



Summary of Water Quality Analyses at Onion Creek near Dripping Springs DR-16-13, October 2016

Abel Porras, P.E.

City of Austin
Watershed Protection Department
Environmental Resource Management Division

Abstract

Water quality sampling was conducted at Onion Creek and Ranch Road 12 near Dripping Springs for five events in 2014 and 2015. This sampling was initiated to provide baseline values for various water quality metrics. Results from this sampling are included here and show a riverine system with a low frequency of detection of nutrients and total suspended solids in the water column. Summaries of other water quality characteristics, such as temperature, dissolved oxygen, pH, and the concentration of other ions, were also provided to fully characterize the chemistry of the sites. Measurements of nutrients in the benthic algae were also summarized along with the amount of chlorophyll-a, which indicate an oligotrophic system. Finally, benthic macroinvertebrates were also assessed using the City of Austin's Environmental Integrity Index scoring system. The results from the scoring indicate a system with excellent aquatic life.

Introduction

The City of Dripping Springs is currently planning to expand their Waste Water Treatment Plant (WWTP) and convert it from a land application facility to a discharge facility. The Texas Commission on Environmental Quality (TCEQ) has issued a draft Texas Pollutant Discharge Elimination System (TPDES) permit to the City of Dripping Springs allowing a maximum discharge rate of 995,000 gallons per day of effluent from the WWTP (WQ0014488003). This effluent can be directly discharged into a tributary of Onion Creek in an area that provides recharge to the Trinity Aquifer and approximately 15 miles upstream of the Barton Springs Edwards Aquifer Recharge Zone.

To determine the impact of the WWTP discharge on Onion Creek and its associated recharge zone, the City of Austin has sought to determine baseline values for several site-specific water quality parameters needed as inputs for initial and boundary conditions for any water quality model. Furthermore, these values may serve as background data to determine any impact from

future development. This report summarizes the water quality data collected from 5 locations on private property over the course of a year and a half. This data will be used to statistically show whether (and to what extent) an impact from the WWTP would occur if permitted.

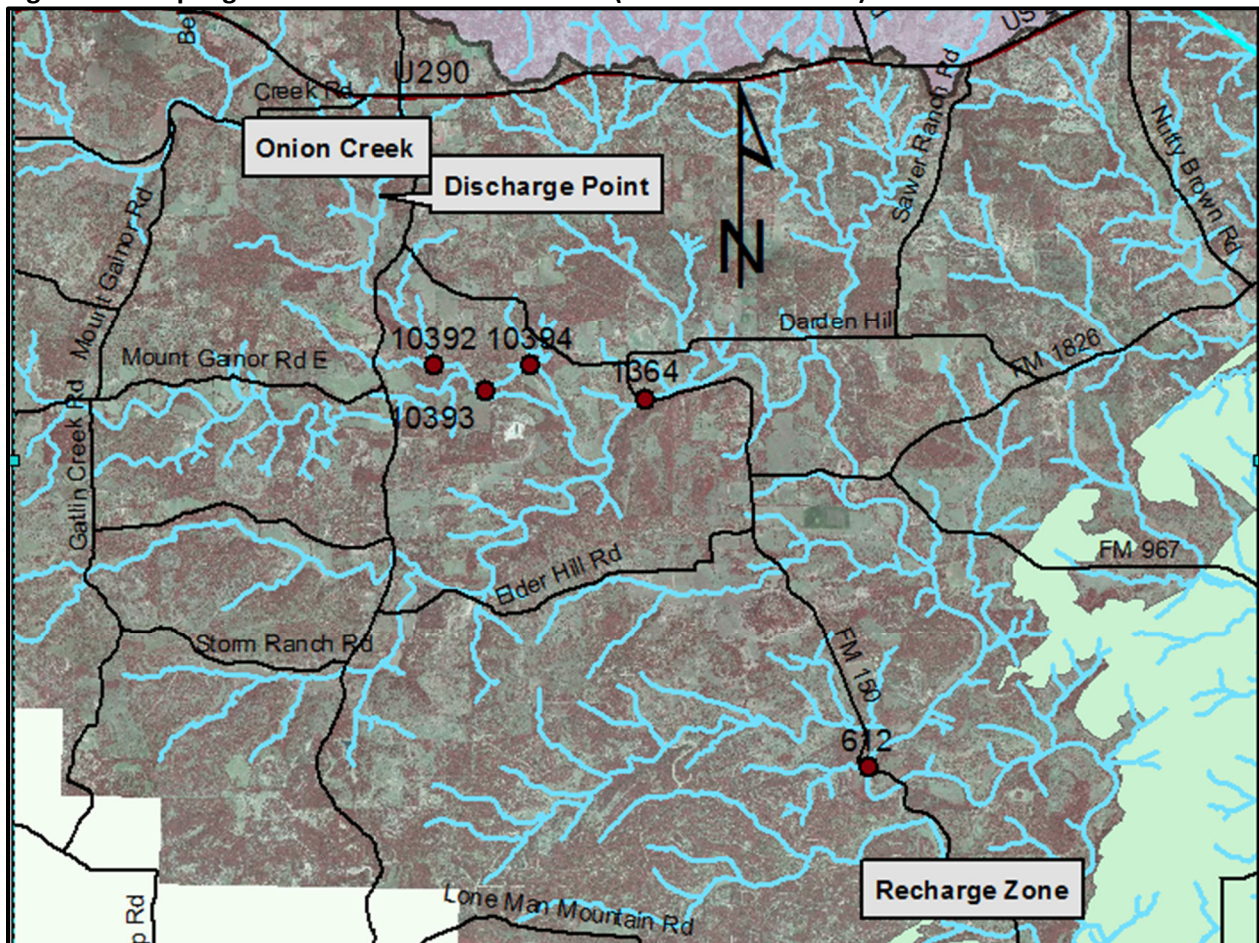
Methods

Water quality samples were collected at five locations downstream of the WWTP (Table 1, Figure 1). Several of the site locations are within private property and were accessed with permission from the land owner.

Table 1. Proposed Sample Site Locations

Site Number	Site Name	Latitude/Longitude
10392	Onion Creek DS Dripping Springs Piped Outfall	30.1495/ -98.0821
10393	Onion Creek DS South Onion	30.1454/ -98.0738
10394	Onion Creek DS Dripping Springs Trib Outfall	30.1488/ -98.0667
1364	Onion Creek at Most Upstream Hwy 150 Crossing	30.1437/ -98.0485
612	Onion Creek near Driftwood (HWY 150)	30.0854/ -98.0134

Figure 1: Sampling Site Locations on Onion Creek (Scale: 1 in = 2 miles)



These locations were accessed on the dates given in Table 2 which also detail which water quality parameter categories were collected.

Table 11.3. Proposed Visit Date Schedule with Categories Sampled

Sample Date	Sample Categories Collected
March 12, 2014	Water quality (3 reps), Benthic algae, Physiochemical field parameters
April 24, 2014	Water quality, Benthic algae, Physiochemical field parameters, Benthic macroinvertebrates
July 24, 2014	Water quality, Benthic algae, Physiochemical field parameters
August 7, 2015	Water quality (3 reps), Physiochemical field parameters, Benthic macroinvertebrates
December 16, 2015	Water quality (3 reps), Benthic algae, Physiochemical field parameters

Results

A summary of the data gathered from the water quality samples taken will be partitioned into three parts: water chemistry, benthic algae, and benthic macroinvertebrates.

Water Chemistry

Tables 1 and 2 present a summary of the water quality data. Table 1 consists of water quality data whose measurements were above detection limits at all of their respective samples. The average concentration and its standard deviation were averaged across the sites and shown here. The averages and the standard deviations is partitioned for each site in Appendix A.

Table 1: Average Water Quality Summary for Parameters with 100% Detection

Parameter	Average	Standard Deviation	Units
DISSOLVED OXYGEN	7.56	1.44	mg/L
WATER TEMPERATURE	23.4	7.6	°C
PH	7.88	0.21	Std units
CONDUCTIVITY	524.0	20.7	µS/cm
TOTAL KJELDAHL NITROGEN	0.21	0.07	mg/L
ALKALINITY (AS CaCO ₃)	207	18	mg/L
ORGANIC CARBON	1.99	0.42	mg/L
PHEOPHYTIN	0.23	0.06	µg/L
CHLORIDE	25.22	4.69	mg/L
SODIUM	12.01	1.69	mg/L
MAGNESIUM	18.01	0.94	mg/L
CALCIUM	78.55	4.97	mg/L
POTASSIUM	1.36	0.13	mg/L
SULFATE	42.29	12.25	mg/L
FLUORIDE	0.19	0.01	mg/L
STRONTIUM	0.33	0.06	mg/L

Table 2 includes the water quality data whose measurements were below the detection limit at least one time. Thus, instead of averages and standard deviations, the detection probabilities were used as a baseline statistic that can then be compared in future sampling. All of these detection probabilities were based on fifty-six samples collected over the life of the project over the five sites.

Table 2: Average Water Quality Detection Probabilities for Parameters less than 100% Detection

Parameter	Detection Limit (mg/L)	Detection Probability
AMMONIA	0.008	0.47
NITRATE/NITRITE	0.008	0.69
ORTHOPHOSPHORUS	0.004	0.29
PHOSPHORUS	0.008	0.29
TOTAL SUSPENDED SOLIDS	1.0	0.70
VOLATILE SUSPENDED SOLIDS	1.0	0.39
CHLOROPHYLL-A	0.0002	0.74

Benthic Algae

The nutrient concentrations of benthic algae biomass were also collected and summarized. Tables 3 and 4 present the summaries, which again were averaged over the sites. It is important to note that the chlorophyll-a concentration in the Table 3 was converted from concentrations in mg/L to mg/m² by using a standard area (0.001963 m²) from which the benthic algae was

obtained from the sampled rocks in the stream. This conversion enables a comparison to trophic status in the stream. Appendix A contains averages and standard deviations at each site.

Table 3: Average Water Quality Summary for Parameters with 100% Detection in Benthic Algae

Parameter	Average	Standard Deviation	Units
AMMONIA AS N	0.29	0.28	mg/L
TOTAL KJELDAHL NITROGEN AS N	18.44	13.64	mg/L
PHOSPHORUS AS P	0.75	0.61	mg/L
TOTAL SUSPENDED SOLIDS	3092	3592	mg/L
VOLATILE SUSPENDED SOLIDS	388	402	mg/L
ORGANIC CARBON	40.05	20.00	mg/L
CHLOROPHYLL-A	5.28	3.4	mg/m ²

Table 4 shows the detection probabilities for nitrate/nitrite and orthophosphorus concentrations in the benthic algae. These detection probabilities are based on 16 samples.

Table 4: Average Water Quality Detection Probabilities for Parameters less than 100% Detection in Benthic Algae

Parameter	Detection Limits (mg/L)	Detection Probability
NITRATE/NITRITE AS N	0.008-0.04 †	0.44
ORTHOPHOSPHORUS AS P	0.004-0.016 ‡	0.63

† Out of the 9 non-detects, 5 had a detection limit of 0.008 mg/L, 3 had a detection limit of 0.016 mg/L, and 1 had a detection limit of 0.04 mg/L

‡ Out of the 6 non-detects, 4 had a detection limit of 0.004 mg/L and 2 had a detection limit of 0.016 mg/L

Benthic Macroinvertebrates

Another method used to assess water quality involves sampling benthic macroinvertebrates in the stream. The City of Austin regularly measures the quality of streams under its Environmental Integrity Index (EII), of which benthic macroinvertebrate community health is a sub-index. Scoring of benthic macroinvertebrates is based on a multimetric calculation of the following nine metrics:

- Number of taxa,
- Hilsenhoff Biotic Index,
- Number of Ephemeroptera taxa,
- Percent of total individuals as Chironomidae,
- Number of Ephemeroptera / Plecoptera / Trichoptera (EPT) taxa,
- Percent of total as EPT,
- Percent of total as predators,
- Number of pollution intolerant taxa, and
- Percent dominance of the top three taxa in the sample.

The calculation for each of these metrics is then compared to historical calculations of these metrics. A metric above the 95th percentile is given a score of 100, a metric below the 5th percentile is given a score of 0, and a metric between the two percentiles is interpolated between 5 and 95. These nine normalized scores are then averaged to produce the benthic sub-index score.

During four site visits, the benthic macroinvertebrates were sampled in Onion Creek. The results (Table 5) indicate macroinvertebrate sub-index scores above 89, which when compared with other Austin creeks is considered excellent.

Table 5: Results of Macroinvertebrate Scores from Samples at Onion Creek

Site Number	Site Name	Site Visit	Macroinvertebrate Sub-index Score
1364	Onion Creek at Most Upstream Highway 150	April 24, 2014	94
1364	Onion Creek at Most Upstream Highway 150	August 7, 2015	95
10392	Onion Creek downstream of Dripping Springs Piped Outfall	August 7, 2015	98
10393	Onion Creek downstream of South Onion	April 24, 2014	89

Summary

The results of this sampling of Onion Creek indicate a healthy aquatic ecosystem. Nutrients, with the exception of Total Kjeldahl Nitrogen, in the water column were typically (that is, between 30% to 75% of the samples) at concentrations below detection limits. Additionally, concentrations of Total Suspended Solids, a measure of clarity in the water, were also below detection limits. Concentration of nutrients in the benthic algae were also below detection limits for nitrate/nitrite and orthophosphorus. Chlorophyll-a concentrations in the benthic algae averaged around 5 mg/m² across the five sites indicating oligotrophic status. Scoring of benthic macroinvertebrates in the stream also indicated excellent aquatic life use. The weight of all of this evidence points to a riverine system favorable to ecological diversity in Onion Creek downstream of Ranch Road 12 near Dripping Springs, Texas.

Appendix A

Table A.1: Summary of Water Quality Parameters in Onion Creek

Site No	Site Name	Parameter	Average	Standard Deviation	
612	Onion Creek near Driftwood (Hwy 150)	Total Kjeldahl Nitrogen	0.18	0.035	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Total Kjeldahl Nitrogen	0.16	0.030	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Total Kjeldahl Nitrogen	0.26	0.042	MG/L
10393	Onion Creek DS South Onion	Total Kjeldahl Nitrogen	0.19	0.051	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Total Kjeldahl Nitrogen	0.28	0.202	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Total Suspended Solids	5.16	4.724	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Alkalinity (As CaCO ₃)	217	12.8	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Alkalinity (As CaCO ₃)	202	15.5	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Alkalinity (As CaCO ₃)	192	17.8	MG/L
10393	Onion Creek DS South Onion	Alkalinity (As CaCO ₃)	216	16.6	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Alkalinity (As CaCO ₃)	209	28.0	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Organic Carbon	1.70	0.207	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Organic Carbon	1.61	0.304	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Organic Carbon	2.81	0.298	MG/L
10393	Onion Creek DS South Onion	Organic Carbon	1.81	0.405	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Organic Carbon	2.00	0.864	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Chlorophyll-a	1.210	0.557	UG/L
612	Onion Creek near Driftwood (Hwy 150)	Chloride	28.15	5.35	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Chloride	23.55	4.94	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Chloride	25.58	5.15	MG/L
10393	Onion Creek DS South Onion	Chloride	23.43	3.77	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Chloride	25.39	4.24	MG/L

612	Onion Creek near Driftwood (Hwy 150)	Boron	0.04	0.03	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Boron	0.04	0.03	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Boron	0.05	0.04	MG/L
10393	Onion Creek DS South Onion	Boron	0.04	0.03	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Boron	0.04	0.02	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Sodium	12.75	1.48	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Sodium	11.07	1.50	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Sodium	12.77	2.33	MG/L
10393	Onion Creek DS South Onion	Sodium	11.36	1.53	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Sodium	12.08	1.62	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Magnesium	18.08	1.07	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Magnesium	15.92	0.58	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Magnesium	20.32	1.73	MG/L
10393	Onion Creek DS South Onion	Magnesium	18.05	0.67	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Magnesium	17.68	0.67	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Calcium	86.78	2.98	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Calcium	77.01	5.58	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Calcium	69.62	6.32	MG/L
10393	Onion Creek DS South Onion	Calcium	80.44	4.32	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Calcium	78.88	5.67	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Potassium	1.34	0.15	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Potassium	1.30	0.10	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Potassium	1.50	0.14	MG/L
10393	Onion Creek DS South Onion	Potassium	1.32	0.14	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Potassium	1.36	0.14	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Sulfate	54.30	13.08	MG/L

1364	Onion Creek at Most Upstream Hwy 150 Crossing	Sulfate	36.10	11.97	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Sulfate	43.90	12.26	MG/L
10393	Onion Creek DS South Onion	Sulfate	38.55	11.24	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Sulfate	38.62	12.67	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Fluoride	0.19	0.02	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Fluoride	0.19	0.02	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Fluoride	0.19	0.02	MG/L
10393	Onion Creek DS South Onion	Fluoride	0.19	0.01	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Fluoride	0.20	0.01	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Pheophytin	0.20	0.00	UG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Pheophytin	0.27	0.12	UG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Pheophytin	0.20	0.00	UG/L
10393	Onion Creek DS South Onion	Pheophytin	0.30	0.18	UG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Pheophytin	0.20	0.00	UG/L
612	Onion Creek near Driftwood (Hwy 150)	Strontium	0.39	0.06	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Strontium	0.29	0.04	MG/L
10392	Onion Creek ds Dripping Springs Piped Outfall	Strontium	0.35	0.09	MG/L
10393	Onion Creek DS South Onion	Strontium	0.30	0.06	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Strontium	0.32	0.06	MG/L

Table A.2: Summary of Benthic Algal Parameters in Onion Creek

Site No	Site Name	Parameter	Average	Standard Deviation	
612	Onion Creek near Driftwood (Hwy 150)	Ammonia	0.31	0.299	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Ammonia	0.24	0.175	MG/L
10393	Onion Creek DS South Onion	Ammonia	0.41	0.492	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Ammonia	0.19	0.147	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Nitrate/Nitrite	0.13	0.197	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Nitrate/Nitrite	0.11	0.154	MG/L
10393	Onion Creek DS South Onion	Nitrate/Nitrite	0.08	0.121	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Nitrate/Nitrite	0.12	0.177	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Total Kjeldahl Nitrogen	14.64	9.14	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Total Kjeldahl Nitrogen	11.08	5.38	MG/L
10393	Onion Creek DS South Onion	Total Kjeldahl Nitrogen	34.88	30.86	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Total Kjeldahl Nitrogen	13.15	9.19	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Orthophosphorus	0.014	0.007	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Orthophosphorus	0.022	0.024	MG/L
10393	Onion Creek DS South Onion	Orthophosphorus	0.016	0.009	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Orthophosphorus	0.007	0.006	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Phosphorus	0.62	0.523	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Phosphorus	0.47	0.346	MG/L
10393	Onion Creek DS South Onion	Phosphorus	1.33	1.120	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Phosphorus	0.58	0.464	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Total Suspended Solids	3676	5355	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Total Suspended Solids	1354	816	MG/L
10393	Onion Creek DS South Onion	Total Suspended Solids	3243	1773	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Total Suspended Solids	4098	6424	MG/L

612	Onion Creek near Driftwood (Hwy 150)	Volatile Suspended Solids	438	539	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Volatile Suspended Solids	208	112	MG/L
10393	Onion Creek DS South Onion	Volatile Suspended Solids	424	226	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Volatile Suspended Solids	485	732	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Organic Carbon	38.90	19.970	MG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Organic Carbon	30.83	11.362	MG/L
10393	Onion Creek DS South Onion	Organic Carbon	62.38	30.373	MG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Organic Carbon	28.10	18.280	MG/L
612	Onion Creek near Driftwood (Hwy 150)	Chlorophyll-a	543	337	UG/L
1364	Onion Creek at Most Upstream Hwy 150 Crossing	Chlorophyll-a	308	114	UG/L
10393	Onion Creek DS South Onion	Chlorophyll-a	396	162	UG/L
10394	Onion Creek DS Dripping Springs Trib Outfall	Chlorophyll-a	276	335	UG/L