Appendix E

to the Guadalupe-Blanco River Authority
Clean Rivers Program
FY 2004/2005 QAPP

Nutrient Study of Lakes Dunlap and McQueeney

Prepared by the Guadalupe-Blanco River Authority

In Cooperation with the Texas Commission on Environmental Quality (TCEQ)

Effective Period
April 1, 2004 – August 31, 2005

Questions concerning this QAPP should be directed to:

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S-A1 APPROVAL PAGE

The following signatures are required for the special study:

Debbie Magin, Guadalupe-Blanco River Authority Project Manager	Date
Josie Longoria, Guadalupe-Blanco River Authority Quality Assurance Officer	Date
Allison Woodall, TCEQ CRP Project Manager	Date
Sharon Coleman, TCEQ CRP Lead Quality Assurance Specialist	Date
Laurie Curra, TCEQ CRP Project Quality Assurance Specialist	Date

The Guadalupe-Blanco River Authority will secure written documentation from each project participant (e.g., subcontractors, other units of government, laboratories) stating the organization's awareness of and commitment to requirements contained in this quality assurance project plan appendix and any amendments of this plan. The Guadalupe-Blanco River Authority will maintain this documentation as part of the project's quality assurance records, and will be available for review.

A2 TABLE OF CONTENTS

Tables:

Figures:

LIST OF ACRONYMS

As described in Section A2 of the basin-wide QAPP

SS-A3 DISTRIBUTION LIST

As described in Section A3 of the basin-wide QAPP.

SS-A4 PROJECT/TASK ORGANIZATION

Description of Responsibilities

TCEQ

Linda Brookins
CRP Program Manager

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Sharon Coleman
CRP Lead Quality Assurance Specialist

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Allison Woodall
CRP Project Manager

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Eric Reese
CRP Data Manager

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Laurie Curra
CRP Project Quality Assurance Specialist

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

GBRA

Debbie Magin
GBRA Project Manager

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Josephine Longoria
GBRA Quality Assurance Officer

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Debbie Magin
GBRA Data Manager

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Michael McCall
GBRA Laboratory Analyst/Field Technician

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Josephine Longoria
GBRA Regional Laboratory Director

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Juan Carmona
GBRA Laboratory Analyst

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Brian Lyssy
GBRA Laboratory Technician III

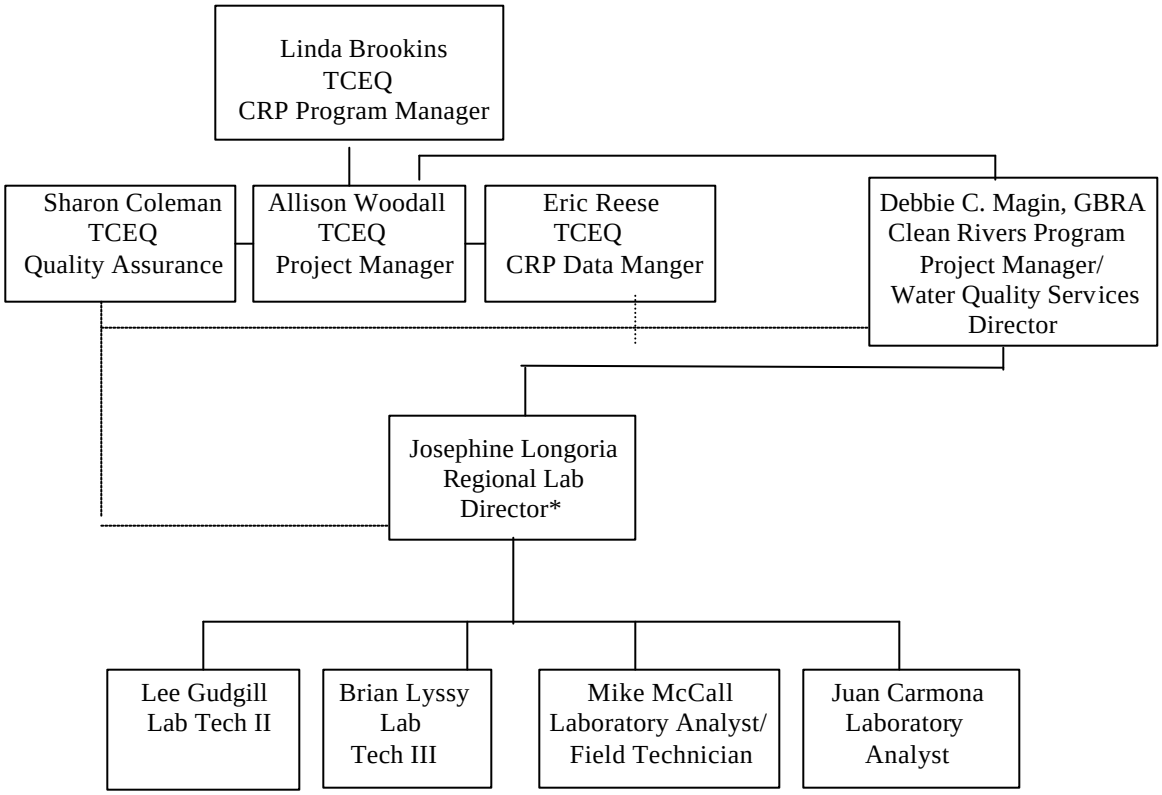
As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Lee Gudgell
GBRA Laboratory Technician II

As described in the basin-wide 2004-05 QAPP, Revision 1, Section A4.

Figure SS-A4.1 is the special study organization chart.

Figure SS-A4.1 CRP Organizational Chart-- Lines of Communication**



* Serve as Quality Assurance Officer

** See Project/Task Organization in this section for a description of each position's responsibilities.

SS-A5 PROBLEM DEFINITION

GBRA has been sampling the Guadalupe River Segment 1804 (below the confluence with the Comal River) since 1987. Chlorophyll a was added to the list of analyses in 1996. This segment of the river is made up primarily of run-of-river impoundments. These water bodies are narrow, shallow and have short residence times. The first two of these types of impoundments in the series of six are Lakes Dunlap and McQueeney. The flow in these waterbodies is used to generate hydroelectric power. The impoundments pond the natural river flow for periods of the time during the day; then the flow is diverted through turbines to generate electricity during peak demand.

Lake Dunlap receives treated wastewater effluent from the New Braunfels wastewater treatment plants as well as the treatment plant located at the Mission Valley Mills textile plant. Lake McQueeney receives no point source discharges. Both impoundments may be impacted by non-point sources including the homes that line their banks, most of which are on septic tanks.

In the 2002 305(b) assessment, the sampling location in Lake McQueeney was listed as a concern due to elevated chlorophyll a concentrations. The chlorophyll a concentration at this site averages approximately 7 ug/L over the historical database, but 25% of the data points fall in the range of 10-40 ug/L. Factors contributing to elevated chlorophyll a could include contributions of nutrients from non-point sources such as natural background concentrations from the Comal Springs, fertilizer use along the banks by homeowners and farms, and septic tanks, as well as point source dischargers into and upstream of Lake Dunlap. Additionally, there appears to be an inverse relationship between flow and chlorophyll a concentration.

Therefore, the nutrient study has been initiated to look for sources of nutrients, better define relationships between flow and chlorophyll a and to characterize the lake conditions.

SS-A6 PROJECT/TASK DESCRIPTION

The intensive monitoring project on Lakes Dunlap and McQueeney will collect data on the two impoundments in order to characterize lake conditions and determine levels of nutrients and chlorophyll a throughout the impoundments. Additionally, the monitoring would attempt to identify correlations between the chlorophyll a concentrations and their possible causes.

The monitoring of these two impoundments will occur monthly, April through October and bimonthly during November through March. Two sampling locations are located on Lake Dunlap, one downstream and one upstream of the existing routine monitoring site. Four sites are located on Lake McQueeney, upstream of the existing site which is located 0.5 upstream of the dam, and spaced approximately equidistance to the upstream release into the impoundment at the Dunlap Canal.

The list of parameters for analysis will include those on the current monitoring plan at the routine monitoring sites: pH, temperature, dissolved oxygen, specific conductance, total phosphorus, nitrate-nitrogen, turbidity, total suspended solids, ammonia-nitrogen, chlorophyll a, pheophytin, sulfate, chloride, hardness, *E. coli*, flow, and flow severity. In addition to the routine analyses, total kjeldahl nitrogen, secchi disk and days since last significant rainfall will be reported.

At the end of the data collection efforts, data will be screened using TCEQ screening protocols. There will also be a spatial analysis of the data within the two waterbodies to determine the sources of nutrient contributions as well as the waterbodies' response to the sources. A final report will be generated that includes the data analysis as well as a description of the operations of the hydroelectric system.

SS-A7 QUALITY OBJECTIVES AND CRITERIA

The purpose of nutrient study is to collect surface water quality data that will characterize lake conditions, look for possible nutrient sources and determine if there is a relationship between flow and chlorophll a. At the end of the study, data will be screened using TCEQ screening protocols and there will be spatial analyses performed on the monitoring sites within and between the waterbodies.

The measurement performance specifications to support the project objectives for data set are specified in Tables SS-A7.1.

Table SS-A7.1 - Measurement Performance Specifications

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	Lab Reporting Limit (RL)	RECOVERY AT RLs	PRECISION (RPD of LCS/LCS dup)	BIAS (%Rec. of LCS)	Lab
Field Parameters										
pH	pH/ units	water	SM 4500-H^+ B. and TCEQ SOP	00400	NA[1]	NA	NA	NA	NA	Field
DO	mg/L	water	SM 4500-O G. and TCEQ SOP	00300	NA[1]	NA	NA	NA	NA	Field
Conductivity	umhos/cm	water	SM 2510 and TCEQ SOP	00094	NA[1]	NA	NA	NA	NA	Field
Conductivity	umhos/cm	water	SM 2510	00095	NA[1]	NA	NA	NA	NA	GBRA
Temperature	^oC	water	SM 2550 and TCEQ SOP	00010	NA[1]	NA	NA	NA	NA	Field
Flow	cfs	water	TCEQ SOP	00061	NA[1]	NA	NA	NA	NA	Field
Flow measurement method	1-gage 2-electric 3-mechanical 4-weir/flume 5-doppler	water	TCEQ SOP	89835	NA[1]	NA	NA	NA	NA	Field
Flow severity	1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry	water	TCEQ SOP	01351	NA[1]	NA	NA	NA	NA	Field
Secchi Disk	m	water	TCEQ SOP	00078	NA[1]	NA	NA	NA	NA	Field
Days since last significant rainfall	days	water	TCEQ SOP	72053	NA[1]	NA	NA	NA	NA	Field
Conventional Parameters										
TSS	mg/L	water	SM 2540	00530	4	1	NA	20	NA	GBRA

			D.							
Conventional Parameters (cont.)										
Turbidity	NTU	water	SM 2130 B	82079	0.5	0.5	NA	20	NA	GBRA
Sulfate	mg/L	water	EPA 300.0	00945	10	1	75-125	20	80-120	GBRA
Sulfate[3]	mg/L	water	SM 4500-SO_4 E.	00945	10	1	75-125	20	80-120	GBRA
Chloride	mg/L	water	EPA 300.0	00940	10	1	75-125	20	80-120	GBRA
Chloride[3]	mg/L	water	SM 4500-Cl C.	00940	10	1	75-125	20	80-120	GBRA
Chlorophyll-a, spectrophotometric method	ug/L	water	SM 10200-H	32211	5	1	75-125	20	NA	GBRA
Pheophytin, spectrophotometric method	ug/L	water	SM 10200-H	32218	3	1	75-125	20	NA	GBRA
E. coli, IDEXX Colilert	MPN/100 mL	water	SM 9223-B	31699	1	1	NA	0.5[2]	NA	GBRA
Ammonia-N, total	mg/L	water	SM 4500-NH_3 E.	00610	0.02	0.02	75-125	20	80-120	GBRA
Hardness, total (as CaC03)	mg/L	water	SM 2340 C.	00900	5	5	NA	20	80-120	GBRA
Nitrate-N, total	mg/L	water	EPA 300.0	00620	0.02	0.02	75-125	20	80-120	GBRA
Nitrate/nitrite-N, total[3]	mg/L	water	SM 4500-NO_3 E. + NO_2 B.	00630	0.04	0.02	75-125	20	80-120	GBRA
Total phosphorus	mg/L	water	SM 4500-P B. + E.	00665	0.06	0.05	75-125	20	80-120	GBRA
Total Kjeldahl Nitrogen	mg/L	water	SM 4500-N D.	00625	0.2	1.0[4]	75-125	20	80-120	GBRA

References:

1 Reporting to be consistent with SWQM guidance and based on measurement capability.

2 Based on range statistic as described in Standard Methods, 20th Edition, Section 9020-B, " Quality Assurance/Quality Control – Intralaboratory Quality Control Guidelines."

3 Secondary method listed. To be used in the event that the primary method cannot be used or needs to be confirmed, i.e. automated method cannot be used due to instrument failure.

4 GBRA Regional Laboratory is working to bring the reporting limit more in line with the AWRL by performing MDL studies at 0.2 mg/L. If the reporting limit is lowered based on valid MDL studies the appendix will be amended to reflect new RL.

Ambient Water Reporting Limits (AWRLs)

As described in Section A7 of the basin-wide QAPP.

Precision

As described in Section A7 of the basin-wide QAPP.

Bias

As described in Section A7 of the basin-wide QAPP.

Representativeness

Site selection, the appropriate sampling regime, the sampling of all pertinent media according to TCEQ SOPs, and use of only approved analytical methods will assure that the measurement data represents the conditions at the site. Data collected in the nutrient study are considered to be spatially and temporally representative of ambient water quality conditions. At a minimum, samples are collected over at least two seasons (to include inter-seasonal variation) and over two years (to include inter-year variation) to include some data collected during an index period (March 15- October 15). Although data may be collected during varying regimes of weather and flow, the data sets will not be biased toward unusual conditions of flow, runoff, or season.

Comparability

As described in Section A7 of the basin-wide QAPP.

Completeness

As described in Section A7 of the basin-wide QAPP.

SS-A8 SPECIAL TRAINING/CERTIFICATION

As described in Section A7 of the basin-wide QAPP.

SS-A9 DOCUMENTS AND RECORDS

As described in Section A9 of the basin-wide QAPP.

SS-B1 SAMPLING PROCESS DESIGN

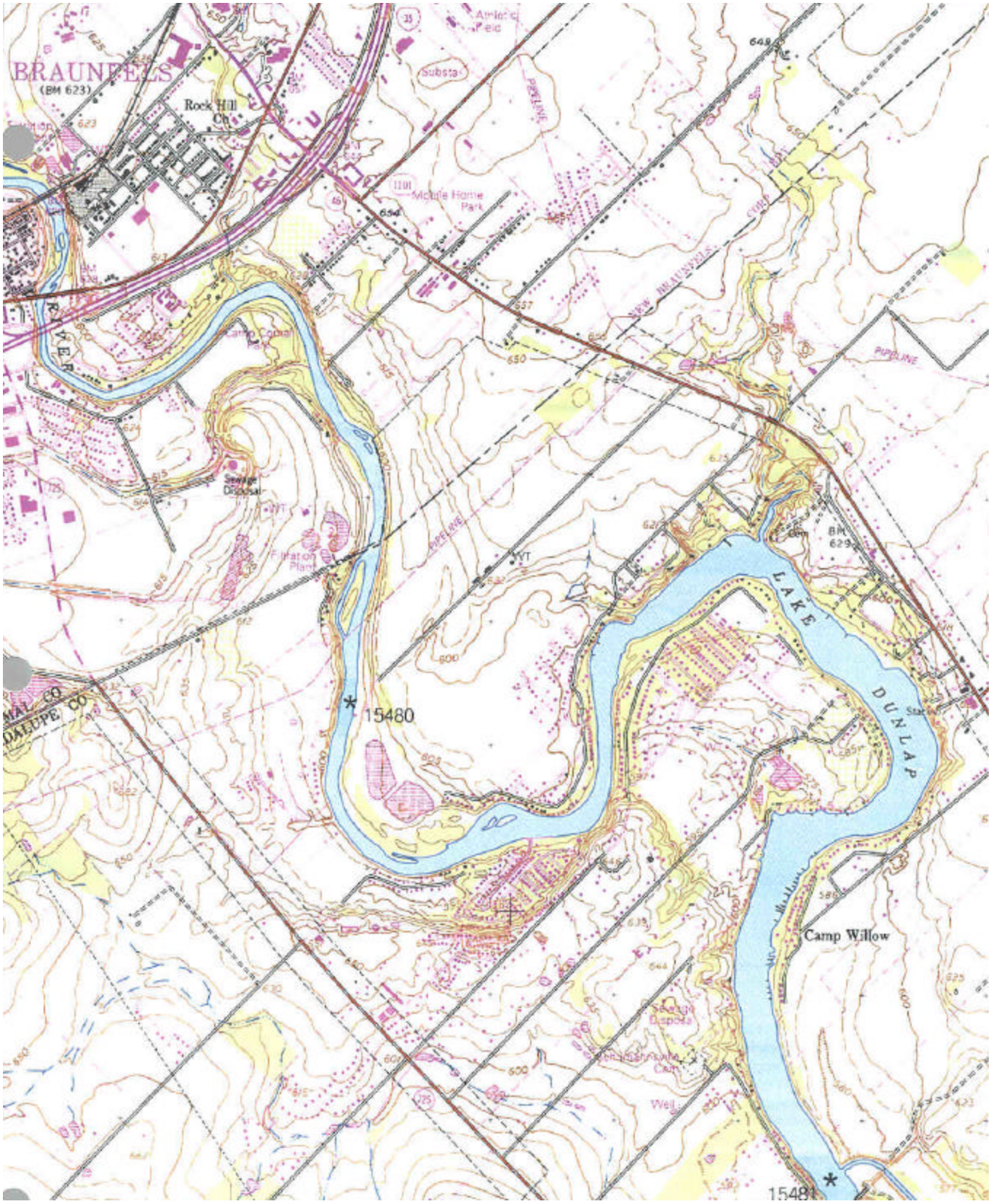
The data collection design is summarized in Tables SS-B1. – B2. (Sampling Sites and Monitoring Frequencies 2004 and 2005) and Figures SS-B1. – 3. (Sample Site Maps).

Table SS-B1.1. Sampling Sites and Monitoring Frequencies 2004

Seg	Reg	Basin	Lat	Long	Long Desc	Stn Id	Start Date	End Date	Source1/ Source2	Program Code	EC	Conventional	Flow	Field
1804	13	18	29.66	98.068	LAKE DUNLAP-GUADALUPE RIVER AT DAM 0.3 KM NORTH OF DITTMAR FALLS BRIDGE	15481	4/1/2004	8/31/2004	GB/GB	SS	6	6	6	6
1804	13	18	29.68	98.091	GUADALUPE RIVER WEST BANK, APPROXIMATELY .7 KM SOUTH OF COMAL-GUADALUPE COUNTY LINE, APPROX. 4.0 RIVER KM DOWNSTREAM OF IH 35	15480	4/1/2004	8/31/2004	GB/GB	SS	6	6	6	6
1804	13	18	29.6	98.043	LAKE MCQUEENEY, 0.2 KM UPSTREAM OF THE MCQUEENEY DAM	18213	4/1/2004	8/31/2004	GB/GB	SS	6	6	6	6
1804	13	18	29.6	98.039	LAKE MCQUEENEY IN MAIN POOL SOUTH OF TREASURE ISLAND, 1.2 KM UPSTREAM OF DAM	15273	4/1/2004	8/31/2004	GB/GB	SS	6	6	6	6
1804	13	18	29.62	98.028	GUADALUPE RIVER 4.3 RIVER KM UPSTREAM OF LAKE MCQUEENEY DAM, 0.6 KM WEST OF SH 46 AND 3.2 KM NORTH OF FM 78	15517	4/1/2004	8/31/2004	GB/GB	SS	6	6	6	6
1804	13	18	29.64	98.044	GUADALUPE RIVER 3.9 RIVER KM DOWNSTREAM OF LAKE DUNLAP DAM NEAR POWERHOUSE, 1.3 KM WEST OF SH 46 AND 5.2 KM NORTH OF FM 78	15516	4/1/2004	8/31/2004	GB/GB	SS	6	6	6	6

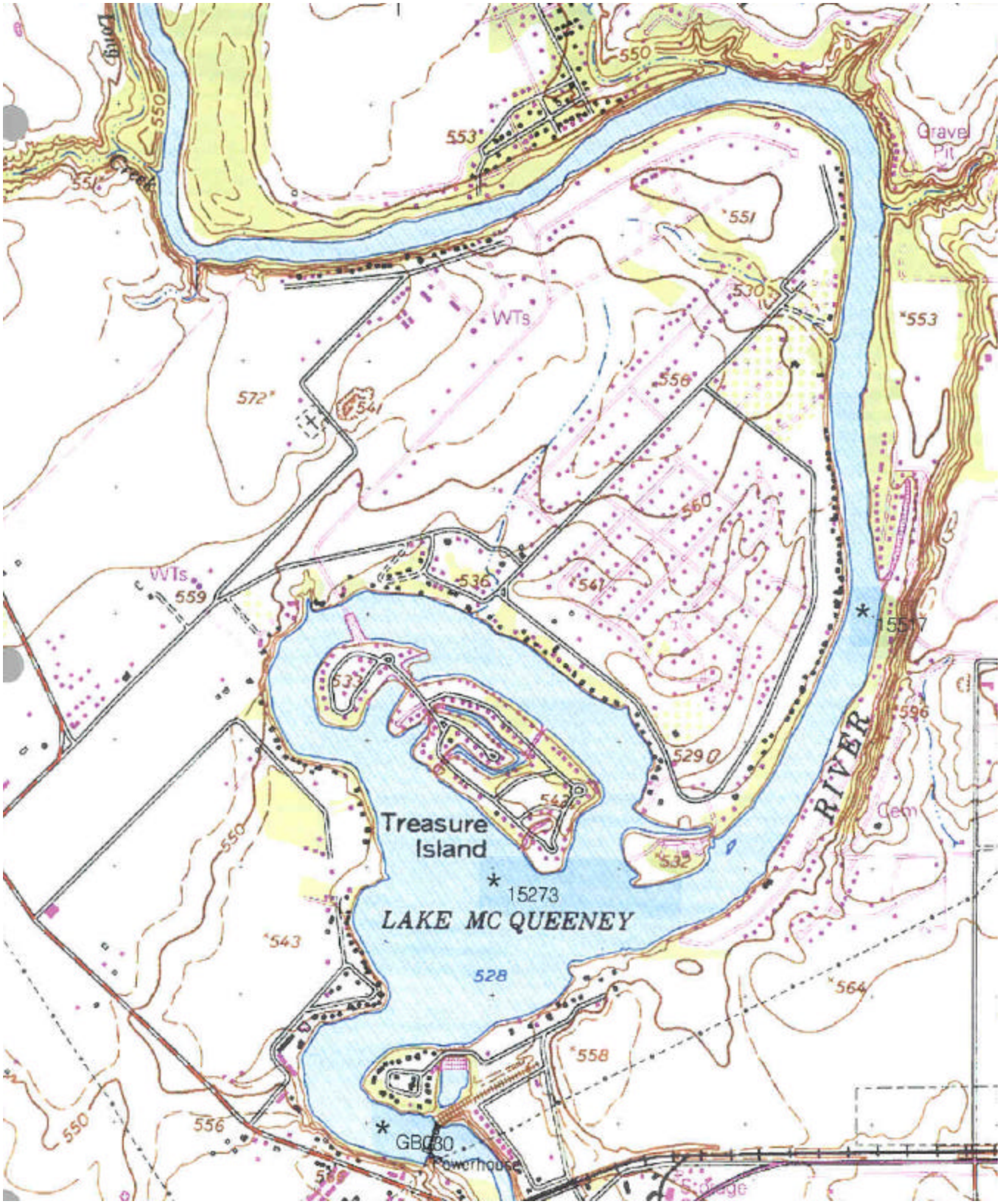
Table SS-B1.2. Sampling Sites and Monitoring Frequencies 2005

Seg	Reg	Basin	Lat	Long	Long Desc	Stn Id	Start Date	End Date	Source1/ Source2	Program Code	EC	Conventional	Flow	Field
1804	13	18	29.655	98.068	LAKE DUNLAP-GUADALUPE RIVER AT DAM 0.3 KM NORTH OF DITTMAR FALLS BRIDGE	15481	9/1/2004	8/31/2005	GB/GB	SS	8	8	8	8
1804	13	18	29.676	98.091	GUADALUPE RIVER WEST BANK, APPROXIMATELY .7 KM SOUTH OF COMAL-GUADALUPE COUNTY LINE, APPROX. 4.0 RIVER KM DOWNSTREAM OF IH 35	15480	9/1/2004	8/31/2005	GB/GB	SS	8	8	8	8
1804	13	18	29.595	98.043	LAKE MCQUEENEY, 0.2 KM UPSTREAM OF THE MCQUEENEY DAM	18213	9/1/2004	8/31/2005	GB/GB	SS	8	8	8	8
1804	13	18	29.599	98.039	LAKE MCQUEENEY IN MAIN POOL SOUTH OF TREASURE ISLAND, 1.2 KM UPSTREAM OF DAM	15273	9/1/2004	8/31/2005	GB/GB	SS	8	8	8	8
1804	13	18	29.622	98.028	GUADALUPE RIVER 4.3 RIVER KM UPSTREAM OF LAKE MCQUEENEY DAM, 0.6 KM WEST OF SH 46 AND 3.2 KM NORTH OF FM 78	15517	9/1/2004	8/31/2005	GB/GB	SS	8	8	8	8
1804	13	18	29.635	98.044	GUADALUPE RIVER 3.9 RIVER KM DOWNSTREAM OF LAKE DUNLAP DAM NEAR POWERHOUSE, 1.3 KM WEST OF SH 46 AND 5.2 KM NORTH OF FM 78	15516	9/1/2004	8/31/2005	GB/GB	SS	8	8	8	8



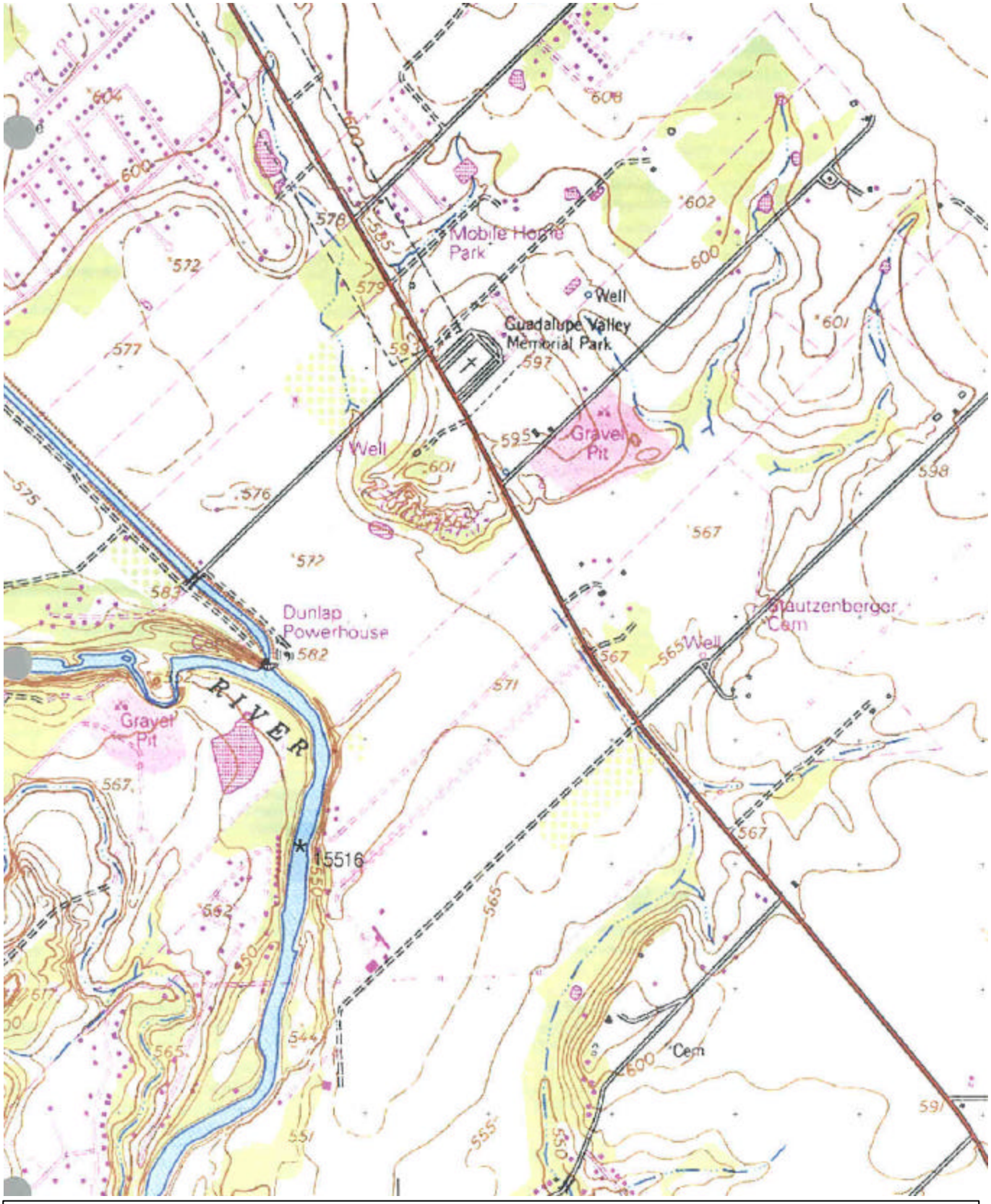
Name: NEW BRAUNFELS EAST
Date: 2/6/104
Scale: 1 inch equals 2000 feet

Caption: 2003-2005 Lake Dunlap Nutrient Study



Name: MCQUEENEY
Date: 2/6/104
Scale: 1 inch equals 1250 feet

Caption: 2003-2005 Lake McQueeney Nutrient Study



Name: NEW BRAUNFELS EAST
Date: 2/6/104
Scale: 1 inch equals 1250 feet

Caption: 2003-2005 Lake McQueeney Nutrient Study

Sample Design Rationale and Site Selection Criteria

The sample design rationale is based on the intent of the study to characterize the spatial and temporal nutrient and chlorophyll a concentrations in Lakes Dunlap and McQueeney by collecting conventional, nutrient, chlorophyll a, and field measurements at locations spatially distributed in the two water bodies. To this end, 6 sites, two in Lake Dunlap and four in Lake McQueeney, have been selected based on accessibility, the intent to assess the progressive impairment along the water body, the intent to assess the impact of anthropogenic sources (i.e., wastewater discharges and septic tanks), and the intent to characterize hydrologic and other effects from tributaries (Comal River).

SS-B2 SAMPLING METHODS

Field Sampling Procedures.

As described in Section B2 of the basin-wide QAPP.

Sample volume, container types, preservation requirements, and holding time requirements.

As described in Section A9 of the basin-wide QAPP. Total Kjeldahl Nitrogen has been added to the list of parameters described in the basin-wide QAPP. Table SS-3 describes the volume, container type, preservation and holding time specific for this parameter.

Table SS-B2.1. Sample Storage, Preservation, and Handling Requirements

Parameter	Matrix	Container	Preservation	Sample Volume	Holding Time
Total Kjeldahl Nitrogen	Water	Plastic or glass	Cool, 4oC, H2SO4 to pH <2	1L	28 days

Sample Containers

As described in Section B2 of the basin-wide QAPP.

Processes to Prevent Contamination

As described in Section B2 of the basin-wide QAPP.

Documentation of Field Sampling Activities

As described in Section B2 of the basin-wide QAPP.

Recording Data

As described in Section B2 of the basin-wide QAPP.

Deficiencies, Nonconformances and Corrective Action Related to Sampling Requirements

As described in Section B2 of the basin-wide QAPP.

SS-B3 SAMPLING HANDLING AND CUSTODY

Chain-of -Custody

As described in Section B2 of the basin-wide QAPP.

Sample Labeling

As described in Section B3 of the basin-wide QAPP.

Sample Handling

As described in Section B3 of the basin-wide QAPP.

Deficiencies, Nonconformances and Corrective Action Related to Chain-of-Custody

As described in Section B3 of the basin-wide QAPP.

SS-B4 ANALYTICAL METHODS

The analytical methods, associated matrices, and performing laboratories are listed in Table SS-2 of Section SS-A7. The authority for analysis methodologies under the Clean Rivers Program is derived from the TSWQS (§§307.1 - 307.10) in that data generally are generated for comparison to those standards and/or criteria. The Standards state that "Procedures for laboratory analysis will be in accordance with the most recently published edition of *Standard Methods for the Examination of Water and Wastewater*, the latest version of the *TCEQ Surface Water Quality Monitoring Procedures Manual*, 40 CFR 136, or other reliable procedures acceptable to the executive director." Copies of laboratory SOPs are retained by the *Guadalupe-Blanco River Authority* and are available for review by the TCEQ. Laboratory SOPs are consistent with EPA requirements as specified in the method.

Standards Traceability

As described in Section B4 of the basin-wide QAPP.

Analytical Method Modification

As described in Section B4 of the basin-wide QAPP.

Deficiencies, Nonconformances and Corrective Action Related to Analytical Methods

As described in Section B4 of the basin-wide QAPP.

SS-B5 QUALITY CONTROL

Sampling Quality Control Requirements and Acceptability Criteria

As described in Section B5 of the basin-wide QAPP.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

As described in Section B5 of the basin-wide QAPP revision X.

Failures in Field and Laboratory Quality Control and Corrective Action

As described in Section B5 of the basin-wide QAPP revision X.

SS-B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

As described in Section B6 of the basin-wide QAPP.

SS-B7 INSTRUMENT CALIBRATION AND FREQUENCY

As described in Section B7 of the basin-wide QAPP.revision X.

SS-B8 INSPECTION/ACCEPTANCE REQUIREMENT FOR SUPPLIES AND CONSUMABLES

As described in Section B8 of the basin-wide QAPP revision X.

SS-B9 NONDIRECT MEASUREMENTS

As described in Section B9 of the basin-wide QAPP revision X.

SS-B10 DATA MANAGEMENT

As described in Section B10 of the basin-wide QAPP revision.

SS-C1 ASSESSMENTS AND RESPONSE ACTIONS

As described in Section C1 of the basin-wide QAPP.

Corrective Action

As described in Section C1 of the basin-wide QAPP.

SS-C2 REPORTS TO MANAGEMENT

Reports to Guadalupe-Blanco River Authority Project Management

As described in Section C2 of the basin-wide QAPP.

Reports to TCEQ Project Management

As described in Section C2 of the basin-wide QAPP.

Reports by TCEQ Project Management

As described in Section C2 of the basin-wide QAPP.

SS-D1 DATA REVIEW, VERIFICATION, AND VALIDATION

As described in Section D1 of the basin-wide QAPP.

SS-D2 VERIFICATION AND VALIDATION METHODS

As described in Section D2 of the basin-wide QAPP.

SS-D3 RECONCILIATION WITH USER REQUIREMENTS

Data produced in this project will be analyzed and reconciled with project data quality requirements. Data meeting project requirements will be used in spatial and temporal analysis and by the TCEQ for the Water Quality Inventory in accordance with TCEQ's Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data, and for TMDL development, stream standards modifications, and permit decisions as appropriate. Data which does not meet requirements will not be used in the project's statistical analyses and will not be submitted to the SWQM portion of TRACS, nor will it be considered appropriate for any of the uses also noted above..

Example letter to document adherence to the Basin-wide QAPP Appendix X

DATE: date

TO: name
organization

FROM: name
organization

RE: Appendix X to the Guadalupe-Blanco River Authority FY2004-05 CRP QAPP

Please sign and return this form by date to:

address

I acknowledge receipt of the referenced document(s). I understand the document(s) describe quality assurance, quality control, data management and reporting, and other technical activities that must be implemented to ensure the results of work performed will satisfy stated performance criteria.

_____

Signature Date

Copies of the signed forms should be sent by the Guadalupe-Blanco River Authority to the TCEQ CRP Project Manager within 60 days of TCEQ approval of the QAPP.