Clean Water Act §319(h) Nonpoint Source Grant Program

Development of the Lower Nueces River Watershed Protection Plan
Large Debris Evaluation
and
Modeling and Data Analysis

TSSWCB Project # 12-05
Revision 2

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

Prepared by
Nueces River Authority
and
Texas A&M AgriLife Research & Extension – Blackland Research Center

Effective Period: Upon EPA approval through September 2015
with annual revisions required

Questions concerning this quality assurance project plan should be directed to:

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Section A1 Approval Sheet

Quality Assurance Project Plan (QAPP) for the *Development of the Lower Nueces River Watershed Protection Plan – Large Debris Evaluation and Modeling and Data Analysis.*

United States Environmental Protection Agency (EPA), Region VI

Name: Curry Jones
Title: USEPA Chief State/Tribal Programs Section

Signature: ______________________________ Date: ___________________

Name: Henry Brewer
Title: USEPA Texas Nonpoint Source Project Officer (PO)

Signature: ______________________________ Date: ___________________

Texas State Soil and Water Conservation Board (TSSWCB)

Name: Jana Lloyd
Title: TSSWCB Project Manager (PM)

Signature:_________________________________Date: ___________________

Name: Mitch Conine
Title: TSSWCB Quality Assurance Officer (QAO)

Signature:_________________________________Date: ___________________

Nueces River Authority (NRA)

Name: Rocky Freund
Title: Deputy Executive Director / NRA PM

Signature:_________________________________Date: ___________________

Texas A&M AgriLife Research & Extension – Blackland Research Center (BRC)

Name: Jason McAlister
Title: Research Assistant / BRC PM

Signature:______________________________ Date: ____________________

Section A2: Table of Contents

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List of Acronyms and Abbreviations

BAEN	Biological and Agricultural Engineering
ASCII	American Standard Code for Information Interchange
BMP	Best Management Practice
BRC	Texas A&M AgriLife Research & Extension – Blackland Research Center
CAR	Corrective Action Report
CD	Compact Disk
CRP	Clean Rivers Program
DGPS	Differential Global Positioning System
DQO	Data Quality Objective
FDC	Flow Duration Curve
EPA	United States Environmental Protection Agency
FM	Farm to Market Road
FY	Fiscal Year
GIS	Geographic Information System
GPS	Global Positioning System
KML	Keyhole Markup Language
LDC	Load Duration Curve
LDRP	Large Debris Removal Plan
LULC	Land Use Land Cover
NAD83	North American Datum of 1983
NOAA	National Oceanic and Atmospheric Administration
NRA	Nueces River Authority
NRWP	Nueces River Watershed Partnership
OSSF	On-site Sewage Facility
PM	Project Manager
PO	Project Officer
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QAO	Quality Assurance Officer
QC	Quality Control
ROM	Read Only Memory
RW	Rewritable
SELECT	Spatially Explicit Load Enrichment Calibration Tool
SH	State Highway
SSL	Spatial Sciences Laboratory
SWPP	Source Water Protection Plan
SWQMIS	Surface Water Quality Monitoring Information System
TAMU	Texas A&M University
TDS	Total Dissolved Solids
TIFF	Tagged Image File Format
TCEQ	Texas Commission on Environmental Quality

TSSWCB	Texas State Soil and Water Conservation Board
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture
USGS	United States Geological Survey
WPP	Watershed Protection Plan

Unit Abbreviations

ft	feet
m	meters
mg/l	milligrams per liter
NTU	Nephelometric Turbidity Unit
μg/l	micrograms per liter

Section A3: Distribution List

Organizations, and individuals within, which will receive copies of the approved QAPP and any subsequent revisions include:

United States Environmental Protection Agency, Region VI (EPA)

1445 Ross Avenue, Suite 1200 (6WQ-AT)
Dallas, TX 75202-2733

Name: Curry Jones
Title: USEPA Chief State/Tribal Programs Section

Name: Henry Brewer
Title: USEPA Texas Nonpoint Source PO

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Title: Deputy Executive Director

Texas A&M AgriLife Research & Extension – Blackland Research Center (BRC)

720 East Blackland Road
Temple, TX 76502

Name: Jason McAlister
Title: Research Assistant

Section A4: Project/Task Organization

The following is a list of individuals and organizations participating in the project with their specific roles and responsibilities:

EPA – Environmental Protection Agency, Region 6, Dallas, Texas. Provides project oversight and funding at the federal level.

Henry Brewer, EPA Texas Nonpoint Source PO
Responsible for overall performance and direction of the project at the federal level. Ensures that the project assists in achieving the goals of the Clean Water Act. Reviews and approves the QAPP, project progress, and deliverables.

TSSWCB – Texas State Soil and Water Conservation Board, Temple, Texas. Provides project overview at the State level.

Jana Lloyd, TSSWCB PM
Responsible for ensuring that the project delivers data of known quality, quantity, and type on schedule to achieve project objectives. Tracks and reviews deliverables to ensure that tasks in the workplan are completed as specified. Reviews and approves QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants.

Mitch Conine, TSSWCB QAO
Reviews and approves QAPP and any amendments or revisions. Responsible for verifying that the QAPP is followed by project participants. Monitors implementation of corrective actions. Coordinates or conducts audits of modeling procedures. Determines that the project meets the requirements for planning, quality assurance (QA), quality control (QC), and reporting under the TSSWCB Clean Water Act §319(h) NPS Grant Program.

NRA – Nueces River Authority, Corpus Christi, Texas. Provides project coordination and administration, coordinates quality assurance (QA) and modeling.

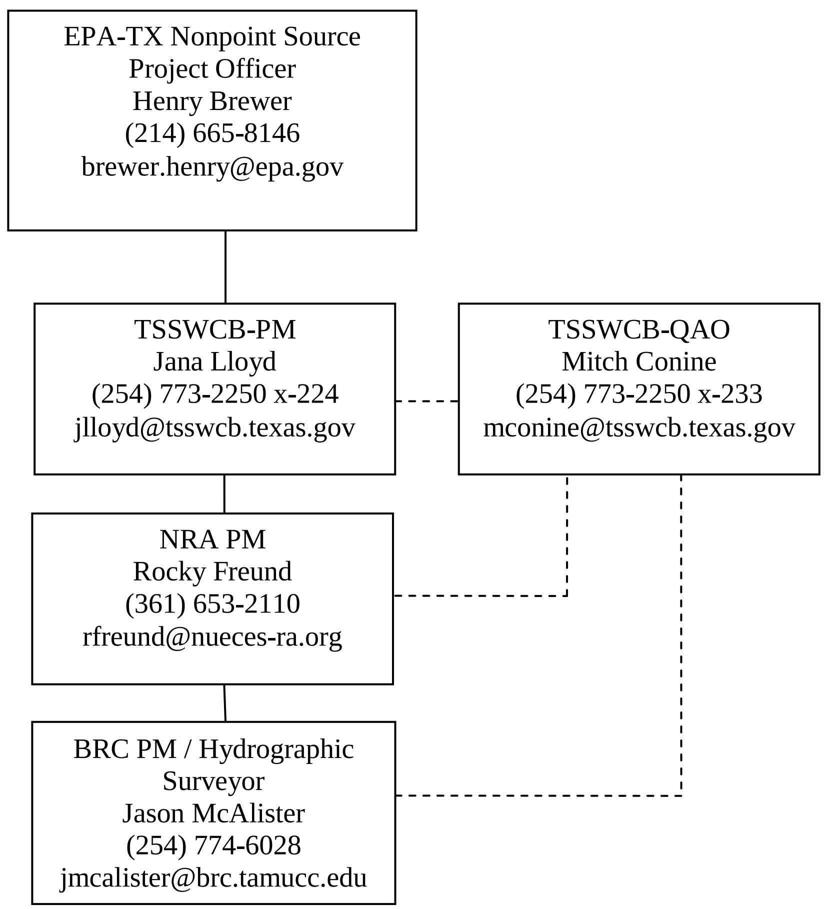
Rocky Freund, NRA Deputy Executive Director,
Responsible for ensuring the smooth operation of the project, timely delivery of quality deliverables and general project coordination and administration at the local level. Coordinates contractor activities and inclusion of modeling and survey results into the watershed protection plan (WPP). Facilitates the watershed steering committee and development of the WPP. Responsible for the development of a geographic information system (GIS) inventory of the project watershed. Responsible for performing modeling activities associated with the Spatially Explicit Load Enrichment Calibration Tool (SELECT) and Flow Duration Curve (FDC) Load Duration Curve (LDC) development. Responsible for creating an inventory of on-site sewage facilities (OSSF).

BRC – Texas A&M ArgriLife Research & Extension - Blackland Research Center, Temple, Texas. Responsible for conducting a survey to inventory large items that should be removed from the river.

Jason McAlister, BRC Research Assistant

Responsible for reporting tasks for the contracted work to inventory large items that should be removed from the river, including development of data quality objectives (DQOs) and a QAPP. Responsible for side scan sound navigation ranging (sonar) data collection, data analysis, and QA procedures. BRC will contribute to the development of quarterly reports and the final project report.

Figure A4-1. Project Organization Chart



Section A5: Problem Definition/Background

The Lower Nueces River is 39 river miles long and is located in parts of Jim Wells, Nueces, and San Patricio Counties. The 116,862-acre watershed is primarily agricultural (cultivated crops and hay and pasture lands). The City of Corpus Christi, population 305,215, lies at the downstream end of the segment, but only a small portion (<1%) falls within the watershed boundary. The City of San Patricio, population 395, is located in the middle of the watershed near the river along Farm to Market Road (FM) 666. 83% of the City of Mathis, population 4,936, is located in the watershed between the river and the Bayou Creek tributary. There are no permitted wastewater treatment facilities in the watershed. The wastewater permit annotation on the map is a no-discharge permit for a sand and gravel operation in the event of excessive rainfall events. There are only two road crossings on this segment – State Highway (SH) 359 just below Wesley Seale Dam at Lake Corpus Christi and FM 666.

Water quality monitoring at SH 359 (12965) and FM 666 (12964) has been conducted since 1977 (Figure A5-1). Early sampling was conducted by the City of Corpus Christi and the United States Geological Survey (USGS). NRA began routine quarterly sampling under the Texas Commission on Environmental Quality's (TCEQ) Clean Rivers Program (CRP) in 1998. A third site at Hazel Bazemore Park (20936) was added to the CRP routine quarterly sampling beginning Fiscal Year (FY) 2011.

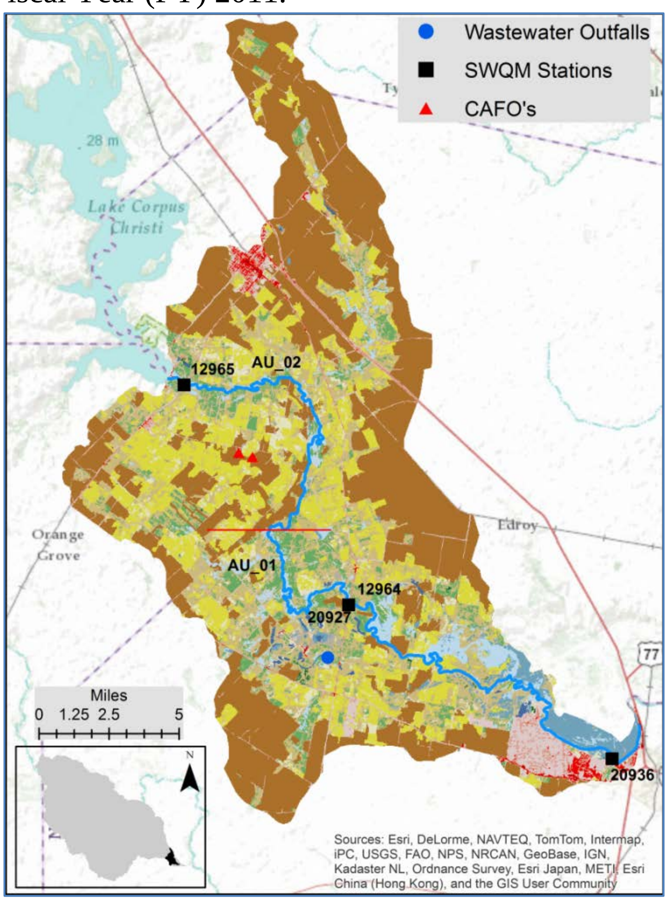


Figure A5-1. Lower Nueces River Watershed

State and federal water resource management and environmental protection agencies have embraced the watershed approach for managing water quality. The watershed approach involves assessing sources and causes of impairments and potential impairment concerns, and utilizing this information to develop and implement watershed management plans. The 2012 303(d) list indicates the Lower Nueces River (Segment 2102) is impaired for total dissolved solids (TDS) and has a concern for chlorophyll-*a*. The average TDS level of 546 mg/l exceeds the 500 mg/l standard. The chlorophyll-*a* concern is based on 9 of 28 samples exceeding the 14.1 µg/l. This project will address these issues as well as sediment issues in the Lower Nueces River watershed.

A turbidity spike (from 20 NTU to 1,900 NTU) in November 2009 resulted in a drinking water violation at the City of Corpus Christi O.N. Stevens Water Treatment Plant. A sediment loading model, developed by USGS, indicated that the turbidity increase was most likely due to localized, heavy rainfall in the Bayou Creek tributary. The land use in the Bayou Creek watershed is primary farmland, which was bare after crop harvest at the time of the storm event. However, major bank manipulation by landowners, may also be contributing to the problem. Given that sediment from farmlands is a known issue, modeling and analysis of nitrates, commonly found in fertilizers, will be conducted to help understand the potential for and prevent additional impairments associated with this parameter.

The Lower Nueces River is the primary drinking water source for nearly 500,000 people in the Coastal Bend Region and also supplies industrial users in the area. The water is released from Lake Corpus Christi and travels approximately 39 miles to water treatment plant intakes. Communities along this portion of the river rely on OSSFs. Although assessments of *E. coli* data remain below water quality standards, trend analysis indicates an increasing trend. Therefore, modeling and analysis of *E. coli* will be conducted to help understand the potential for and prevent an additional impairment associated with this parameter.

In general, better water quality reduces treatment costs and allows industry to cycle water through their cooling towers for longer periods of time, reducing the overall amount of water needed for their operations.

The City of Corpus Christi contracted with NRA (FYs 2011 and 2012) to develop a Source Water Protection Plan (SWPP) to provide evaluation and cost estimates of best management practices (BMP) to help protect the river and the water it provides. It was modeled after USEPA's Elements of Successful WPPs and will be incorporated into the Lower Nueces River WPP.

The Nueces River Watershed Partnership (NRWP) was formed to serve as a means to gather stakeholder input and direction in development of the SWPP. The NRWP met six times between January 2011 and July 2012. Workgroups were also formed to provide more specific input and information. The following workgroups each met once between February 2011 and May 2011: Education and Outreach, Water Quality, Utilities, Agriculture, and Recreation. The mission statement of the NRWP, developed by the Education and Outreach workgroup and adopted by the full NRWP is *"To improve and protect the water quality of the Nueces*

River Watershed so that the river is restored and preserved for current and future generations." The SWPP document is available on the NRWP website http://www.nuecesriverpartnership.org/.

The purpose of this project is to develop a nine element Watershed Protection Plan for the Nueces River Below Lake Corpus Christi Watershed by providing direction for a stakeholder group that will serve as a decision-making body, identify potential nonpoint source pollution threats and/or concerns, conduct pollutant load evaluations, identify management measures to reduce and protect water quality, as well as conduct education and outreach activities.

Section A6: Project Goals and Task Description

NRWP stakeholders are concerned about the threat illegal dumping continues to pose with regard to water quality. In 2003, TCEQ investigated the report of an oil sheen on the river. A diver discovered a tar bucket that was periodically releasing blobs of oil. The bucket was removed, but the diver commented that there were numerous other submerged items such as boats, cars, and refrigerators. The identification of these items and their removal was included in the SWPP as an issue that needs to be addressed. To address this concern, NRA has contracted with BRC to conduct a submerged debris evaluation within Nueces River Segment 2102's navigable reaches. Resulting data will be used for decision support, enabling watershed partners to make informed decisions relative to foreign debris contamination risk and/or removal.

Subtask 3.2 – Modeling and Data Analysis

The results of the modeling effort will be included in a technical report submitted to TSSWCB for inclusion in the Lower Nueces River WPP.

NRA will conduct data analysis that supports the development of a WPP by using geographical information of land use/land cover (LULC) data appropriate for SELECT. (The LULC data were downloaded from the US Department of Agriculture (USDA) Geospatial Data Gateway, http://datagateway.nrcs.usda.gov/, for another project.) The data analysis will also include development of FDCs and LDCs for estimating pollutant loading and load reduction requirements for each site.

Modeling and analysis of nitrates and *E. coli* will be conducted to assess the potential of the river becoming impaired for these parameters. Possible nitrate concerns are associated with fertilizers used for growing crops, and possible *E. coli* concerns are associated with faulty OSSFs.

Subtask 7.1 – Large Debris Evaluation

NRA has subcontracted with BRC to conduct an evaluation of the river to document large debris. BRC will conduct a reconnaissance survey of Nueces River Segment 2102, using standard hydrographic survey techniques. Side scan sonar has the ability to map the river bottom and produce imagery showing submerged debris, submerged structures, and bottom features such as riprap and rock that are otherwise unknown from other site investigations. BRC will determine the identity and spatial distribution of man-made debris. Side scan imagery will be acquired by running survey lines parallel to the shoreline. Bank to bank side scan imagery will be collected, where possible, within Nueces River Segment 2102's navigable reaches. Survey track lines will be spaced to provide the most complete coverage. Resulting side scan imagery will be used to locate and identify bottom features. Submerged objects assessed as man-made in origin will be georeferenced and cataloged.

The objective of this survey evaluation is to identify and map bottom features within Nueces River Segment 2102, determining the spatial distribution of man-made debris found within the river's navigable channel. This objective is centered on qualitative field data acquisition. Since data collection is achieved via bottom imaging (i.e. photographic technique), GIS is simply a more sensible platform for photographic interpretation given its ability to not only display, but spatially orient georeferenced imagery. As an added benefit, this capability as a viewing platform lends itself to mosaicing otherwise discrete representations of the field environment. A final deliverable of this project, a map, is no more (or less) than a georeferenced composite of qualitative observations representing. Based on this information, quantitative inferences may be ascribed with regard to environmental impact, risk potential, and remediation cost - an analysis to be carried out upon completion of this reconnaissance survey.

Evaluation results will be used to develop a Large Debris Removal Plan (LDRP). This decision support tool will allow the NRWP to make informed decisions relative to foreign debris contamination risk and/or removal and will ultimately incorporate the results into the WPP.

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Table A6-1. Project Plan Milestones

Task	Project Milestones	Agency	Start	End
2.1	Develop QAPP for Task 7.1	BRC	May 2013	Oct. 2013
2.2	NRA will implement the approved QAPP. NRA will provide revisions and necessary amendments to the QAPP	NRA	Nov. 2013	Sept. 2015
3.2	NRA will gather necessary data and information to develop LULC data and maps appropriate for potential source characterization using SELECT and will model flows appropriate for FDC and LDC development in the watershed and estimate Pollutant Load Reductions required for each site.	NRA	Dec. 2013	Jun. 2015
7.1	BRC will conduct an evaluation of the river to document large man-made debris Nueces River Segment 2102.	BRC	Dec. 2013	Feb. 2015

Model descriptions

SELECT – Spatially Explicit Load Enrichment Calculation Tool

A spatially-explicit tool, SELECT has been developed by the Spatial Sciences Laboratory (SSL) and Biological and Agricultural Engineering (BAEN) Department at Texas A&M University (TAMU) to calculate contaminant loads resulting from various sources within a watershed. SELECT spatially references the sources, and was developed under ArcGIS 9 environment. SELECT will calculate and allocate pathogen loading to a stream from various sources within a watershed. All loads will be spatially referenced. In order to allocate the *E. coli* load throughout the Lower Nueces River watershed, estimations of the source contributions will be made. This in turn allows the sources and locations to be ranked according to their potential contribution for each sub-watershed. The populations of agricultural animals, wildlife, and domestic pets will be calculated and distributed throughout each sub-watershed according to appropriate land use. Septic system contribution will also be estimated based on criteria including distance to a stream, soil type, failure rate, and age of system. The septic information will be derived from information collected for the OSSF inventory, Task 5 of the 12-05 Project Work Plan, being completed under the *Development of the Lower Nueces River Watershed Protection Plan On-Site Sewage Facility Inventory QAPP*. Once the watershed profile is developed for each potential source, the information can be aggregated to the sub-watershed level to identify the top contributing areas in the watershed.

LDC – Load duration Curve

This is a simple and an effective first-step methodology to obtain data-based TMDLs (Cleland, 2003; Stiles, 2001). A duration curve is a graph that illustrates the percentage of time during which a given parameter's value is equaled or exceeded. For example, an FDC uses the hydrograph of the observed stream flows to calculate and depict the percentage of time the flows are equaled or exceeded.

A LDC, which is related to the FDC, shows the corresponding relationship between the contaminant loadings and stream flow conditions at the monitoring site. In this manner, it assists in determining patterns in pollution loading (point sources, nonpoint sources, erosion, etc.) depending on the streamflow conditions. Based on the observed patterns, specific restoration plans can be implemented that target a particular kind of pollutant source. For example, if the pollutant loads exceed the allowable loads for low stream flow regimes, then the point sources such as waste water treatment plants and direct deposition sources (wildlife, livestock) should be targeted for the restoration plans. Another main advantage of the LDC method is that it can also be used to evaluate the current impairment as some percent of samples which exceed the standard, and therefore it allows for the rapid development of TMDLs (Stiles, 2001).

LULC – Landuse and Land Cover Classification

A LULC dataset for the Lower Nueces River watershed, developed for the 2013 CRP Basin Summary Report for the San Antonio-Nueces Coastal Basin, the Nueces River Basin, and the Nueces-Rio Grande Coastal Basin, will be used. The data were downloaded from the USDA Geospatial Data Gateway. The classification is intended to provide a rough classification of several types of cover. The LULC classification scheme to be used in this delineation will include:

<u>Barren Land</u> – (Rock/Sand/Clay) – Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover and includes transitional areas.

<u>Cultivated Crops</u> – Areas used for the production of annual crops, such as corn, soybeans, vegetables, and cotton, and also perennial woody crops such as orchards and vineyards. Crop

vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.

Deciduous Forest – Areas dominated by trees where 75% or more of the tree species shed foliage simultaneously in response to seasonal change.

Evergreen Forest – Areas dominated by trees where 75% or more of the tree species maintain their leaves all year. Canopy is never without green foliage.

Mixed Forest – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% but less than 50% of total vegetation cover.

Developed Open Space – Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.

Developed Low Intensity – Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49% of total cover. These areas most commonly include single-family housing units.

Developed Medium Intensity – Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79% of the total cover. These areas most commonly include single-family housing units.

Developed High Intensity – Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80-100% of the total cover.

Emergent Herbaceous Wetlands – Areas where perennial herbaceous vegetation accounts for 75-100% of the cover and the soil or substrate is periodically saturated with or covered with water.

Woody Wetlands – Areas where forest or shrubland vegetation accounts for 25-100% of the cover and the soil or substrate is periodically saturated with or covered with water.

Herbaceous – Areas dominated by upland grasses and forbs. In rare cases, herbaceous cover is less than 25%, but exceeds the combined cover of the woody species present. These areas are not subject to intensive management, but they are often utilized for grazing.

Hay/Pasture – Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.

Open Water – All areas of open water, generally with less than 25% cover of vegetation or soil.

Shrub/Scrub – Areas dominated by shrubs; shrub canopy accounts for 25-100% of the cover. Shrub cover is generally greater than 25% when tree cover is less than 25%. Shrub cover may be less than 25% in cases when the cover of other life forms (e.g. herbaceous or tree) is less than 25% and shrubs cover exceeds the cover of the other life forms.

Section A7: Quality Objectives and Criteria

The goal of these efforts is to support the development of a WPP for the Nueces River below Lake Corpus Christi by completing a side scan sonar reconnaissance evaluation of Nueces River Segment 2102, conduct a phased modeling effort to develop pollutant source and loading information and estimates of needed bacteria and nitrate reductions. .

Subtask 3.2 – Modeling and Data Analysis

The objectives of the water quality modeling for this project are as follows:

1) Develop and obtain approval for a QAPP.
2) Spatially characterize and rank sources of bacteria within the watershed using SELECT, a spatially-explicit GIS methodology. Divide the area into sub-watersheds and identify, quantify and rank pollutant loads from various sources, i.e. agriculture, urban/human, wildlife, and other sources in the study area.
3) Develop LDCs to analyze the temporal trends in the observed water quantity and quality data for the watershed. The LDCs will be developed using currently existing water quality from the TCEQ's Surface Water Quality Information System (SWQMIS) database. The FDCs will be developed using flow data available from USGS gauges 08211000, Nueces River near Mathis, 08211200, Nueces River at Bluntzer, and SWQMIS. Evaluate the violations and the required load-reductions of bacteria and nutrients for different flow-rate regimes (low, medium, and high flow) using the FDCs and LDCs.

SELECT **–** this approach was developed by the SSL and BAEN Department at TAMU. High quality spatial data (most recently available LULC data, soils data, hydrographic, etc) will be processed and utilized in the SELECT approach. Distributions for input parameters for SELECT will be created based on literature values and expert knowledge.

LDC **–** this approach has been utilized in several TMDL projects as an initial screening-tool to evaluate the actual temporal load trends in streams (Cleland, 2003; Stiles, 2001). In cases of violations, it is necessary to determine the required load-reduction in that region near the monitoring station. Load-reductions should be calculated for all flow-regimes of the stream. In order to do this continuous monitoring data will be simulated using the actual monitoring data by regression methods. Uncertainty of the model will be estimated via residual error analysis. The straight line passing through residual error plot should have a slope of zero.

LULC - this methodology will be used to develop accurate coverages of LULC layers specific to the Lower Nueces River watershed that will serve as an input to the SELECT model. Aerial imagery will be used to confirm land use types in the watershed.

Subtask 7.1 – Large Debris Evaluation
NRA has subcontracted with BRC to conduct an evaluation of the river to document large debris.

Where site conditions allow, BRC will determine the identity and spatial distribution of man-made debris within the navigable river channel. The information gained through this effort will be used to help stakeholders make informed decisions and support the development of the NRWP's LDRP and WPP.

Identification of man-made debris does not require quantitative documentation (defining an object dimension), but rather qualitative recognition. As an example and with regard to this project's goals, side scan reconnaissance imaging resolution is best characterized in terms of target definition - photographic agility – detail and contrast, rather than the standard of measured resolve (dimension). The side scanning sonar used for this task has a maximum range of 600 feet/183 meters side to side of high resolution coverage. Target separation for this unit is 1.5" (38.1 mm). With variable band width, its 455 kHZ allows wider swaths of data capture in deep water, where its 800 kHz in shallows permits a higher spatial resolution as well as contrast. The agility afforded by the Lowrance HDS Gen2 is more than adequate to achieve quality objectives under a variety of conditions. In-situ conditions will be considered to achieve optimal configuration.

Data obtained using this system will meet data needs presented in Section A6. After data processing, the completeness of final data (i.e., side scan sonar coverage) will be evaluated in consultation with NRA to determine if there are data gaps requiring alternative surveying methods. The overall DQO for this subtask is to develop and implement procedures ensuring representative data of known, acceptable, and defensible quality.

Precision
The measure of agreement among repeated measurements - for target detection and identification, the degree to which overlapping side scan data sets confirm the same georeferenced data will be assessed.

Accuracy
The accuracy or ability of the side scan sonar to detect a given size object is dependent on a number of factors, including the material type, size, and shape of the object, refraction, noise, biological interference, boat wakes, surface reflections, and transducer/skimmer stability. On a homogeneous bottom type, shadow zones or lighter areas (or darker areas for digital reverse image display) on the sonar record are typically a function of the amount of ensonification an area receives. A shadow zone in front (towards the vessel) of a strong reflector indicates a depression in the riverbed. A shadow zone behind (away from the vessel) of a strong reflector indicates a rise in the riverbed.

The position horizontal accuracy is 3 ft at a 95% confidence level. This accuracy level meets the minimum performance standards for soft bottom material navigation and dredging support surveys in the US Army Corps of Engineers (USACE) hydrographic surveying engineering manual (USACE 2002), and further described in Section B2 (Positioning).

Representativeness
The overall degree to which sonograms (bottom images) appropriately reveal submerged debris.

Completeness
Considerable effort will be made to acquire bank-to-bank sonar coverage. In areas requiring multiple passes, 150% coverage is planned providing images at nadir and sufficient resolution in the outer ranges of the survey. The following factors will affect the ability to collect bank-to-bank data: 1) satellite geometry (the number of satellites and their location will impact the accuracy of global positioning system [GPS] data), 2) obstructions along the shoreline such as docks, tree stumps, or pilings (which may restrict vessel operations or restrict bottom imaging), and 3) bank slope (a long shallow bank will not be mapped as close to shore as a steep bank). It is expected that there will be data gaps that cannot be avoided, such as those caused by obstructions or shallow areas. Therefore, it will be a general goal of the project that 90% data completion is achieved.

Section A8: Special Training Requirements/Certification

Subtask 3.2 – Modeling and Data Analysis

Watershed Modeling

All personnel involved in model calibration, validation, and development will have the appropriate education and training required to adequately perform their duties. No special certifications are required.

LULC Classification

No special certifications are required. However, all personnel involved in classification of LULC will have the appropriate education and training required to adequately perform their duties.

Subtask 7.1 – Large Debris Evaluation

BRC staff involved in side scan sonar data collection have received the appropriate education and training required to adequately perform their duties. BRC staff have frequently used the side scan sonar unit for river and reservoir research. No special certifications are required, except that personnel involved in the use of sonar and Differential Global Positioning System (DGPS) instruments have training and/or expertise regarding their appropriate use.

Section A9: Documentation and Records

Subtask 3.2 – Modeling and Data Analysis

All records, including modeler's notebooks and electronic files, will be archived by NRA for at least five years. These records will document model testing, calibration, and evaluation and will include documentation of written rationale for selection of models, record of code verification (hand-calculation checks, comparison to other models), source of historical data, and source of new theory, calibration and sensitivity analyses results, and documentation of adjustments to parameter values due to calibration. Electronic data on the project computer are backed up daily to the primary network drive. The network drive is backed up monthly to a secondary/redundant network drive and to CD. In the event of a catastrophic systems failure of the project computer, the primary network drive can be used to restore the data in less than one day's time. Data generated on the day of the failure may be lost, but can be reproduced from raw data in most cases. In the event of a catastrophic systems failure of the primary network drive, project data on the secondary network drive will be brought up to date with the information on the project computer.

Subtask 7.1 – Large Debris Evaluation

Side scan imagery will be saved to an SD memory card during debris evaluation. Periodically, sonar data will be transferred to an external hard drive via laptop computer. Once complete, raw survey data will be saved to the BRC hydrographic analyst's PC for analysis. An additional copy of raw data will be saved to a BRC network server (for backup redundancy). Once data is post-processed, geometrically and radiometrically corrected imagery will be annotated, and exported as tagged image file format (TIFF) imagery. Exported images will include: discrete imagery, mosaiced tiles, and a master (all-in-one) image. Processed imagery will then be imported to a GIS for further analysis, annotation, target geo-database generation, and final map production - all data layers, and finished map products will be backed up in the manner previously described. Finished raster images, data layers, and map products will be projected in North American Datum (NAD) 83, and referenced to State Plane TX–S. Central.
The following product and information will be provided:

- Master or coverage area map depicting side scan sonar coverage and reconnaissance area maps
- Electronic versions of data products, which will include PDF files for field records and documentation, ArcGIS shapefiles and georeferenced TIFF imagery
- Field records of the quality checks (position)
- Documentation/identification of QC issues

The project data will be provided to NRA and subsequently to TSSWCB and EPA for review.

BRC will keep all data generated for the large debris evaluation for a minimum of five years. Electronic data on the project computers and the network server are backed up daily to the network drive. All data and final summary of findings will be copied to CD-ROM (Read Only Memory) discs upon completion of this subtask and provided to NRA.

Quarterly progress reports will note activities conducted in connection with the modeling and data analysis and large debris evaluation, items or areas identified as potential problems, and any variations or supplements to the QAPP.

A final summary of findings for all subtasks will be submitted to the established stakeholders by the NRA and utilized in the development of the LDRP and WPP development.

Corrective Action Reports (CARs) will be utilized when necessary (Appendix A). CARs document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress report and will be maintained in an accessible location for reference at NRA. CARs resulting in any changes or variations from the QAPP will be made known to pertinent project personnel and documented in updates or amendments to the QAPP. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

Table A9-1 Project Documents and Records

Document/Record	**Location**	**Retention**	**Form**
QAPP, amendments, and appendices	NRA	5 years	Paper/Electronic
QAPP distribution documentation	NRA	5 years	Paper/Electronic
Corrective Action Reports (CARs)	NRA	5 years	Paper/Electronic
Modeler Notebooks	NRA	5 years	Paper/Electronic
Model Input Data Files	NRA	5 years	Electronic
Model Calibration Documentation	NRA	5 years	Paper/Electronic
Model Validation Documentation	NRA	5 years	Paper/Electronic
Model Output	NRA	5 years	Paper/Electronic
Progress reports/ Final Reports	NRA/TSSWCB	5 years	Paper/Electronic

TSSWCB may elect to take possession of records at the conclusion of the specified retention period.

Digital files of LULC data will be produced in shapefile or ArcGIS grid format and stored on CD-ROM disks. Multi-color hard copy maps of land cover can be produced at various geographic scales from these digital files. The side sonar survey inputs and outputs will be delivered to the TSSWCB as requested.

QAPP Amendments

Amendments to the QAPP may be necessary to reflect changes in project organization, tasks, schedules, objectives and methods; address deficiencies and non-conformances; improve operational efficiency; and/or accommodate unique or unanticipated circumstances. Requests for amendments are directed from the NRA PM to the TSSWCB PM in writing. The changes are effective immediately upon approval by the TSSWCB PM and QAO, or their designees, and the EPA PO. Amendments to the QAPP and the reasons for the changes will be documented and distributed to all individuals on the QAPP distribution list by the NRA PM. Amendments shall be reviewed, approved, and incorporated into a revised QAPP during the annual revision process.

QAPP Revisions

This QAPP shall be revised as necessary and reissued annually on the anniversary date, or revised and reissued within 120 days of significant changes, whichever is sooner. The last approved version of the QAPP shall remain in effect until a revised version has been fully approved by the TSSWCB PM and QAO and the EPA PO; the revision must be submitted to the TSSWCB for approval before the last approved version has expired. If the entire QAPP is current, valid, and accurately reflects the project goals and the organization's policy, the annual re-issuance may be done by a certification that the plan is current. This can be accomplished by submitting a cover letter stating the status of the QAPP and a copy of new, signed approval pages for the QAPP.

Section B1: Sampling Process Design (Experimental Design)

Subtask 3.2 – Modeling and Data Analysis

Watershed Modeling
Not relevant.

LULC Classification
Not relevant.

Subtask 7.1 – Large Debris Evaluation

The large debris evaluation will be conducted using side scan sonar. Side scan sonar is a specialized system for detecting objects on the seafloor, lake-bottom, or riverbed. This technology gives a picture-like view of the water around and under a boat. The side scan, like other sonar, sends out sound energy and analyzes the return signal (echo) that has bounced off the bottom or from other objects. The transmitted energy has a fan-shape form that sweeps the bottom from directly beneath the transducer to either side. The strength of the return echo is continuously recorded, creating an image or picture of bottom features. A side scan sonar image is produced one line of data at a time. Natural or human-made submerged objects that lie on the bottom create a darker image (strong return) and shadows from these objects are light areas with little or no return.

Data collection will begin at the uppermost portion of Nueces River Segment 2102 (at Lake Corpus Christi Dam), proceeding downstream to the salt water barrier dam, until all navigable sections of Nueces River Segment 2102 have been sufficiently imaged. Side scan imagery will be acquired by running survey lines parallel to the shoreline. Bank to bank side scan imagery will be collected, where possible, within Nueces River Segment 2102's navigable reaches. Survey track lines will be spaced to provide the most complete coverage; spacing will be determined in-situ (all efforts will be made to achieve survey objectives outlined in section B2. Resulting side scan imagery will be used to locate and identify bottom features. Submerged objects assessed as man-made in origin will be georeferenced and cataloged.

The horizontal datum for this survey is North American Datum of 1983 (NAD83). In addition, any software used on the reconnaissance survey/evaluation will contain the correct datum parameters. All positions/data points will be referenced to State Plane TX–S. Central.

Section B2: Data Collection Methods

Subtask 3.2 – Modeling and Data Analysis

Watershed Modeling
Not relevant.

LULC Classification
NRA used existing online aerial imagery and data from the USDA Geospatial Data Gateway to define LULC polygons in the development of the 2013 CRP Basin Summary Report. The geographic location of the polygons is known and is matched to the same location on the imagery.

Subtask 7.1 – Large Debris Evaluation
This section describes the survey vessel and crew, positioning, and acquisition of side scan data.

Survey vessel and crew
The survey vessel will be a 16-foot tunnel hull skiff operated by BRC personnel. This vessel is equipped with an integrated navigation and data acquisition system and is ideal for shallow-water survey operations. The hydrographic survey crew will consist of a lead hydrographer and an assistant from BRC.

Positioning
Horizontal positions will be acquired with a Trimble® differential global positioning system DGPS. DGPS refers to the particular technique of differential GPS techniques whereby reference receiver-satellite pseudo range corrections observed at the control point(s) are used to improve the imprecise pseudo range observations made elsewhere in real time. This system improves horizontal positioning accuracy to better than 0.5 m (1.6 ft). DGPS is the primary horizontal positioning technique used in the National Oceanic and Atmospheric Administration (NOAA) hydrographic surveys for nautical charting where meter-level positioning uncertainty is acceptable. Position data will be used in real-time to provide navigation information to the vessel operator. The helmsman will be presented with a plan view of the evaluation area with the vessel position and track.

Side Scan Data Collection (Bottom Imaging)
The large debris evaluation of Nueces River Segment 2102 will collect georeferenced side scan imagery. Side scan data will be collected using a Lowrance High Definition System (HDS) Generation 2 (Gen2) Sonar equipped with StructureScan. Using frequencies of 50, 200, 455 and 800 kHz, sonar data will be collected by running lines parallel to the shoreline. During the evaluation, side scan and down scan imagery will be displayed in real-time on the HDS display, showing the coverage and agreement between adjacent survey tracks. In areas where complete coverage cannot be achieved with one pass, multiple passes will be performed and spaced appropriately – while achieving a minimum 60% overlap. Confidence checks will be conducted concurrent with image acquisition, and at post-processing, comparing

images in overlapping tiles, confirming side scan and down scan image agreement.

The side scan sonar acquisition system will be used to replay the survey so that the coverage and quality of the data can be reviewed prior to demobilization from the site. As necessary, screen grabs depicting survey coverage may be forwarded to NRA for review; however, coverage maps are preliminary and some data gaps may not become apparent until after data processing.

Section B3: Sample Handling and Custody Requirements

Subtask 3.2 – Modeling and Data Analysis

Watershed Modeling
Not relevant.

LULC Classification
Not relevant.

Subtask 7.1 – Large Debris Evaluation
No physical samples will be collected as part of this evaluation. All location and depth data will be logged automatically in real-time. Confidence check results and associated field notes will be logged electronically through the side scan system/s display interface and transferred to electronic format.

Section B4: Analytical Methods

Subtask 3.2 – Modeling and Data Analysis

Watershed Modeling
Not relevant.

LULC Classification
The LULC data from the USDA Geospatial Data Gateway were clipped to the Lower Nueces River watershed boundary in order to create a GIS layer specific to the watershed.

Subtask 7.1 – Large Debris Evaluation
Post-processing of side scan sonar imagery will be conducted utilizing SonarTRX. SonarTRX sidescan sonar software allows for viewing, extraction of bathymetric raw-data, and generation of map-images (geo-referenced images) of the river bottom from side scan sonar recordings.

Geo-referenced images created by SonarTRX will be viewed and annotated with Google Earth using Keyhole Markup Language (KML), or they can be imported to other mapping and GIS programs for further processing. The use of KML files to reference the images allows for low cost sharing of side scan image-tiles by simply distributing the KML files and uploading the associated images to any web-server.

SonarTRX will be used to import and process side scan sonar recordings from the side scan sonar. It will be used to view side scan sonar data, define targets and named "clips" of data (time-interval, containing interesting data). Geo-referenced image-tiles will be generated, as well as track lines, coverage area polygons and target placemarks. Image-tiles will be merged into larger geo-referenced "master-images”. Finished side scan sonar data will then be used to produce maps by loading geometrically and radiometrically corrected output images into ESRI mapping software. Work performed within GIS is limited to imagery display, further notation/cataloging of debris location, mosaicing of imagery when necessary, and post production (map-making).

Section B5: Quality Control Requirements

Subtask 3.2 – Modeling and Data Analysis
Watershed Modeling
Not relevant.

LULC Classification
Cross referencing the LULC data from the USDA Geospatial Data Gateway with online aerial imagery will serve as a QC check.

Subtask 7.1 – Large Debris Evaluation
In general, there are two classifications of side scan sonar coverage: complete and reconnaissance coverage. Reconnaissance coverage refers to range of coverage overlap requirements below the minimum specified for complete coverage, and are used to obtain hydrographic data for applications other than nautical charting (e.g. navigational safety, operational planning, and research). Quality control requirements will be implemented by way of the following methods.

The acquisition system and survey protocols are designed with some redundancy to demonstrate that the required accuracy is being achieved during the survey and to provide a backup to primary systems. Data integrity will be monitored throughout the survey by redundant system comparisons and checks against known values.

Side Scan Data Acquisition: Since side scan transducers are angled, most traditional side scanning sonar systems have a "data blind" area to each side of the nadir, the center line of the direction of travel; this means that full coverage of river-bottom requires ensonified swaths overlap by at least 50% to achieve 100% coverage. Although a reconnaissance survey/debris evaluation non-requisite, all reasonable efforts will be made regarding evaluation thoroughness. To this end, forward looking (down scan) sonar will be utilized while traversing survey route, making possible real-time nadir imaging.

The down scan transducer will be operated at a frequency of 200 kHz. Channel condition may require alternate use of an optional 83 kHz bandwidth, particularly in areas where aquatic vegetation makes bottom tracking difficult due to sonar penetration. This dual frequency transducer is responsible for determining depth of water column. Sides scanning elements operate on one of two optional frequencies - 455 kHz or 800 kHz - the latter of which provide optimal side imaging resolution in shallow water conditions. A slight angling of transducer elements provides for bottom imaging left and right of the vessel, while the downward looking element provides a vertical perspective covering nadir, and aiding in target/structure identification. Where sonar range is restricted (insufficient depth to achieve bank to bank coverage), additional transects will be scheduled to achieve a minimum 60% overlap.

Following the field evaluation, all side scan data will be processed as procedurally required to compensate for various geometric and radiometric distortions. As well, certain aspects of raw survey data may require adjustment/correction in order to reconcile any circumstantial or systematic errors. Side scan post-processing software will be utilized for beam angle (slant range) and altitude correction, adjustment of offsets, and integration of external positioning data as necessary.

Positioning: The positioning system will be configured such that satellites below 8 degrees above the horizon will not be used in position computations. Further, the age of pseudo-range correctors used in position computation will not exceed 20 seconds. Horizontal Dilution of Precision will be monitored and recorded, and will not exceed 2.5 nominally. A minimum of four satellites will be used to compute all positions, and horizontal and vertical offsets between the GPS antenna and transducer(s) will be observed and applied in no coarser than 0.1 m increments. Positions will be recorded and archived in NAD83 Coordinate System. A position confidence check will be conducted daily through standard static techniques. Surveyed values will be reviewed to assure target horizontal accuracy is achieved.

Raster Image Analysis: Side scan imagery will be geometrically and radiometrically corrected for georeferencing, providing a means to review overlap and consistency as related river channel plan form agreement, as well as target identity and location.

Section B6: Equipment Testing, Inspection, & Maintenance Requirements

Subtask 3.2 – Modeling and Data Analysis

Watershed Modeling
Not relevant.

LULC Classification
Not relevant.

Subtask 7.1 – Large Debris Evaluation
Prior to mobilization, the survey vessel and equipment will be inspected and confirmed to be in operating order according to manufacturer's specifications. The vessel is inspected and maintained daily by BRC staff.

During mobilization, instrumentation will be tested and system performance testing will be conducted. Horizontal position confidence check and sonar transceiver operability will be assessed respectively.

Section B7: Instrument Calibration and Frequency

Subtask 3.2 – Modeling and Data Analysis

Watershed Modeling
Not relevant.

LULC Classification
Not relevant.

Subtask 7.1 – Large Debris Evaluation

Sonar calibration: A bar check will be conducted prior to and following completion of each day's reconnaissance survey to confirm survey depth, and transducer draft below the water line. A sound reflecting target will be lowered below the down scan transducer to specific intervals below the water surface using calibrated marks on the steel measuring tape. As necessary, to compensate for changes in vessel draft (loading differences), keel offset will be adjusted to compensate until actual depth of water column is achieved. Sonar draft and bar check measurements will be observed with the vessel trimmed to zero roll angle.

Geographic Positioning System:
Although no calibration of GPS is necessary, a position confidence check will be conducted daily through standard static techniques. Surveyed values will be reviewed to assure target horizontal accuracy is achieved.

Section B8: Inspection/Acceptance Requirements for Supplies and Consumables

Subtask 3.2 – Modeling and Data Analysis

Watershed Modeling
Not relevant.

LULC Classification
Not relevant.

Subtask 7.1 – Large Debris Evaluation
No significant consumables are required because all data are digitally recorded. The survey vessel is equipped with survey log forms for any additional survey documentation and a supply of recordable/rewritable SD cards.

Section B9: Data Acquisition Requirements (Non-direct Measurements)

Subtask 3.2 – Modeling and Data Analysis

SELECT and LDC Analyses

Water quality data available from SWQMIS will be used to conduct the SELECT (*E. coli* only) and LDC (*E. coli* and nutrient) analyses.

GIS data to be used will be the latest USDA soils data and USGS hydrographic data available. Imagery to be used will be the latest Google Earth imagery available.

All data used in the modeling procedures for this project were collected in accordance with CRP, TCEQ, USDA, and/or USGS approved quality assurance measures.

LULC Classification

GIS data to be used will be the latest USDA LULC data available.

Subtask 7.1 – Large Debris Evaluation

The horizontal control survey will be based on standard static control techniques. Position verification of the GPS will be performed by logging redundant coordinates over a stationary point. Collectively, average of collected coordinates will be no less than the 95% confidence standard (>3ft).

Section B10: Data Management

Subtask 3.2 – Modeling and Data Analysis

Systems Design

NRA uses personal and network computers. The computers run Windows 7 Professional and Windows XP operating systems, respectively. Software includes Microsoft® Word, Microsoft® Excel, Microsoft® Access, and MySQL. All GIS analysis will be performed using ArcGIS 10x.

Backup and Disaster Recovery

Electronic data on the project computer are backed up daily to the primary network drive. The network drive is backed up monthly to a secondary/redundant network drive and to CD-ROM. In the event of a catastrophic systems failure of the project computer, the primary network drive can be used to restore the data in less than one day's time. Data generated on the day of the failure may be lost, but can be reproduced from raw data in most cases. In the event of a catastrophic systems failure of the primary network drive, project data on the secondary network drive will be brought up to date with the information on the project computer.

Archives and Data Retention

Electronic and paper files will be stored for at least five years. All information will be copied to CD-ROM after the task is complete and stored in a fireproof safe at NRA.

Subtask 7.1 – Large Debris Evaluation

Backup and Disaster Recovery

Data from the survey vessel will be acquired using a Lowrance HDS12 Gen2 with Structurescan. Captured data will be transferred via HD card to laptop computer running Windows XP. Transfer of data will allow backing up of said data to CD-RW (Rewritable) at the end of each survey day. Data will not be removed from HD cards or laptop (transfer mechanism) until they have been loaded and verified to backup hard drive on desktop computer at BRC. At that time, a duplicate working data-set will be created for post processing within SonarTRX, and ESRI's ArcGIS 9.3. Altered files are backed up to disk daily, with full backups to CD-RW weekly along with offsite storage. At the completion of the project, data are archived on two sets of CD-RW, and archived in two separate locations.

Archives and Data Retention

Original data recorded on paper files are stored for at least five years. Data in electronic format are stored on hard drives and CD-RW in a climate controlled room at BRC.

Section C1: Assessments and Response Actions

Table C1-1 presents the types of assessments and response actions for activities applicable to the QAPP.

Table C1-1 Assessments and Response Actions

Assessment Activity	Approximate Schedule	Responsible Party(ies)	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	NRA	Monitoring of the project status and records to ensure requirements are being fulfilled. Monitoring and review of performance and data quality.	Report to project lead in Quarterly Report
Technical Systems Audit	Minimum of one during the course of this project.	TSSWCB QAO	The assessment will be tailored in accordance with objectives needed to assure compliance with the QAPP. Facility review and data management as they relate to the project.	30 days to respond in writing to the TSSWCB QAO to address corrective actions

Project deliverables will be quality controlled by the TSSWCB PM in-house review. The TSSWCB PM will maintain overall responsibility for examining NRA's and BRC's work to ensure methodologies and processes are consistent with the procedures outlined in this QAPP. All project deliverables, maps, supporting digital information, etc. will be submitted by NRA to TSSWCB.

The TSSWCB QAO (or designee) may conduct an audit of the technical systems activities for this project as needed. The NRA PM will have the responsibility for initiating and implementing response actions associated with findings identified during the on-site audit. Once the response actions have been implemented, the TSSWCB QAO (or designee) may perform a follow-up audit to verify and document that the response actions were implemented effectively. Records of audit findings and corrective actions are maintained by the TSSWCB PM and NRA PM. Corrective action documentation will be submitted to the TSSWCB PM within 30 days of receiving audit findings. If audit findings and corrective actions cannot be resolved, then the authority and responsibility for terminating work is specified in agreements or contracts between participating organizations.

Section C2: Reports to Management

Quarterly progress reports developed by the NRA PM will note activities conducted in connection with modeling and data analysis and the large debris evaluation, items or areas identified as potential problems, and any variations or supplements to the QAPP. Quarterly progress reports will be submitted to the TSSWCB PM. CAR forms will be utilized when necessary (Appendix A). CARs will be maintained in an accessible location for reference at NRA. CARs that result in any changes or variations from the QAPP will be made known to pertinent project personnel and documented in an update or amendment to the QAPP.

If the procedures and guidelines established in this QAPP are not successful, corrective action is required to ensure that conditions adverse to quality data are identified promptly and corrected as soon as possible and will be reported to the NRA PM and TSSWCB PM immediately both verbally and in writing. Corrective actions include identification of root causes of problems and successful correction of identified problem. CARs will be filled out to document the problems and the remedial action taken. Copies of CARs will be included in quarterly progress reports. Following any audit performed, a report of findings, recommendations and responses are sent to the TSSWCB PM in the quarterly progress report.

A summary of findings will be developed detailing the results of the large debris evaluation. Items in this report will include a very brief description of methodologies utilized and assumed initial conditions, a detailed narrative regarding specific findings and a discussion/conclusions section that highlights the implications of these findings. The summary will also include a discussion as to how the findings will be used to complete the WPP and implement identified BMPs and post WPP activities.

Section D1: Data Review, Validation and Verification

All data obtained will be reviewed, validated, and verified against the data quality objects outlined in Section A7, "Quality Objectives and Criteria." Only those data that are supported by appropriate QC will be considered acceptable for use.

The procedures for verification and validation are described in Section D2, below. The NRA PM is responsible for validating that all data collected meet the DQOs of the project and are suitable for reporting.

Section D2: Validation Methods

Subtask 3.2 – Modeling and Data Analysis

SELECT and LDC Analyses

There is no validation and calibration for the SELECT model or LDC as they are data processors.

LULC Classification

Aerial imagery will be used to confirm land use types in the watershed.

Subtask 7.1 – Large Debris Evaluation

Data will be reviewed and validated by confirming overlapping side scan image agreement. Additionally, target identification will be evaluated through comparison of ensonified subsurface targets and inspection of those targets (where recoverable).

Section D3: Reconciliation with User Requirements

Subtask 3.2 – Modeling and Data Analysis

SELECT and LDC Analyses

The SELECT modeling framework developed for this project will be used to evaluate bacteria loading in the Lower Nueces River watershed. It will provide information pertaining to watershed characteristics and to the prediction of possible pollution, the sources of this pollution and will provide critical information to assist in identifying management practices to prevent pollution loading in area streams. This, in turn, will be useful for incorporation in the WPP being developed under TSSWCB Project 12-05.

The LDC framework utilized for this project will be used to evaluate bacteria and nutrient loading in relation to flow regimes in the Lower Nueces River. This approach will utilize flow predictions generated by FDCs and pair them with real bacteria and nutrient water quality data to illustrate times when loadings exceed standards. These analyses will aid in targeting water quality BMP recommendations to the most likely areas of bacteria and nutrient loadings.

LULC Classification

The LULC map will be provided to the TSSWCB PM for review to insure that it meets the goals for this project.

These data, and data collected by other organizations, will subsequently be analyzed and used for watershed assessment, watershed plan development, and modeling activities. Thus, data which do not meet requirements will not be submitted to the TSSWCB nor will be considered appropriate for any of the uses noted above.

Subtask 7.1 – Large Debris Evaluation

The results of the large debris evaluation will be incorporated into the WPP and used in the development of the LDRP, a management plan for removal. The LDRP will also address if water quality sampling, in addition to the routine CRP monitoring, should be conducted. DQOs for accuracy will be achieved by meeting the target horizontal accuracy at a 95% confidence level for the large debris evaluation. Methods outlined in Sections B5 will verify that the target accuracies are being obtained. Data will be evaluated real time, procedurally replaced via revisiting questionable data/transects, or culled and excluded. Other data quality indicators, including accuracy, completeness, representativeness, and precision, will be evaluated with a post-processing software and within ArcGIS.

Final review by the BRC hydrographic surveyor will include the evaluation of coverage, targets, and identifying any anomalies/artifacts that may result from system bias.

BRC and NRA will maintain open lines of communication, providing opportunities for review and identification of data gaps. BRC and NRA will discuss and, as necessary, implement appropriate measures to insure deliverables meet acceptable performance standards/expectations. All data will be retained and archived with original datasets.

References

Cleland, B. 2003. TMDL Development from the "bottom up" – Part III: Duration Curves and wet-weather assessments. America's Clean Water Foundation, Washington, DC.

Stiles, T.C., 2001. A simple method to define bacteria TMDLs in Kansas. KS Dept. of Health and Environment. Topeka, KS. http://www.wef.org/pdffiles/TMDL/Stiles.pdf (last accessed, 9/12/2006).

APPENDIX A

Corrective Action Report

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Corrective Action Report
SOP-QA-001
CAR #:______________

Date:_____________________ Area/Location:______________________

Reported by:_____________________ Activity:___________________________

State the nature of the problem, nonconformance or out-of-control situation:
____
____
____
____
____

Possible causes:
____
____
____

Recommended Corrective Actions:
____
____
____

CAR routed to:__________________________________
Received by:____________________________________

Corrective Actions taken:
____
____
____
____

Has problem been corrected?: YES NO

Immediate Supervisor:________________________________

Program Manager:____________________________________

NRA Quality Assurance Officer:______________________________

TSSWCB Quality Assurance Officer:____________________________