.0050/0.00050	µg/L	7439-97-6	Mercury, total	**0.00058**		**0.00066**		**0.00065**	
E200.8	2.0	µg/L	7440-02-0	Nickel, total	**1.63**	J	**1.69**	J	**2.37**	J
E200.8	5.0	µg/L	7782-49-2	Selenium, total	< 8.60		< 8.60		< 8.60	
E200.8	0.50	µg/L	7440-22-4	Silver, total	< 0.440		< 0.440		< 0.440	
E200.8	0.50	µg/L	7440-28-0	Thallium, total	< 2.50		< 2.50		< 2.50	
E200.8	5.0	µg/L	7440-66-6	Zinc, total	< 10.0		< 10.0		< 10.0	
Worksheet 2 Table 3										
E624	50	µg/L	107-13-1	Acrylonitrile	< 10.0		< 10.0		< 10.0	
E625	10	µg/L	120-12-7	Anthracene	< 5.00		< 5.00		< 5.00	
E624	10	µg/L	71-43-2	Benzene	< 5.00		< 5.00		< 5.00	
E625	50	µg/L	92-87-5	Benzidine	< 5.00		< 5.00		< 5.00	
E625	5.0	µg/L	56-55-3	Benzo(a)anthracene	< 5.00		< 5.00		< 5.00	
E625	5.0	µg/L	50-32-8	Benzo(a)pyrene	< 5.00		< 5.00		< 5.00	
E625	10	µg/L	111-44-4	Bis(2-chloroethyl)ether	< 5.00		< 5.00		< 5.00	
E625	10	µg/L	117-81-7	Bis(2-ethylhexyl)phthalate	< 5.00		< 5.00		< 5.00	
E624	10	µg/L	75-27-4	Bromodichloromethane [Dichlorobromomethane]	< 5.00		< 5.00		< 5.00	
E624	10	µg/L	75-25-2	Bromoform	< 5.00		< 5.00		< 5.00	
E624	2.0	µg/L	56-23-5	Carbon tetrachloride	< 5.00		< 5.00		< 5.00	
E624	10	µg/L	108-90-7	Chlorobenzene	< 5.00		< 5.00		< 5.00	
E624	10	µg/L	124-48-1	Chlorodibromomethane [Dibromochloromethane]	< 5.00		< 5.00		< 5.00	
E624	10	µg/L	67-66-3	Chloroform	< 5.00		< 5.00		< 5.00	
E625	5.0	µg/L	218-01-9	Chrysene	< 5.00		< 5.00		< 5.00	
E625	10	µg/L	106-44-5	m-Cresol [3-Methylphenol]	< 5.00		< 5.00		< 5.00	
E625	10	µg/L	95-48-7	o-Cresol [2-Methylphenol]	< 5.00		< 5.00		< 5.00	

E625	10	µg/L	106-44-5	p-Cresol [4-Methylphenol]	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	106-93-4	1,2-Dibromoethane	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	541-73-1	m-Dichlorobenzene [1,3-Dichlorobenzene]	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	95-50-1	o-Dichlorobenzene [1,2-Dichlorobenzene]	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	106-46-7	p-Dichlorobenzene [1,4-Dichlorobenzene]	<	5.00		<	5.00		<	5.00		
E625	5.0	µg/L	91-94-1	3,3'-Dichlorobenzidine	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	107-06-2	1,2-Dichloroethane	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	75-35-4	1,1-Dichloroethene [1,1-Dichloroethylene]	<	5.00		<	5.00		<	5.00		
E624	20	µg/L	75-09-2	Dichloromethane [Methylene chloride]	<	10.0		<	10.0		<	10.0		
E624	10	µg/L	78-87-5	1,2-Dichloropropane	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	542-75-6	1,3-Dichloropropene [1,3-Dichloropropylene]	<	5.00		<	5.00		<	5.00		
E625	10	µg/L	105-67-9	2,4-Dimethylphenol	<	5.00		<	5.00		<	5.00		
E625	10	µg/L	84-74-2	Di-n-Butyl phthalate	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	100-41-4	Ethylbenzene	<	5.00		<	5.00		<	5.00		
E300	500	µg/L	16984-48-8	Fluoride	<	10,000		<	5,000		<	5,000		
E625	5.0	µg/L	118-74-1	Hexachlorobenzene	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	87-68-3	Hexachlorobutadiene	<	5.00		<	5.00		<	5.00		
E625	10	µg/L	77-47-4	Hexachlorocyclopentadiene	<	5.00		<	5.00		<	5.00		
E625	20	µg/L	67-72-1	Hexachloroethane	<	5.00		<	5.00		<	5.00		
E624	50	µg/L	78-93-3	Methyl ethyl ketone	<	10.0		<	10.0		<	10.0		
E625	10	µg/L	98-95-3	Nitrobenzene	<	5.00		<	5.00		<	5.00		
E625	20	µg/L	55-18-5	N-Nitrosodiethylamine	<	5.00		<	5.00		<	5.00		
E625	20	µg/L	924-16-3	N-Nitroso-di-n-butylamine	<	5.00		<	5.00		<	5.00		
E625	333	µg/L	84852-15-3	Nonylphenol	<	5.00		<	5.00		<	5.00		
E625	20	µg/L	608-93-5	Pentachlorobenzene	<	5.00		<	5.00		<	5.00		
E625	5.0	µg/L	87-86-5	Pentachlorophenol	<	5.00		<	5.00		<	5.00		
E625	10	µg/L	85-01-8	Phenanthrene	<	5.00		<	5.00		<	5.00		
E608	0.20	µg/L	12674-11-2	Polychlorinated biphenyls (PCBs)	<	0.0125		<	0.0125		<	0.0125		
E625	20	µg/L	110-86-1	Pyridine	<	5.00		<	5.00		<	5.00		
E625	20	µg/L	95-94-3	1,2,4,5-Tetrachlorobenzene	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	79-34-5	1,1,2,2-Tetrachloroethane	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	127-18-4	Tetrachloroethene [Tetrachloroethylene]	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	108-88-3	Toluene	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	71-55-6	1,1,1-Trichloroethane	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	79-00-5	1,1,2-Trichloroethane	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	79-01-6	Trichloroethene [Trichloroethylene]	<	5.00		<	5.00		<	5.00		
E625	50	µg/L	95-95-4	2,4,5-Trichlorophenol	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	NA	TTHM (Total trihalomethanes)	<	5.00		<	5.00		<	5.00		
E624	10	µg/L	75-01-4	Vinyl chloride	<	2.00		<	2.00		<	2.00		
Worksheet 2 Table 6														
E300	400 (ug/L)	mg/L	24959-67-9	Bromide		**48.3**			**49.8**			**51.2**		
SM2120B	--	PCU	NA	Color (PCU)		**15.0**			**15.0**			**15.0**		
E300	--	mg/L	NA	Nitrate-Nitrite (as N)	<	20.0		<	10.0		<	10.0		
SM4500 S2-D	--	mg/L	18496-25-8	Sulfide (as S)	<	0.050		<	0.050		<	0.050		
SM5540C	--	mg/L	NA	Surfactants	<	0.050		<	0.050		<	0.050		
E200.8	20 (ug/L)	mg/L	7440-42-8	Boron, total		**3.57**			**3.71**			**3.95**		
E200.8	0.30 (ug/L)	mg/L	7440-48-4	Cobalt, total	<	0.00040		<	0.00040		<	0.00040		
E200.8	7.0 (ug/L)	mg/L	7439-89-6	Iron, total	<	0.500		<	0.500		<	0.500		
E200.8	20 (ug/L)	mg/L	7439-95-4	Magnesium, total		**1,060**			**1,060**			**1,160**		
E200.8	0.50 (ug/L)	mg/L	7439-96-5	Manganese, total		**0.00478**	J		**0.00829**	J		**0.00705**	J	
E200.8	1.0 (ug/L)	mg/L	7439-98-7	Molybdenum, total		**0.00886**	J		**0.00927**	J		**0.00982**	J	
E200.8	5.0 (ug/L)	mg/L	7440-31-5	Tin, total	<	0.00058		<	0.00058		<	0.00058		
E200.8	30 (ug/L)	mg/L	7440-32-6	Titanium, total	<	0.00390			**0.00666**	J	<	0.00390		
Other Reported Analytes														
E200.8	--	µg/L	7440-70-2	Calcium		**345,000**			**352,000**			**382,000**		
E200.8	--	µg/L	7440-09-7	Potassium		**318,000**			**320,000**			**347,000**		
E200.8	--	µg/L	7440-23-5	Sodium		**9,490,000**			**9,780,000**			**9,520,000**		
E300	--	mg/L	14797-65-0	Nitrogen, Nitrite (As N)	<	10.0		<	5.00		<	5.00		
M4500 NH3 D	--	mg/L	7727-37-9	Nitrogen, Total Kjeldahl	<	0.50		<	0.50		<	0.50		
SM2320B	--	mg/L	NA	Alkalinity, Bicarbonate (As CaCO3)		**118**			**119**			**120**		
SM2320B	--	mg/L	NA	Alkalinity, Carbonate (As CaCO3)	<	5.00		<	5.00		<	5.00		
SM2320B	--	mg/L	NA	Alkalinity, Hydroxide (As CaCO3)	<	5.00		<	5.00		<	5.00		

QA NOTES AND DATA QUALIFIERS:

(NO CODE) - Confirmed identification.
J - Analyte detected, estimated concentration.
Detections are bolded.

NOTES:

[1] Minimum Analytical Level
mg/L - milligrams per liter.
µg/L - micrograms per liter.
PCU - platinum-cobalt units.
su - standard pH units.

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
Deep Hole - 6/7/2021 15:15 - Flow toward GOM at ~ 0.4 m/s (5 hr since flow reversal)						
	5	8.08	27.10	5.27	44,080	28.52
	10	8.04	26.80	5.27	44,800	29.04
	15	8.04	26.80	5.20	45,400	29.47
	20	8.01	26.56	4.74	45,400	29.47
	25	8.00	26.30	4.42	45,450	29.51
	29	8.01	26.50	4.47	45,485	29.54
Deep Hole - 6/7/2021 17:36 - Flow toward GOM at ~ 0.9 m/s (7.3 hr since flow reversal)						
	5	8.23	27.70	5.77	44,175	28.59
	10	8.19	27.50	5.61	44,444	28.78
	15	8.18	27.50	5.45	44,570	28.88
	20	8.14	27.30	5.23	44,600	28.90
	25	8.14	27.20	5.23	44,400	28.75
	30	8.13	27.10	5.13	44,700	28.97
Deep Hole - 6/8/2021 10:48 - Flow toward CC Bay at ~ 0.26 m/s (9.7 hr since flow reversal)						
	5	7.86	25.80	3.65	47,350	30.88
	10	7.86	25.50	3.30	47,998	31.35
	15	7.84	25.30	2.76	49,353	32.33
	20	7.83	25.20	2.60	50,090	32.86
	25	7.83	25.10	2.49	50,020	32.81
	30	7.83	25.10	2.44	50,218	32.95
Deep Hole - 6/8/2021 15:35 - Flow toward GOM at 0.58 m/s (4 hr since flow reversal)						
	5	8.04	27.00	5.74	48,070	31.40
	10	8.03	27.10	5.37	48,200	31.50
	15	8.02	27.00	5.33	48,380	31.63
	20	7.99	26.80	4.82	48,729	31.88
	25	7.99	26.70	5.00	48,339	31.60
	30	7.96	26.60	4.63	48,651	31.82
Deep Hole - 6/9/2021 11:43 - Flow toward CC Bay at 0.25 m/s (11.3 hr since flow reversal)						
	5	8.02	27.21	3.38	44,033	28.49
	10	8.01	27.02	2.48	42,321	27.25
	15	8.00	26.93	2.79	42,425	27.33
	20	7.99	26.92	2.70	41,978	27.00
	25	7.99	26.72	2.68	43,661	28.22
	30	7.97	26.23	2.47	44,658	28.94
	35	7.94	26.23	2.93	41,972	27.00
	40	7.94	26.18	2.81	45,033	29.21
	45	7.94	26.16	2.42	42,606	27.46
	50	7.94	26.15	2.43	42,196	27.16
	55	7.93	26.14	2.47	43,600	28.17
	60	7.93	26.13	2.53	40,551	25.97
	65	7.93	26.13	2.50	41,818	26.89

	70	7.93	26.16	2.27	42,791	27.59
	75	7.92	26.09	2.82	44,628	28.92
Deep Hole - 6/9/2021 14:35 - Flow toward GOM at 0.18 m/s (1.8 hr since flow reversal)						
	5	8.13	27.91	5.61	43,682	28.23
	10	8.13	27.86	5.38	44,132	28.56
	15	8.12	27.57	5.68	43,211	27.89
	20	8.11	27.71	8.35	42,560	27.42
	25	8.11	27.42	6.75	43,961	28.44
	30	8.12	27.38	6.98	44,404	28.76
	35	8.11	27.30	6.56	44,663	28.94
	40	8.10	27.15	6.01	44,889	29.11
	45	8.09	26.73	4.77	44,252	28.65
	50	8.06	26.63	4.29	44,312	28.69
	55	8.07	26.61	6.65	45,111	29.27
	60	8.06	26.46	4.54	43,489	28.09
	65	8.06	26.40	5.30	44,976	29.17
	70	8.06	26.40	4.70	44,195	28.60
	75	8.06	26.45	5.79	40,287	25.78
	80	8.07	26.53	6.65	41,199	26.44
Deep Hole - 6/9/2021 16:04 - Flow toward GOM at 0.52 m/s (3.2 hr since flow reversal)						
	1	8.10	27.83	7.30	39,792	25.43
	5	8.07	27.85	4.30	41,555	26.70
	10	8.08	27.75	4.65	41,519	26.67
	15	8.08	27.77	4.70	41,416	26.60
	20	8.08	27.71	4.55	39,964	25.55
	25	8.07	27.60	4.59	41,423	26.60
	30	8.06	27.36	4.35	39,371	25.12
	35	8.04	27.32	4.39	39,892	25.50
	40	8.04	27.16	4.47	39,330	25.09
	45	8.03	27.07	4.63	39,962	25.55
	50	8.02	27.02	4.68	39,510	25.22
	55	8.01	26.96	4.29	40,568	25.99
	60	8.04	27.53	4.80	39,702	25.36
	65	8.01	26.92	4.54	39,973	25.56
	70	8.01	27.34	4.96	39,982	25.56
	75	8.01	26.76	5.12	39,044	24.89
	80	7.98	26.72	4.76	39,872	25.48
	85	7.98	26.90	6.83	38,927	24.80
Deep Hole - 6/10/2021 12:44 - Flow toward CC Bay at 0.42 m/s (>11 hr since flow reversal)						
	1	8.17	27.78	9.17	43,062	27.79
	5	8.17	27.76	9.19	43,034	27.77
	10	8.17	27.57	9.13	43,086	27.80
	15	8.16	27.50	8.99	42,046	27.05
	20	8.15	27.52	8.99	43,251	27.92
	25	8.15	27.50	8.94	43,162	27.86
	30	8.15	27.52	8.98	43,116	27.83

	35	8.15	27.51	8.91	43,110	27.82
	40	8.15	27.44	8.94	42,168	27.14
	45	8.15	27.40	8.87	42,684	27.51
	50	8.14	27.45	8.62	43,086	27.80
	55	8.15	27.43	8.89	43,187	27.88
	60	8.14	27.37	8.46	43,689	28.24
	65	8.14	27.40	8.28	43,089	27.81
	70	8.14	27.40	0.43	43,068	27.79
	75	8.14	27.37	0.07	43,106	27.82
	80	8.14	27.39	0.62	43,331	27.98
Deep Hole - 6/10/2021 14:58 - Flow toward GOM at 0.21 m/s (< 1 hr since flow reversal)						
	1	8.18	28.19	8.35	42,990	27.73
	5	8.18	28.18	9.32	42,906	27.67
	10	8.18	28.16	9.14	42,612	27.46
	15	8.18	28.12	9.09	43,091	27.81
	20	8.18	27.82	8.60	42,902	27.67
	25	8.17	28.09	8.45	42,170	27.14
	30	8.17	27.70	1.79	42,986	27.73
	35	8.14	27.38	0.00	43,658	28.22
	40	8.12	27.30	0.00	43,726	28.27
	45	8.11	27.26	0.00	43,562	28.15
	50	8.11	27.41	0.34	43,631	28.20
	55	8.12	27.30	0.08	43,503	28.10
	60	8.11	27.28	0.51	43,619	28.19
	65	8.11	27.22	0.95	43,163	27.86
	70	8.11	27.36	1.51	42,796	27.59
	75	8.12	27.39	2.24	43,712	28.26

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
Intake 1 - 6/9/2021 08:24						
	5	8.09	27.37	8.33	36,297	22.90
	10	8.08	27.31	6.03	39,919	25.52
	15	8.02	27.21	5.64	39,214	25.01
Intake 2 - 6/10/2021 11:09						
	1	8.20	27.92	9.64	42,164	27.14
	5	8.20	27.86	9.38	42,396	27.31
	10	8.18	27.57	8.55	42,461	27.35
	15	8.13	27.66	8.92	42,626	27.47

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
Deep Hole - 6/7/2021 15:15 - Flow toward GOM at ~ 0.4 m/s (5 hr since flow reversal)						
	5	8.08	27.10	5.27	44,080	28.52
	10	8.04	26.80	5.27	44,800	29.04
	15	8.04	26.80	5.20	45,400	29.47
	20	8.01	26.56	4.74	45,400	29.47
	25	8.00	26.30	4.42	45,450	29.51
	29	8.01	26.50	4.47	45,485	29.54
Deep Hole - 6/7/2021 17:36 - Flow toward GOM at ~ 0.9 m/s (7.3 hr since flow reversal)						
	5	8.23	27.70	5.77	44,175	28.59
	10	8.19	27.50	5.61	44,444	28.78
	15	8.18	27.50	5.45	44,570	28.88
	20	8.14	27.30	5.23	44,600	28.90
	25	8.14	27.20	5.23	44,400	28.75
	30	8.13	27.10	5.13	44,700	28.97
Deep Hole - 6/8/2021 10:48 - Flow toward CC Bay at ~ 0.26 m/s (9.7 hr since flow reversal)						
	5	7.86	25.80	3.65	47,350	30.88
	10	7.86	25.50	3.30	47,998	31.35
	15	7.84	25.30	2.76	49,353	32.33
	20	7.83	25.20	2.60	50,090	32.86
	25	7.83	25.10	2.49	50,020	32.81
	30	7.83	25.10	2.44	50,218	32.95
Deep Hole - 6/8/2021 15:35 - Flow toward GOM at 0.58 m/s (4 hr since flow reversal)						
	5	8.04	27.00	5.74	48,070	31.40
	10	8.03	27.10	5.37	48,200	31.50
	15	8.02	27.00	5.33	48,380	31.63
	20	7.99	26.80	4.82	48,729	31.88
	25	7.99	26.70	5.00	48,339	31.60
	30	7.96	26.60	4.63	48,651	31.82
Deep Hole - 6/9/2021 11:43 - Flow toward CC Bay at 0.25 m/s (11.3 hr since flow reversal)						
	5	8.02	27.21	3.38	44,033	28.49
	10	8.01	27.02	2.48	42,321	27.25
	15	8.00	26.93	2.79	42,425	27.33
	20	7.99	26.92	2.70	41,978	27.00
	25	7.99	26.72	2.68	43,661	28.22
	30	7.97	26.23	2.47	44,658	28.94
	35	7.94	26.23	2.93	41,972	27.00
	40	7.94	26.18	2.81	45,033	29.21
	45	7.94	26.16	2.42	42,606	27.46
	50	7.94	26.15	2.43	42,196	27.16
	55	7.93	26.14	2.47	43,600	28.17
	60	7.93	26.13	2.53	40,551	25.97
	65	7.93	26.13	2.50	41,818	26.89

	70	7.93	26.16	2.27	42,791	27.59
	75	7.92	26.09	2.82	44,628	28.92
Deep Hole - 6/9/2021 14:35 - Flow toward GOM at 0.18 m/s (1.8 hr since flow reversal)						
	5	8.13	27.91	5.61	43,682	28.23
	10	8.13	27.86	5.38	44,132	28.56
	15	8.12	27.57	5.68	43,211	27.89
	20	8.11	27.71	8.35	42,560	27.42
	25	8.11	27.42	6.75	43,961	28.44
	30	8.12	27.38	6.98	44,404	28.76
	35	8.11	27.30	6.56	44,663	28.94
	40	8.10	27.15	6.01	44,889	29.11
	45	8.09	26.73	4.77	44,252	28.65
	50	8.06	26.63	4.29	44,312	28.69
	55	8.07	26.61	6.65	45,111	29.27
	60	8.06	26.46	4.54	43,489	28.09
	65	8.06	26.40	5.30	44,976	29.17
	70	8.06	26.40	4.70	44,195	28.60
	75	8.06	26.45	5.79	40,287	25.78
	80	8.07	26.53	6.65	41,199	26.44
Deep Hole - 6/9/2021 16:04 - Flow toward GOM at 0.52 m/s (3.2 hr since flow reversal)						
	1	8.10	27.83	7.30	39,792	25.43
	5	8.07	27.85	4.30	41,555	26.70
	10	8.08	27.75	4.65	41,519	26.67
	15	8.08	27.77	4.70	41,416	26.60
	20	8.08	27.71	4.55	39,964	25.55
	25	8.07	27.60	4.59	41,423	26.60
	30	8.06	27.36	4.35	39,371	25.12
	35	8.04	27.32	4.39	39,892	25.50
	40	8.04	27.16	4.47	39,330	25.09
	45	8.03	27.07	4.63	39,962	25.55
	50	8.02	27.02	4.68	39,510	25.22
	55	8.01	26.96	4.29	40,568	25.99
	60	8.04	27.53	4.80	39,702	25.36
	65	8.01	26.92	4.54	39,973	25.56
	70	8.01	27.34	4.96	39,982	25.56
	75	8.01	26.76	5.12	39,044	24.89
	80	7.98	26.72	4.76	39,872	25.48
	85	7.98	26.90	6.83	38,927	24.80
Deep Hole - 6/10/2021 12:44 - Flow toward CC Bay at 0.42 m/s (>11 hr since flow reversal)						
	1	8.17	27.78	9.17	43,062	27.79
	5	8.17	27.76	9.19	43,034	27.77
	10	8.17	27.57	9.13	43,086	27.80
	15	8.16	27.50	8.99	42,046	27.05
	20	8.15	27.52	8.99	43,251	27.92
	25	8.15	27.50	8.94	43,162	27.86
	30	8.15	27.52	8.98	43,116	27.83

	35	8.15	27.51	8.91	43,110	27.82
	40	8.15	27.44	8.94	42,168	27.14
	45	8.15	27.40	8.87	42,684	27.51
	50	8.14	27.45	8.62	43,086	27.80
	55	8.15	27.43	8.89	43,187	27.88
	60	8.14	27.37	8.46	43,689	28.24
	65	8.14	27.40	8.28	43,089	27.81
	70	8.14	27.40	0.43	43,068	27.79
	75	8.14	27.37	0.07	43,106	27.82
	80	8.14	27.39	0.62	43,331	27.98
Deep Hole - 6/10/2021 14:58 - Flow toward GOM at 0.21 m/s (< 1 hr since flow reversal)						
	1	8.18	28.19	8.35	42,990	27.73
	5	8.18	28.18	9.32	42,906	27.67
	10	8.18	28.16	9.14	42,612	27.46
	15	8.18	28.12	9.09	43,091	27.81
	20	8.18	27.82	8.60	42,902	27.67
	25	8.17	28.09	8.45	42,170	27.14
	30	8.17	27.70	1.79	42,986	27.73
	35	8.14	27.38	0.00	43,658	28.22
	40	8.12	27.30	0.00	43,726	28.27
	45	8.11	27.26	0.00	43,562	28.15
	50	8.11	27.41	0.34	43,631	28.20
	55	8.12	27.30	0.08	43,503	28.10
	60	8.11	27.28	0.51	43,619	28.19
	65	8.11	27.22	0.95	43,163	27.86
	70	8.11	27.36	1.51	42,796	27.59
	75	8.12	27.39	2.24	43,712	28.26

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
Intake 1 - 6/9/2021 08:24						
	5	8.09	27.37	8.33	36,297	22.90
	10	8.08	27.31	6.03	39,919	25.52
	15	8.02	27.21	5.64	39,214	25.01
Intake 2 - 6/10/2021 11:09						
	1	8.20	27.92	9.64	42,164	27.14
	5	8.20	27.86	9.38	42,396	27.31
	10	8.18	27.57	8.55	42,461	27.35
	15	8.13	27.66	8.92	42,626	27.47