LOUISIANA'S BEACH PROGRAM

QUALITY ASSURANCE PROJECT PLAN

Submitted to U.S. Environmental Protection Agency
In Partial Fulfillment of Federal Assistance Agreement Number CU-00F09801-0
for Development of Coastal Recreation Water Monitoring and Public Notification

Louisiana Department of Health and Hospitals

Office of Public Health

628 North 4th Street
Baton Rouge, Louisiana 70821

January 2011

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Bienville Building
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A4. Project/Task Organization

Project organization is outlined in Figure A4.1. The Louisiana Department of Health and Hospitals (LDHH), Office of Public Health (OPH) personnel will be responsible for maintaining the quality assurance/quality control (QA/QC) requirements of all field data collection, laboratory analyses, and data management/reporting. Project responsibilities for key project personnel include:

- Louisiana BEACH Program Manager/ Quality Assurance Officer (Mr. Gordon Leblanc) - has the responsibility and authority to direct all aspects of program implementation, and is the final authority determining when resampling and advisories are warranted. The Louisiana BEACH Program Manager serves as the program's QA officer and provides oversight for the implementation of the quality assurance project plan (QAPP). The Louisiana BEACH Program Manager will communicate with the U.S. Environmental Protection Agency's (USEPA) Technical Project Manager and the Project Officer to ensure that data generated by the program meet USEPA requirements and will provide adequate documentation that the program is achieving its QA/QC standards. At a minimum, the Program Manager will audit the program annually to document that the program's data quality goals are being met. The BEACH Program Manager will also be the program's primary point of contact, except as he otherwise designates, and will be responsible for submitting all data and required reports to USEPA

- Field Activities Manager (Mr. Chris Lemaire) – is responsible for 1) ensuring that all field data collection personnel are adequately trained to collect data in accordance with the standard operation procedures (SOP), 2) ensuring that data are collected consistently among field personnel in order to limit observer effects, and 3) oversight of all field operations to ensure on schedule completion of assigned fieldwork with strict adherence to SOPs. The Field Activity Manager will immediately report any failure to fully meet SOP requirements to the Louisiana BEACH Program Manager.

- Laboratory Activities Manager (Dr. Stephen Martin) – is responsible for 1) overseeing laboratory analyses of water samples 2) data processing duties related to the parameters analyzed by the laboratory under this program, 3) ensuring that the QA/QC procedures that have been established by the laboratory for those parameters and the guidelines of this QAPP are followed, and 4) ensuring that analytical tests are performed in accordance with approved methods. The Laboratory Activities Manager will immediately report to the Louisiana BEACH Program Manager any failure to meet any of the laboratory's QA/QC guidelines that pertain to analyses conducted for this program. All laboratory analyses conducted under this program will be performed under the supervision of the Laboratory Activities Manager.

- Data Manager (Mr. Chris Lemaire) – is responsible for 1) ensuring that all data collected by the program are entered into the program's Database accurately and timely 2) conducting database administrative functions, including correction of historic data, maintaining periodic backups of the database, processing all statistical/classification

analyses, and 3) notifying the appropriate persons when follow up actions or advisories are indicated by statistical/classification analyses. The Data Manager will also be responsible for reporting all data collected under this program to USEPA in a timely fashion.

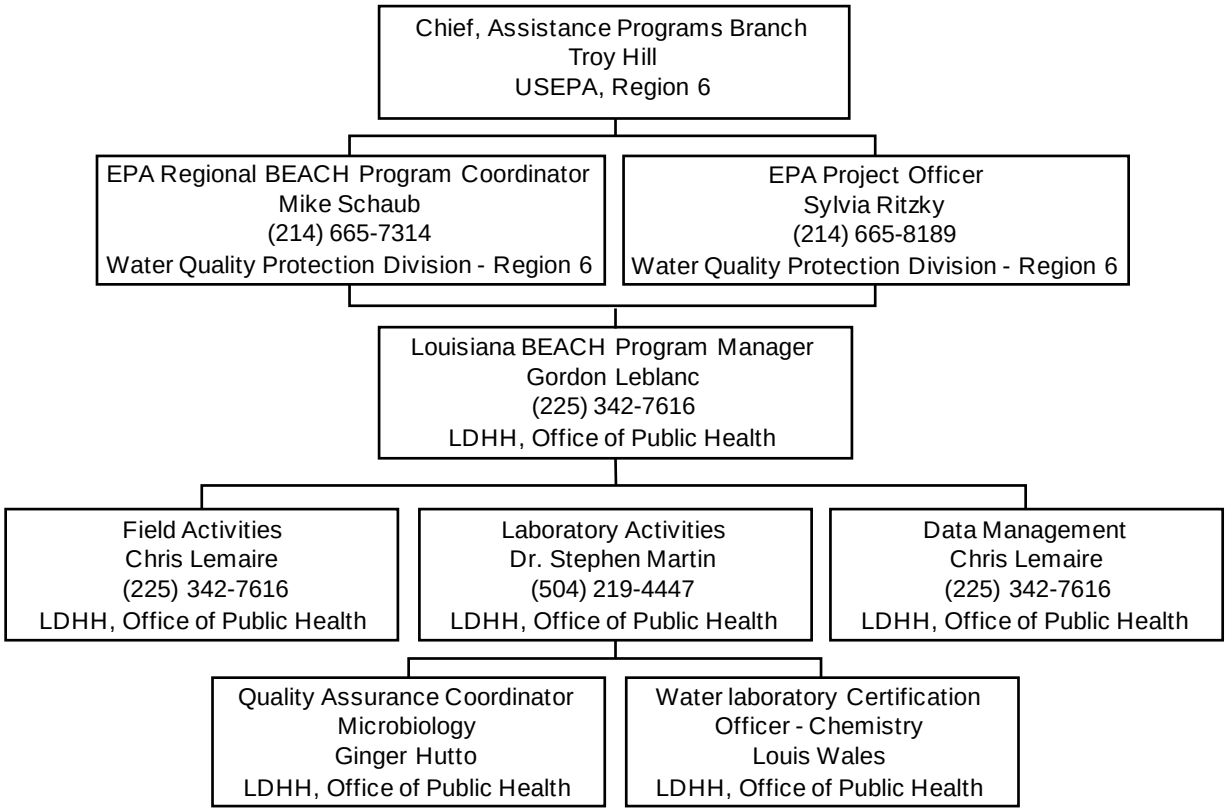

Figure A4.1. Project organization chart.

A5. Problem Definition and Background

The Beaches Environmental Assessment, Closure, and Health (BEACH) grant program was initiated by USEPA in 1997 in response to the growing concern about public health risks posed by polluted bathing beaches. USEPA established this national program to protect public health at our nation's beaches and to ensure timely notification of the public when they may be at risk of illness due to contact with polluted waters. The BEACH Act, passed on October 10, 2000, as an amendment to the Clean Water Act (CWA), provides states and tribal authorities with funding and guidance to establish statewide/tribal lands BEACH Programs to determine pathogen indicator densities in coastal recreation waters, and to advise the public of those densities and the associated risk of primary contact activities in those waters (USEPA 2002a). Responsibility for developing and implementing Louisiana's BEACH Program was assigned by the State of Louisiana to LDHH in 2002. With funding from USEPA, LDHH has developed a coastal recreational waters monitoring and public notification program, known as Louisiana's BEACH

Program, which is described in *Louisiana's BEACH Grant Final Report, Grant Year 2001* ("Beach Report"; LDHH 2003). The Beach Report identifies beach sites located in Louisiana's coastal recreation waters, identifies water quality issues for each beach site, and describes how Louisiana will implement the program.

This QAPP defines the objectives of the sampling program, as well as methods, organization, and quality management activities necessary to meet program goals prior to initiating sample collection, and was prepared in accordance with *EPA Guidance For Quality Assurance Project Plans* (USEPA 1998). This QAPP also fulfills USEPA's requirement that an approved QAPP that addresses and implements the specifications in *Requirements for QA Project Plans for Environmental Data Operations* (USEPA QA/R-5) be in place prior to collection of environmental data. LDHH will be the principal data user/decisions maker under Louisiana's BEACH Program, and is responsible for the preparation of this QAPP.

Typically a QAPP is prepared to ensure that data collected for a designed experiment or observational study are adequate to address the study's hypotheses. However, in this case, LDHH has accepted USEPA's guidance, which is detailed in *National Beach Guidance and Required Performance Criteria for Grants* (USEPA 2002a), in the development of Louisiana's BEACH Program, augmented by Louisiana's existing administrative code requirements pertaining to water quality monitoring of waters used for primary contact recreation. LDHH has fully adopted USEPA's guidance for establishing sampling locations, sampling intervals, sampling methods, sampled indicator organism, and statistical decision rules and estimated sampling variability. USEPA's guidance has been merged with Louisiana's existing primary contact decision rule to produce a unified sampling program and decision process.

A6. Project/Task Description and Schedule

The objectives of Louisiana's BEACH Program are to:

1. Collect data representative of the water quality conditions at monitored beaches that are of sufficient accuracy and quantity to make correct and timely assessments in accordance with the standards described in the Beach Report.
2. Use the monitoring data to assess water quality conditions at high and moderate risk beaches weekly during the period that the beaches are used for primary contact recreation.
3. Provide the results of those assessments to the public in a timely fashion in order that they may make informed decisions about the risk of participating in primary contact recreation at designated beach sites.

To develop a program that meets those objectives, Louisiana has delineated its coastal recreation waters, identified beaches within those waters that are regularly used by the public for primary contact recreation, and ranked each beach using a risk-based classification process (see Chapter 2 of the Beach Report for a description of the original risk-based classification, and Chapter 2 of the *Final Louisiana BEACH Grant Report 2005 Swim Season* for a description of the current classification system).

Once states have developed a risked-based ranking of their beaches, USEPA recommends development of a three-tiered monitoring plan (USEPA 2002a). Different intensities of monitoring, varying with the risk of exposure assessed under the risk-based classification process, are required for each tier. LDHH adopted this approach, as described in Chapter 3 of the Beach Report, and assigned each beach site to one of the three tiers (see Table 3.2 of the Beach Report). Sample sites for each beach were also been identified (see Section 3.1 and Table 3.3 of the Beach Report). Beach tier assignments and sample sites are evaluated annually at the conclusion of each swim season to determine if current estimates of beach use or water quality warrant a change in tier assignments or modification of sample sites.

LDHH has also identified the "indicator organisms" that will be used by Louisiana's BEACH Program. Because it is difficult to directly detect the many different pathogens or parasites that may be present in surface waters, "indicator organisms" are the fundamental monitoring tool used to measure both changes in water quality and the potential presence of hard-to-detect target pathogenic organisms. An indicator organism provides evidence of the presence or absence of a pathogenic organism that survives under similar physical, chemical, and nutrient conditions. The Louisiana BEACH Program will use two indicator organisms to assess beach water quality, fecal coliform and enterococci. Fecal coliform is the primary indicator organism currently used as the standard to assess bacteriological water quality for "bathing beaches/places" by LDHH (LAC 51:XXIV §909.B), and to assess whether a water body's designated use, set by LDEQ (LAC 33:IX §1113.C.5), is being met. Enterococci will also be used because a number of recent epidemiological studies examining the relationship between swimming-associated health risks and bacteria presence have found that enterococci were the most predictive indicator for enteric disease symptom development in bathers at beaches in marine environments. Accordingly, enterococci are USEPA's recommended indicator organisms for monitoring marine recreational waters (USEPA 2002a and 2002b), and will be used by the Louisiana's BEACH Program in addition to fecal coliform.

Indicator organism densities, as well as physiochemical parameters that have been identified in other studies as being predictive of indicator organism densities, will be measured for each water sample collected under this program. Table A6.1 identifies the water quality parameters that will be sampled, the number of samples that will be collected, the matrix sampled, sample preservation and maximum holding times. River stage will also be recorded for any sample stations that are directly influenced by inland water discharge. Only indicator organism densities are required to assess water quality under the established decision rule described in Section A7 of this QAPP. Physiochemical parameters are being collected for future examination of their correlation with indicator organism densities and to evaluate the potential for development of predictive models of indicator organism densities that could augment the established decision rule.

To reduce sampling error, all samples will be collected under the supervision of licensed sanitarians or qualified environmental scientists, employed by or under contract with LDHH, that have been trained to collect samples in accordance with the program's SOP (see Appendix). All collected samples will be submitted to the closest LDHH's laboratory for analysis. Laboratory analyses will be conducted in accordance with the LDHH's laboratory's quality control/quality

assurance (QA/QC) procedures. After samples have been collected and submitted to the laboratory for analysis, sample collection personnel will immediately submit a copy of completed datasheets to designated BEACH Program data management personnel. Laboratory results will be transferred to designated BEACH Program data management personnel immediately by email or facsimile, followed by transfer of hardcopy results, which the program will retain for a minimum of three years. Environmental data and laboratory results will be entered into LDHH's BEACH Program database by LDHH staff immediately following receipt of results. To reduce common data entry errors, the database will limit the data that can be entered into each field to predefined categories or expected ranges, depending on data field type. The database will also automatically calculate all routinely used statistics and decision rule determinations.

Samples collected at designated beach sample sites during the designated monitoring period will be evaluated in accordance with Louisiana's BEACH Program decision rule (see Section A7). The result of the decision rule is a dichotomous classification of water quality as "in compliance" or "out of compliance" with the rule. Water quality at designated beach sites that have been identified as posing a high to moderate potential for exposing primary contact users to water borne pathogens (identified as Tier 1 and 2, respectively as described above) will be classified weekly during the swimming season, and classification result made available to the public.

Louisiana's BEACH Program is intended to be a long-term program, operating annually from 1 April, one month before the start of the "recreational period" or "swimming season", and continuing through the end of the swimming season on 31 October (the designated monitoring period). Additional sampling may also be conducted outside the designated monitoring period at sample sites and for purposes to be established by the BEACH Program Manager in support of program goals. The annual schedule for Louisiana's BEACH Program is outlined in Table A6.2.

A7. Data Quality Objectives

The purpose of this program is to provide the public with accurate and timely information about the water quality and associated risk of engaging in primary contact recreation at designated beaches in Louisiana's coastal recreational waters. For Tier 1 and 2 designated beach sites during the swimming season, sample results will be evaluated in accordance with Louisiana's BEACH Program decision rule and classified as "in compliance" or "out of compliance". This section describes the rational behind and the process for Louisiana's BEACH Program decision rule, and identifies the data quality objective (DQOs) for the sampled parameters.

<u>Bacteriological Water Quality Criteria.</u>
LDHH's criteria for bacteriological water quality for bathing beaches/places state that the fecal coliform count shall not exceed 200 colony forming units (cfu) (either MPN of MF) per 100 ml as a 30-day geometric mean based on not less than five samples during any 30-day period nor exceed 400 cfu/100 ml in more than 10 percent of all samples during any 30-day period (LAC 51:XXIV §909.B). This standard was based on USEPA's recommendations in *Quality Criteria for Water* (USEPA 1976), which was established by USEPA based on evaluation of

bacteriological data that indicated that using a fecal coliform indicator group maximum geometric mean of 200-cfu/100 ml would result in an estimated 19 illnesses per 1,000 swimmers at marine beaches. However, that relationship was only approximate (USEPA 1986). LDEQ's water quality assessment criteria for primary-contact recreation states that not no more than 25 percent of the total samples collected shall exceed a fecal coliform density of 400/100 ml (LAC 33:IX §1113.5i). Accordingly, sites meeting LDHH's criteria would also meet LDEQ's criteria.

Table A6.1. Water quality parameters to be sampled.

Parameter	Number of Samples	Matrix	Sample Preservation	Holding Time
Enterococci	1/week during Swimming Season[1]	Water	Partial emersion in wet ice at 1-4° C	≤ 6 hours
Fecal Coliform	1/week during Swimming Season[1]	Water	Partial emersion in wet ice at 1-4° C	≤ 6 hours
Salinity	1/week during Swimming Season[1]	Water	N/A	< 24 Hours
Surface Water Temperature	1/week during Swimming Season[1]	Water	N/A	N/A (Measured *in situ*)
Tide Conditions[2]	1/week during Swimming Season[1]	Water	N/A	N/A (Based on value reported by others)
Weather	1/week during Swimming Season[1]	Atmospheric conditions	N/A	N/A (Field observation)
Wind Direction[2]	1/week during Swimming Season[1]	Atmospheric conditions	N/A	N/A (Based on value reported by others)
Wind Speed[2]	1/week during Swimming Season[1]	Atmospheric conditions	N/A	N/A (Based on value reported by others)
Precipitation	Day of sample and each of 2 prior days[3]	Atmospheric conditions	N/A	N/A (Based on value reported by others)
River Stage (at sites directly influenced by river discharge only)	1/week during Swimming Season[1]	Water	NA	N/A (Based on value reported by others)

[1] Number of routine samples at Tier 1 and 2 beaches. Routine samples at Tier 3 beaches may be less frequent than once/week, and sampling may occur at any time throughout the year. [2] See Field Datasheet for permitted values; values reported by NOAA. [3] Data will be obtained from the Louisiana Molluscan Shellfish database.

Table A6.2. Annual schedule of tasks for Louisiana's BEACH Program.

Task	Start Date	Completion Date
Update QAPP	As required	NA
Conduct routine monitoring of designated beaches	Apr. 1 annually	Oct. 31 annually
Evaluate tier assignments for existing and any additional beach sites to be monitored in the next swimming season; evaluate sample site locations.	Nov. annually	Mar. annually
Conduct annual QA/QC review of previous year's monitoring and notification data	Nov. annually	Jan. of next year annually
Submit previous year's monitoring and notification data and annual report to USEPA	Nov. annually	Jan. of next year annually

The enterococci criteria recommended by USEPA were developed using the geometric mean indicator density corresponding to the accepted gastrointestinal illness rate of 19 illnesses per 1,000 swimmers. The beach is out of compliance if the geometric mean exceeds 35-cfu/100 ml (USEPA 1986, 2002a and 2002b). Noncompliance is also triggered by an unacceptably high value for the most recent sample. The maximum acceptable bacterial density for the most recent sample, referred to as the single-sample maximum criterion, is set higher than the geometric mean in order to avoid unnecessary noncompliance events based on a single sample. However, decisions about beach water quality should be based primarily on the long-term geometric mean bacterial density rather than single sample values. Bacterial densities fluctuate from day-to-day around the geometric mean, and thus a decision based on a single sample, or even several samples, may be erroneous; i.e., the sample may exceed the recommended mean criteria even though the long-term geometric mean has been met, or may fall below the maximum even if the geometric mean is in the noncompliance range (USEPA 1986, 2002a and 2002b).

The single sample maximum criterion is established based on a specified desired chance, or probability, that the beach will be identified as having adequate water quality when in fact water quality is acceptable, balanced by the offsetting probability of deciding that water quality threatens public health when in fact it does. Using a larger probability value for the upper percentile decision limit corresponds to a less stringent (i.e. higher) maximum value, decreasing the chance that the beach will be erroneously classified as out of compliance when in fact it is in compliance (a type I error), but increasing the chance of failing to classify a beach as out of compliance when public health is truly at risk (a type II error). USEPA has specified the desired upper percentile for designated bathing beaches at 75%, based on the Agency's judgment, which, when combined with the observed sample variability from USEPA studies (assumed log-normal distribution and $\log_{10}$ standard deviation = 0.7 cfu/100ml), results in a single sample maximum allowable enterococci density of 104 cfu/100 ml (USEPA 1986, 2002a and 2002b).

The bacteriological measures of water quality described above fall into two categories: those measuring long-term or steady-state conditions, and those measuring current or proximate conditions. The geometric mean criteria for fecal coliforms and enterococci are steady-state measures. The single sample maximum is a proximate measures. In summary, the bacteriological water quality criteria that will be used for Louisiana's BEACH Program are:

	Fecal Coliforms*	Enterococci*
Steady-State Criteria		
Geometric mean maximum	200	35
Proximate Criteria		
Single Sample Maximum	NA	104

*****Quantities are expressed as cfu/100 ml.

Louisiana's BEACH Program Water Quality Classification Decision Rule

On a weekly basis during the swimming season, LDHH will classify water quality at each sampling location on Tier 1 and 2 beaches as "in compliance" or "out of compliance" with the bacteriological criteria. Fecal coliform and enterococci steady-state geometric means will be calculated for each sampling location based on water quality sample results collected during the classification week and all samples collected in the preceding four weeks (a total of five weeks), and compared with the criteria. If any of the steady-state criteria are exceeded, the sampling location will be classified as "out of compliance". The sampling location will remain classified as "out of compliance" until all steady-state conditions are less than or equal to the maximum criteria (single sample criteria must also be met as described below).

If the weekly sample's enterococci density is greater than the single sample maximum criterion, LDHH will either classify the sampling location as "out of compliance" or resample. If the sample result is determined to be accurate and standards are indeed being exceeded, the sampling station will be classified as "out of compliance". Resampling will only be conducted when there is reason to doubt the accuracy or certainty of the first sample based on predefined quality assurance measures. Resampling will be considered reasonable when the location's sampling results fail to meet predefined laboratory quality assurance measures or when a sampling location's results have historically been in compliance and no known or potential sources of fecal contamination are present. If a single sample maximum criterion was exceeded, the sampling location will remain classified as "out of compliance" until all bacteriological criteria are met.

If the sampling location's steady-state conditions are less than the maximum criteria AND the weekly sample's enterococci density (proximate conditions) is less than or equal to the single sample maximum criterion, then the sampling location would be classified as "in compliance". Figure A7.1 graphically depicts this classification decision process.

Sampling after an advisory will typically occur on the next regularly scheduled sample collection date (i.e., the next week), unless the source of the exceedance has been identified and eliminated. In that event, intensive sampling may be conducted and the most recent five samples used to determine compliance with the program's water quality decision rule rather than all samples collected during the most recent 30-days in an effort to reduce the time that the sample location may be wrongly classified as out of compliance. Additional sampling will only be conducted when the program manager determines that additional sampling is likely to expedite lifting an erroneous advisory. For this and all other water quality decisions, non-independent samples, or samples collected on the same date at the same location, will be averaged, and their arithmetic mean used in compliance determinations.

The Louisiana BEACH Program database will automate the classification process, performing all necessary calculations and generating the appropriate weekly classification for each sampling location. Immediately following the weekly classification process, LDHH will implement the public notification and risk communications provisions described in Chapter 4 of the Beach Report.

Louisiana BEACH Program DQOs

Data quality objectives for the parameters measured under this QAPP (both field and laboratory). DQOs were originally established by obtaining estimates of the most likely data quality that is achievable based either on manufacturer's specifications, scientific experience, or historical data. Since program initiation, DQOs have been assessed annually (see *Final Louisiana BEACH Grant Report 2004 Swim Season* and *Final Louisiana BEACH Grant Report 2005 Swim Season*). Based on those assessments, the original DQOs were adjusted as presented in Table A7.1. The DQOs in Table A7.1 are used as quality control criteria both for field and laboratory measurement processes to set the bounds of acceptable measurement error. DQOs are usually established for six aspects of data quality: precision, bias, accuracy, representativeness, comparability, and completeness (USEPA 1998, 2002a). Each of these terms are described in the context of their application within Louisiana' BEACH Program below.

Precision - is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions (USEPA 2002a). The upper and lower 95% confidence intervals of individual samples will be estimated using IDEXX® MPN Generator© software for enterococci densities and Standard Methods tables for fecal coliform densities when needed. The precision of sampling methods will be estimated by comparing laboratory results for two samples taken consecutively on the same day at the same sampling site, and will be referred to as field duplicates. The precision of laboratory analyses (intra-laboratory) plus any variability induced during sample handling and transport, will be estimated by analyzing two aliquots of the same water sample, which will be subdivided in the field and will be referred to as field splits. Field duplicate and field split samples, collectively referred to as quality control samples, will be collected for approximately 10 percent of routine samples. The sample events (sample point and week) at which field quality control samples will be collected, will be randomly selected at the beginning of each annual sampling period, and will be approximately evenly divided between field duplicates and field splits. Sampling and analysis precision will be estimated from each quality control sample by calculating the relative percent difference (Sample RPD) as follows:

$$Sample\ RPD = \frac{|C_1 - C_2|}{(C_1 + C_2)/2}\ x\ 100$$

where C_1 is the first of the two values and C_2 is the second value. To estimate across sample precision, the mean and standard error of Sample RPDs within field duplicates and field splits will be calculated and compared to their respective precision goals. If the lower 95^{th} percentile of the mean RPDs is less than their precision goals, then the DQO will have been met. If the lower 95^{th} percentile is greater than the precision goals, then the DQO will have been exceeded. In the event of a precision goal exceedance, corrective measures will be identified and

implemented before and during subsequent sample collections and analyses to ensure that precision goals are achieved.

Bias - is the systematic or persistent distortion of a measurement process that causes errors in one direction (USEPA 2002a). Bias assessments for environmental measurements are typically based on analysis of spiked samples, which is not feasible for microbiological samples. It is assumed that bias will be minimized in this study by close adherence to SOPs and QA plans.

Accuracy - is the degree of agreement between an observed value and an accepted reference or true value. Accuracy is a combination of random error (precision) and systematic error (bias), both of which are due to sampling and analytical operations (USEPA 2002a). Accuracy is estimated by comparing the measured value to its "true" value. Because microbiological analysis measures constantly changing living populations, the true values cannot be known. Accordingly, accuracy, like bias, is difficult to assess for microbiological analyses. However, because indicator organism density estimates are assumed to have minimum bias, accuracy equates to precision, which will be rigorously assessed.

Accuracy is also defined as the similarity of an entity to its original form, which applies to all recorded information, data entry, and calculations. Accuracy will be controlled by double-checking sources, manual data entries, or electronic data transfers and performing recalculations. Environmental data and laboratory results will be entered into LDHH's BEACH Program database by LDHH staff immediately following receipt of results. To reduce common data entry errors, the database will limit the data that can be entered into each field to predefined categories or expected ranges, depending on data field type. The database will also automatically generate the necessary statistics, and based on those statistics, categorize water quality in accordance with the decision rule. Automation of these processes will reduce the potential for human errors, and increase the accuracy and consistency of water quality decision rule results.

Representativeness – is the degree to which data accurately and precisely represent the characteristics of a population, and therefore it addresses the natural variability or the spatial and temporal heterogeneity of a population. The sampling design should define the area of sample collection such that it is typical and representative of each area of concern. The Louisiana BEACH Program has accomplished this by selecting sample sites that have been identified as representative of the risk of exposure to bacteria contamination at each designated beach as described in Section B.1 of this QAPP and Section 3.1 of the Beach Report.

Comparability - Two data sets are considered comparable when the two sets can be considered equivalent with respect to the measurement of a specific variable or group of variables (USEPA 2002a). Louisiana's BEACH Program has been designed based on USEPA guidance, which will facilitate comparison of Louisiana's results with those of other coastal states BEACH programs. Adequate training of field sampling and laboratory personnel and the use of standardized methods for sampling and analysis of bacterial indicator densities will ensure comparability.

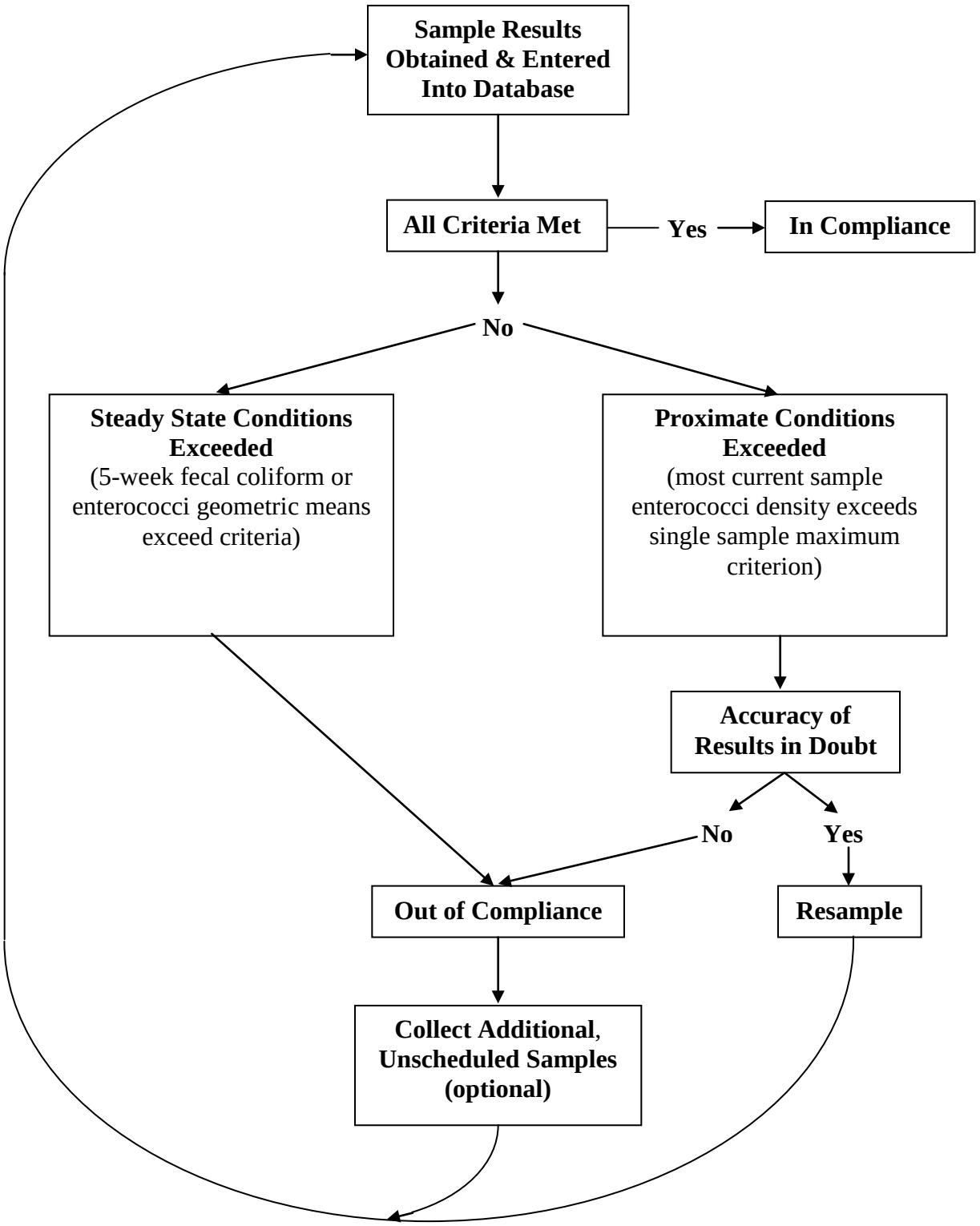

Figure A7.1. Louisiana's BEACH Program sampling station water quality classification decision process flow chart

Table A7.1 Data quality objectives for Louisiana's BEACH Program monitoring indicators.

Parameter	Concentration Units	Matrix	Method	Measurement Range	Reporting Level	Precision (Mean RPD)	Accuracy	Completeness
Enterococci	MPN/100ml	Water	IDEXX Enterolert[1]	10 to 1,461	1	Sample 60%; lab 45%	NA	98%
Fecal Coliform	MPN/100ml	Water	A-1-M method[2]	1 to1,600	1	Sample 60%; lab 45%	NA	98%
Salinity	ppt	Water	Standard Methods2520-B	1 to 15 w/o dilution	1	Sample 10%, lab 5%	Sample 10%, lab 5%	98%
Surface Water Temperature	°F	Water	Field	-40 to 160	1	$\pm$ 2°	$\pm$ 2°	98%
Tide Conditions	NA	Atmospheric conditions	Digital transfer	See sample form for permitted values	NA	NA	NA	98%
Weather	NA	Atmospheric conditions	Field	See sample form for permitted values	NA	NA	NA	98%
Wind Direction	NA	Atmospheric conditions	Digital transfer	See sample form for permitted values	NA	NA	NA	98%
Wind Speed	NA	Atmospheric conditions	Digital transfer	See sample form for permitted values	NA	NA	NA	98%
Precipitation	Inches/previous 24 hours	Atmospheric conditions	Digital transfer	0+	NA	NA	NA	98%
River Stage	Feet on flood gauge	Water	Digital transfer	Gauge dependent	NA	NA	NA	98%

[1] Enterolert® Quanti-Tray. [2] *Official Methods of Analysis of the AOAC*, 15th Edition 1990, p436-437; or Fecal Coliform Direct Test (A-1 Medium). 9221 E.2. *Standard Methods for the Examination of Water and Wastewater, 20th Edition.*

Completeness - is the percentage of measurements made that are judged to be valid according to specific criteria and entered into the data management system (USEPA 2002a). Accidental or inadvertent loss of samples during transport or lab activities should be avoided by close adherence to SOPs. However, in the event of a lost sample, immediate resampling of the sample site will provide a suitable replacement sample. The SOP also includes provision that will ensure entry of all collected sample data into the database. Percent completeness *(%*C) for measurement parameters will be estimated as follows:

$$\%C = \frac{V}{T} \; x\,100$$

where *V* is the number of measurements judged valid and *T* is the total number of measurements.

A8. Special Training Requirements/Certification

All samples will be collected under the supervision of licensed sanitarians or qualified environmental scientists, employed by or under contract with LDHH, that have been trained to collect samples in accordance with the program's SOP (see Appendix) by the Field Activities Manager. The Field Activities Manager will evaluate field staffs' compliance with the SOP by auditing sample collection practices of all field personnel annually. All laboratory analyses will be conducted at LDHH laboratories under the direction of the Laboratory Activities Manager. Data entry staff receives training on the proper procedures to enter and validate data by the Data Manager.

A9. Documentation And Records

Documents that describe, specify, report, or certify activities performed in this QAPP are listed in Table A9.1. LDHH Molluscan Shellfish Program will retain all documents and associated digital data. Laboratory records and QA manuals will be retained at LDHH laboratories. The format of all data reporting will be consistent with the requirements and procedures for data validation and data assessment described in Sections B, C, and D of this QAPP.

Table A9.1. Documentation Records

Document/Record	**Retention Time**	**Form**
QAPP, amendments, and appendices	3 year minimum	Paper/digital
QAPP distribution documentation	3 year minimum	Paper/digital
Field data sheet/Laboratory results	3 year minimum	Paper/digital
Corrective action reports	3 year minimum	Paper/digital
Documentation of public notification efforts	3 year minimum	Paper/digital
Field SOPs	3 year minimum	Paper/digital
Annual reports	3 year minimum	Paper/digital
BEACH database	Permanent	Digital
BEACH GIS files	Permanent	Digital

Amendments/Revisions to the QAPP.
This QAPP is intended to be a living document, subject to revision as additional information becomes available, and accordingly, it is anticipated that changes may occur and amendments/revisions to the QAPP will be required. Amendments/Revisions to the QAPP are necessary to reflect changes in project organization, tasks, schedules, objectives, and methods; to improve operational efficiency; and to accommodate unique or unanticipated circumstances. Any requests for amendments/revisions will be directed to the Louisiana BEACH Program Manager in writing and will be reviewed/discussed by all applicable parties involved.

Any changes to technical procedures will be considered significant and will be reviewed by the Louisiana BEACH Program Manager and USEPA Project Officer to determine if they significantly affect the technical and quality objectives of the program. If so, the QAPP will be revised and re-approved, and a revised copy will be sent to all persons on the distribution list. If it is determined by the Louisiana BEACH Program Manager and USEPA Project Officer that the amendments/revisions are not significant, then the amendments/revisions will become effective immediately and will be distributed by the Louisiana BEACH Program Manager to all personnel on the distribution list.

MEASUREMENT / DATA ACQUISITION

B1. Sampling Process Design

Rationale for the Design.
Louisiana's BEACH Program sampling design fulfills USEPA's guidelines in *National Beach Guidance and Performance Criteria for Grants* (USEPA 2002a), *Ambient Water Quality Criteria for Bacteria—1986* (USEPA 1986), and *Implementation Guidance for Ambient Water Quality Criteria for Bacteria* (USEPA 2002b). Louisiana has adopted USEPA's tiered monitoring approach under which sampling effort is proportionate to risk of exposure. Louisiana's BEACH Programs tiered sampling design is outlined in Table B1.1. The sampling schedule will be in accordance with Table A6.2 and the SOP (see Appendix).

Design Assumptions.
This design assumes that:

- Indicator organism densities at the selected sample sites are representative of the densities throughout the swimming area the sampling site was chosen to represent.
- Indicator organism steady-state conditions can be estimated with acceptable precision by the geometric mean of five samples.
- Single samples will have acceptable power to detect exceedances when they occur.
- Decision rule results are representative of true water quality conditions for the time period that they cover.

LDHH does not possess data to test these assumptions, but believes them to be reasonable based on USEPA's guidance.

Procedures for Locating and Selecting Environmental Samples.
For each beach that was assigned to a monitoring tier, the Louisiana BEACH Program selected sample locations based on density of beach use and proximity to potential sources of contamination. LDHH originally documented beach use during the Memorial Day weekend, 2002, using aerial photography, and analyzed the photographs to estimate the number of beach users at designated beaches and to identify the locations with the greatest density of use. Sanitary surveys of those beaches were conducted in accordance with USEPA's guidance (USEPA 2002a) during late February through early March 2003 to identify any known or potential sources of fecal contamination affecting designated beaches. Sample sites were then selected based on each beach's monitoring tier assignment, centered in the area of densest use, and adjusted for any known or potential sources of pollution detected during the sanitary surveys (see Section 3.1of the Beach Report for details). Selected sample locations for designated beach sites are provided in Table B1.2 (Maps of sample sites are provided in Section 3.1 of the Beach Report). The original tier assignments and sample locations are assessed annually at the conclusion of the swim season, and results of that evaluation reported in the Annual BEACH Report for the year. For monitored sites, the assessment includes a review of the total number of swimmers and their spatial distribution along the beach during the previous swim season and projected use for the coming season, and any changes in the location of potential sources of contamination discharge to the beach. Local authorities are also surveyed to determine if any new potential beach sites should be considered.

Classification of Measurements as Critical or Noncritical.
Indicator organism densities are the critical measurements to be collected under this QAPP, as they are necessary to assess water quality under the established decision rule. Physiochemical measurements are not used in the decision rule and thus are not critical. However, those measurements will be examined in the future to assess their association with indicator organism densities, and their potential use as variables in predictive models that would augment the established decision rule.

Validation of Any Nonstandard Methods.
The program will use no nonstandard methods.

B2. Sampling Methods Requirements

All samples collected for the Louisiana BEACH Program will be obtained in accordance with the program's SOP (see Appendix) under the supervision of licensed sanitarians or qualified environmental scientists, employed by or under contract with LDHH, that have been trained to collect samples in accordance with the program's SOP. All collected samples will be submitted to the closest LDHH's laboratory for analysis. Laboratory analyses will be conducted in accordance with the LDHH's laboratory quality control/quality assurance (QA/QC) procedures.

Table B1.1. Louisiana's BEACH Program tiered sampling design.

Tier 1	Tier 2	Tier 3
When to Conduct Basic Sampling		
Sampling Period - Begins on April 1, one month before the start of the "recreational period" and continues through October 31 (end of "recreational period"). **Sampling Frequency** - One sample will be collected per week during the sampling period.	**Sampling Period -** Begins on April 1, one month before the start of the "recreational period" and continues through October 31 (end of "recreational period"). **Sampling Frequency -** One sample will be collected per week during the sampling period.	**Sampling Period –** Samples may be collected at any time during the year, with an effort to sample during adverse conditions, when indicator organism densities are expected to be highest. **Sampling Frequency -** Will be variable, and designed to determine the range of indicator organism densities.
When to Conduct Additional Sampling		
After exceedance of a water quality standard – When bacterial concentrations exceed a water quality standard, LDHH will immediately either issue an advisory or resample. If a sample result is determined to be accurate and standards are indeed being exceeded, an advisory will be issued. Resampling will only be conducted when there is reason to doubt the accuracy or certainty of the first sample. Resampling will be considered reasonable when a beach's sampling results fail to meet predefined laboratory quality assurance measures, or when the beach's sampling results have historically met water quality standards and no known or potential sources of fecal contamination are present**.**		
Reclassify after an advisory – Additional sampling may be conducted to determine whether a public notification can be discontinued. Since an advisory will not be lifted without sample results meeting water quality standards, accelerated sampling may be conducted to remove the advisory sooner.		
After a sewage spill or pollution event – Additional sampling will be conducted immediately after a sewage spill or a significant pollution event where the potential exists that indicator organism levels may be expected to exceed the standards.		
After an adverse condition event – Additional samples may be collected following the occurrence of an adverse condition event at beaches where sample data indicate a statistically meaningful increase in indicator organism density with the adverse condition. LDHH anticipates that several years of data collection will be required at a monitored beach before adverse conditions can be evaluated.		
Where to Collect Samples		
A sampling point will be established in the middle of the area(s) of densest use and every 500 meters (1640 ft.) thereafter along densely used beach segments. In areas of low-density use, no portion of the designated beach will be > 1 mile from a sample station. If known or potential pollution sources are present, the sample point(s) will be located to capture the pollution source.	A sampling point will be established in the middle of the area(s) of densest use. For continuous beach segments, no portion of the designated beach will be > 2 miles from a sample point. If known or potential pollution sources are present, the sample point(s) will be located to capture the pollution source.	
What Water Depth to Sample		
Water samples will be collected 6-12 inches below the water's surface in waist-deep water (approx. 39 inches).		

B3. Sample Handling And Custody

Sample custody procedures will ensure the sample's integrity from collection through recordation of results. Field sampling personnel will directly deliver all water samples to the laboratory, maintaining possession until released to the laboratory for processing. Chain of custody will be documented on the Louisiana BEACH Program Water Sample Form, which records the date, time and field personnel collecting water samples, and the date, time and laboratory personnel receiving the samples. Once the laboratory accepts the sample, LDHH laboratory's sample custody procedures will be followed.

B4. Analytical Methods Requirements

All analyses will be conducted by LDHH laboratories using the methods specified in Table A7.1, which will be followed without deviation. LDHH laboratories are an accrediting authority under USEPA's National Environmental Laboratory Accreditation Program (NELAP) and certify laboratories to follow USEPA guidelines. Accordingly, all analyses will be conducted in accordance with the LDHH laboratory QAPP, SOPs, and QA/QC plans and USEPA's guidelines. Required turnaround times for sample processing are defined in the Louisiana BEACH Program SOP (see Appendix).

B5. Quality Control Requirements

Measures of precision and completeness specified in Table A7.1, and described in Section A7 will be assessed at the end of each month during which data are collected, and annually as part of the program evaluation process. In addition to the QC measures identified in this QAPP, LDHH laboratory will conduct all quality control requirements specified in their QA manuals (see Bradford et al. 2002, or most current edition). All quality control data and performance criteria will be monitored and errors in the system corrected as they arise. All quality control data and results will be maintained as specified in Table A9.1.

B6. Instrument Testing, Inspection, and Maintenance Requirements

All testing, inspection, and maintenance of laboratory equipment will be conducted as prescribed by LDHH laboratory QA manuals.

B7. Instrument Calibration

All laboratory instrument calibration will be conducted as prescribed by LDHH laboratory QA manuals.

Table B1.2. Louisiana BEACH Program's selected sample sites for designated beaches and calibration sample sites.

USEPA ID	State ID	Beach Name	LATITUDE	LONGITUDE
LA134778	CNST1	Constance Beach	+29.75889	-93.58028
LA971783	CYPT1	Cypremort Point State Park	+29.73694	-91.85417
LA860482	DUNG1	Dung Beach	+29.75306	-93.62444
LA733869	FNTB1	Fontainebleau State Park	+30.33556	-90.04583
LA427986	FOUR1	Fourchon	+29.10194	-90.18917
LA984228	FOUR2	Fourchon	+29.09972	-90.19361
LA677480	FOUR3	Fourchon	+29.09778	-90.19833
LA452669	FOUR4	Fourchon	+29.09167	-90.21056
LA725358	GBRZ1	Gulf Breeze	+29.75722	-93.59111
LA430483	GIB1	Grand Isle Beach	+29.23417	-89.99028
LA325065	GIB2	Grand Isle Beach	+29.21889	-90.01333
LA799656	GIB3	Grand Isle Beach	+29.20250	-90.03667
LA240078	GISP1	Grand Isle State Park	+29.25917	-89.95028
LA221569	GISP2	Grand Isle State Park	+29.25583	-89.95333
LA204303	GISP3	Grand Isle State Park	+29.25278	-89.95583
LA186192	GISP4	Grand Isle State Park	+29.25056	-89.95889
LA720012	HACK1	Hackberry Beach	+29.75333	-93.10500
LA489985	HOLLY1	Holly Beach	+29.76889	-93.43750
LA829030	HOLLY2	Holly Beach	+29.76917	-93.44417
LA109442	HOLLY3	Holly Beach	+29.76944	-93.44944
LA697221	HOLLY4	Holly Beach	+29.76944	-93.45417
LA164373	HOLLY5	Holly Beach	+29.76944	-93.45944
LA467180	HOLLY6	Holly Beach	+29.76972	-93.46417
LA202517	LCNB1	North Beach - Lake Charles	+30.23583	-93.23361
LA981443	LCSB1	South Beach - Lake Charles	+30.19528	-93.27083
LA595220	LTFL1	Little Florida	+29.75528	-93.60500
LA135245	MART1	Martin Beach	+29.74861	-93.66389
LA960851	PONT1	Pontchartrain Beach	+30.03340	-90.06242
LA284049	RUTH1	Rutherford Beach	+29.75861	-93.12611

B8. Inspection/Acceptance Requirements for Supplies

Critical Supplies.
The necessary supplies for field sampling include sterile 250-ml polycarbonate sample bottles (or other LDHH laboratory approved sample container), insulated containers for transporting samples, 18-inch tongs, the Louisiana BEACH Program Water Sample Form, and sampling SOP.

Inspection Requirements and Procedures.
Prior to sampling, field personnel are responsible for inspection and acceptance of sample containers. Any sample containers suspected of being non-sterile will be discarded. LDHH Laboratory inspects its laboratory supplies in accordance with LDHH laboratory QA manuals.

Tracking and Quality Verification of Supplies.
Sterile sample containers will only be accepted if the delivery container and individual containers are sealed. Containers will be stored in accordance with the manufacturer's recommendations.

B9. Data Acquisition Requirements (Non-Direct Measurements)

Non-direct measures to be collected under the Louisiana BEACH Program are tide conditions, weather, wind direction and speed, precipitation data, and river stage (Tables A6.1 and A7.1). Tide conditions, wind direction, and wind speed will be obtained from National Oceanic and Atmospheric Administration (NOAA), precipitation data will be obtained from the Molluscan Shellfish Program's database, and river stage will be acquired the US Geological Survey Stream Gauge database. The representativeness, precision, and bias of these measures acquired from the designated sources is anticipated to be superior to field collected data. All non-direct measures are non-critical measurements.

B10. Data Management

Following delivery of the sample to the nearest LDHH laboratory, data management will be conducted in accordance with the SOP (Recordation of Results). Once sample data are in the database, the database will automatically generate the necessary statistics, and based on those statistics, categorize water quality in accordance with the decision rule. Automation of these processes will reduce the potential for human errors, and increase the accuracy and consistency of water quality decision rule results.

ASSESSMENT/OVERSIGHT

C1. Assessment and Response Actions

The BEACH Program Manager/Quality Assurance Officer will be responsible for making sure that the below described assessment procedures are conducted to ensure that:

- All elements of the QAPP are correctly implemented as prescribed;
- The quality of the data generated by implementation of the QAPP is adequate; and
- Corrective actions, when needed, are implemented in a timely manner and their effectiveness is confirmed.

Assessment activities will include:

Surveillance - is the continual or frequent monitoring of the status of a project and the analysis of records to ensure that specified requirements are being fulfilled. Key project personnel are responsible for surveillance of the aspects of the program under their control. Any corrective action taken to remedy deficiencies should be documented.

Technical Systems Audit (TSA) - is a thorough and systematic onsite qualitative audit, where equipment, personnel, training, procedures, and record keeping are examined for conformance to the QAPP. The BEACH Program Manager should conduct a TSA annually within two months of beginning routine sampling for the swimming season to reveal any weaknesses in the management structure, policy, practices, or procedures. Any deficiencies identified during the TSA should be documented and corrective actions implemented.

Performance Evaluation (PE) - is a type of audit in which the quantitative data generated by the measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory. PEs will be conducted by LDHH's laboratory in accordance with their QA manuals and QAPP that are applicable to the laboratory analyses conducted under this QAPP.

Audit of Data Quality (ADQ) - reveals how the data were handled, what judgments were made, and whether uncorrected mistakes were made. An ADQ will be performed annually at the end of each swimming season and audit results reported in the program's Annual Report.

Data Quality Assessment (DQA) – is the application of the statistical estimates described in Section A7 to determine whether the data meet the DQOs. A DQA will be performed annually at the end of each swimming season, evaluating the precision of the data collected during that season relative to the DQOs. DQA audit results will be reported in the program's Annual Report.

Response Actions will address:

Failure to Collect a Routine Sample During the Designated Monitoring Period – will result in the adoption of the previous week's classification. As soon as possible, a replacement sample will be collected to meet minimum sample requirements for future weeks.

Failure to Meet DQOs – identified in this QAPP will result in a thorough examination of field practices. If the SOP is not being followed, corrective actions will be implemented to ensure future compliance. If it is determined that the SOP is being followed, and that improvements to the SOP are not possible or are not anticipated to result in meeting the DQO, then the DQO will be reexamined and the QAPP amended as necessary.

C2. Reports To Management

LDHH has developed a BEACH Program database to manage data collected under this program. Details of this system are provided in LDHH's data submission plan, as described in Appendix 6

of the Beach Report. The Louisiana BEACH Program database stores all data collected under the program, and facilitates annual data transfers to EPA as specified in Appendix E of EPA's beach guidance (USEPA 2002a) including beach description data, beach program data, sampling location and method identification data, and monitoring and notification data to EPA via electronic file transfer in a format specified by EPA. Summary data and weekly decision rule outcomes are also entered on the Louisiana BEACH Program's website, which will be the primary mechanism to report monitoring data to the public. LDHH will promptly report advisories to the designated EPA contact(s) via telephone and/or email. The report will include the sampling location, sample collection date, date results received, indicator organism densities, and intended action.

LDHH will submit an annual technical report to EPA no later than March of the following year, after the end of the prior recreational period, that will summarize the number of beaches monitored in each tier, list any additional beaches to be added to the program or tier reassignments to be made in the coming year, a compilation of sampling results, and a summary of assessment activities and response actions described in Section C1. The report will also include, for Tier 1 and 2 beaches, the number of beaches for which advisories were issued, and document for each beach the number of times water quality criteria were exceeded and the number of days under advisories. For Tier 3 beaches, the annual technical report will summarize the findings on beach water quality based on adverse condition sampling and recommend one of the following: continue sampling at each beach using Tier 3 monitoring methods; reassign the beach to Tier 1 or 2; or discontinue sampling at the beach. Recommendations to discontinue sampling would be appropriate if beach use remains low AND sampling indicates that the beach's water quality consistently meets BEACH Program water quality standards. LDHH will maintain responsibility for all monitoring and reporting aspects of the Louisiana BEACH Program.

DATA VALIDATION AND USABILITY

D1. Data Review, Validation And Verification

The following describes the potential for deviation from the quality specifications identified in this QAPP and the criteria for deciding the degree to which each data item has met its quality specifications as described in Section B above.

Sampling Design.
Variance in the time and location of sample collection from the Program's design are anticipated to be minimal. Variance in the date of sample collection will have no effect on the weekly assessment of water quality, provided at least one sample is collected each week in time to post the scheduled weekly classification results. The number of unusable samples collected will be assessed as Completeness, as described in Section A7 above. Variation in sampling location is also expected to be minimal. The location of all sampling sites along the shoreline will be monumented to ensure precise relocation, and sampling location from the shore is a function of water depth. Within these constraints, all samples will be collected within an area representative

of each sample site. Additionally, the precision of indicator organism densities will be estimated as described in Section A7.

Sample Collection Procedures.
Departures from the sample collection procedures specified in the SOP will be assessed as described in Section C1.

Sample Handling.
All samples will be handled according to the SOP to ensure that the sample continues to be representative of its native environment as it moves through the analytical process. Field sample collection and laboratory personnel will routinely examine the integrity of sample containers, maintain sample preservation temperatures, and will comply with maximum holding times to ensure that samples are transported and stored under conditions that will not adversely affect the quality of the sample. Any samples that are suspected of not meeting the specified conditions will be rejected.

Analytical Procedures
LDHH laboratories will be capable of analyzing samples weekly and have the instrumentation, techniques, and qualified staff to perform the analyses. Laboratory SOPs related to chain of custody, instrumentation, and technique have been developed as part of their QA manuals for their NELAP certification process.

Quality Control
Sampling quality control will be carried out as discussed in Section B5. Laboratory quality control activities will be conducted according to the laboratory's approved QA manual.

Calibration
Instrument calibration activities will be performed by LDHH laboratories following their QA manual.

Data Reduction and Processing
No data reduction is anticipated; all data collected under the program will be available in LDHH's BEACH Program database.

D2. Validation And Verification Methods

Validation and verification activities will be performed as described in Section B5 and by following LDHH laboratory's approved QA manual. Final responsibility for data acceptance resides with the BEACH Program Manager.

D3. Reconciliation With Data Quality Objectives

DQA will be performed as described in Section C1 above.

LITERATURE CITED

Bradford, H.B., S. Martin, and A. Hager. 2002. *Quality Assurance Manual for Laboratory Analysis of Surface Water, Wastewater, and Groundwater*. Louisiana Department of Health and Hospitals, Office of Public Health.

Louisiana Department of Health and Hospitals. 2003. Louisiana's BEACH Grant Final Report, Grant Year 2001. Louisiana Department of Health and Hospitals, Office of Public Health.

USEPA. 1976. Quality Criteria Water. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 1986. *Ambient Water Quality Criteria for Bacteria–1986*. EPA-440/5-84-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1998. *EPA Guidance For Quality Assurance Project Plans; EPA QA/G-5.* USEPA/600/R-98/018. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

USEPA. 1999. *Action Plan for Beaches and Recreational Water*s. USEPA 600/R-98-079. U.S. Environmental Protection Agency, Office of Research and Development and Office of Water, Washington, DC.

USEPA. 2002a. *National Beach Guidance and Required Performance Criteria for Grants.* June 2002. USEPA 823/B-02-004. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 2002b. *Implementation Guidance on Water Quality Criteria for Beaches. Draft. May 2002*. EPA-823-B-02-003. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Appendix A. Louisiana's BEACH Program Sample Collection Standard Operating Procedures.

Louisiana's BEACH Program
Sample Collection Standard Operating Procedures

This document describes the standard operating procedures that are to be followed during collection of water samples for Louisiana's BEACH Program.

Sampling Method

A grab sample of water is obtained using a pre-sterilized 250-ml polycarbonate sample bottle with a screw cap or other approved container. The basic steps for this procedure, derived from Bordner et al. (1978) and IITF (1999) as cited in USEPA 2002, are as follows. All samples shall be collected between 7:00 and 11:30 AM, unless otherwise approved by the BEACH Program Manager, to reduce the effects of temporal variability.

1. After arriving at the sample site, but prior to collecting the first sample, complete the general and environmental information on the top portion of the "Louisiana BEACH Water Sample Form" (attached). You must have the necessary environmental information from NOAA to complete the sample form.

2. When collecting the first sample of the sampling run, label two sample bottles. Label one bottle "TC1", which will be used as a temperature control. Label the second bottle "1", and record the sample number, and sampling location on the lower portion of the sample form. Subsequent samples should be labeled in sequential order[1]. When collecting the last sample of the sampling run, label a second bottle "TC2". Label must be written legibly in waterproof ink.

3. Remove the bottle cap just before obtaining each sample and protect them from contamination. Be careful not to touch the inside of the bottle itself or the inside of the cover.

4. The first sample to be prepared is the TC1 sample. This sample should be collected prior to sample 1, using the same methods as for other surface water samples described below.

5. To collect the surface water samples, carefully move to the first sampling location to avoid kicking up bottom material at the sampling station. The sampler should be positioned offshore from the sample station marker at a water depth of not less than 36" (0.91m) nor greater than 40" (1m), and downstream of any water current to take the sample from the incoming flow.

6. Open a sampling bottle and grasp it with 18-inch tongs and plunge the bottle mouth downward into the water to avoid introducing surface scum. Position the mouth of the bottle into the current and away from the sampler. The sampling depth should be 15 to 30

[1] See additional requirements for labeling quality control samples in the section titled Quality Control Samples below.

centimeters (6 to 12 inches) below the water surface. If the water body is static, an artificial current can be created by moving the bottle horizontally with the direction of the bottle pointed away from the sampler. Tip the bottle slightly upward to allow air to exit and the bottle to fill.

7. Remove the bottle from the water body.

8. Pour out a small portion of the sample to allow an air space of 2.5 centimeters (1 to 2 inches) above each sample for proper mixing of the sample before analysis.

9. Tightly cap the bottle.

10. Collect water temperature and record the temperature (in °Fahrenheit) on the sample form for each sample numbered 1 through *n* (the last sample). There is no need to record temperatures for the temperature control samples as their temperatures are the same as the first and last sample, respectively.

11. Place the samples in a suitable insulated container and transport them to the laboratory as soon as possible. Bacteriological samples should be iced or refrigerated at 1 to 4 °C (34 to 39 °F) during transit to the laboratory. Take care to ensure that sample bottles are not totally immersed in water during transit or storage. Samples must be delivered to the lab AS SOON AS POSSIBLE. The initiation of sample analysis must begin within 6 hours after collection so that they are held less than 6 hours between collection and initiation of analysis (USEPA, 2000). Do not analyze samples that exceed holding time limits.

12. Upon delivery of the samples to the lab, record the time and date received by the lab and have the analyst initial the sample form acknowledging receipt of the samples. Retain the bottom canary-colored copy of the sample form (the "field copy") and leave the original (white copy) and the remaining copies with the lab.

Recordation of Results

13. Deliver the field copy of the sample form to the Louisiana BEACH Program database manager. The database manager will verify that all of the field collected information is complete and within the expected range for each recorded parameter. Any incomplete or out of range entries will be immediately addressed and corrected.

14. The database manager will retain the field copy of the form in a separate file, which will be reviewed daily to ensure that all lab results are received in a timely manner. If the database manager has not received results from the lab for any sample seventy-two hours after the lab received the sample, the database manager will immediately contact the lab to determine the disposition of the analysis. If results could not be obtained from the sample, another sample will be collected as soon as possible.

15. Immediately after completing the analyses, the lab will deliver a completed copy of the sample form to the database manager. Upon receipt of lab results, the database manager will verify that results were recorded for all collected samples. The database manager will immediately enter all data into Louisiana's BEACH Program database. Fecal coliform and enterococci results that are reported as less than detection limits (shown as "<2" for fecal coliform and "<10" for enterococci) will be recorded in the database as 2 for fecal coliform and 5 for enterococci. Prior to concluding a data entry session, the database manager will validate that all entries into the database during the session were correctly entered.

Quality Control Samples

Louisiana's Beach Program QAPP requires that approximately 10% of scheduled samples be designated as quality control samples (QC samples). To achieve this goal, ten percent of scheduled samples will be selected at random at the beginning of each monitoring period (and for other scheduled sampling periods) as QC samples. QC samples will be assigned in approximately equal proportions ($\simeq$ 5% each) at random to be collected as either field duplicate or field split samples. The database manager shall provide a schedule of QC samples to all field-sampling personnel prior to the start of each monitoring period. It is the responsibility of field-sampling personnel to fully and accurately implement the QC sampling schedule.

Sampling methods and recordation of results for QC samples shall be the same as described above with the following additional requirements. A field duplicate sample is a second sample collected at approximately the sample location as the regular scheduled sample. To collect a **field duplicate** sample, two sample containers are carried to the sample location and filled in consecutive grabs, using the sampling methods described above. If a QC sample is to be collected at the first sample location on the sample run, then three sample bottles must be carried to the sampling location in order to collect the TC1 sample (see step 2 above). Samples are labeled as described in step 2 above, with the sample number of the latter recorded sample followed by the letters "FD" for field duplicate.

A **field split** sample is collected simultaneously with the scheduled sample in a single grab using a sterile 540ml Whirl-Pak® bag. The sample should be collected as follows:

- Move to the sample location as described in step 5 above.
- Hold one of the two white pull-tabs in each hand and lower the bag into the water. Position the mouth of the bag into the current and away from the sampler. Open the bag at a depth of 15 to 30 centimeters (6 to 12 inches) below the water surface by pulling the white pull-tabs. The bag should begin to fill with water. You may need to "scoop" water into the bag by drawing it through the water up current and away from you. Fill the bag no more than 3/4 full! Lift the bag out of the water. Pour out excess water. Pull on the wire tabs to close the bag. Continue holding the wire tabs and flip the bag over at least 4-5 times quickly to seal the bag. Don't try to squeeze the air out of the top of the bag. Fold the ends of the wire tabs together at the top of the bag, being careful not to puncture the bag. Twist them together, forming a loop. Carry the sample to shore, supporting the bottom of the container.

- Label two pre-sterilized 250-ml polycarbonate sample bottle as described in step 2 above, with the sample number of the second bottle followed by the letters "FS" for field split. Remove the bottle caps and protect them from contamination. Hold the bag securely and vigorously shake the sample continuously for a minimum of 60 seconds. Immediately open the Whirl-Pak and pour the sample into each of the prepared sample bottles, filling the bottles to within 2.5 centimeters (1 to 2 inches) of the rim of the bottle.
- Proceed as normal from step 9 above.

Summary Timeline of Events

The following is a summary of the events, from sample collection through notification of an advisory:

Event	Maximum Duration Between Consecutive Events (Hours)	Cumulative Time Over All Prior Events (Hours)
Sample collected (typically on Monday or Tuesday of each week during the swimming season).	0	0
Deliver sample to lab and sample analysis initiated	6	6
Lab obtains results	24	30
Lab notifies BEACH Database Manager of lab results	24	54
BEACH Database Manager process data to obtain classification results • If decision rule indicates an out-of-compliance result, BEACH Program Manager determine if an advisory or resampling is required • If BEACH Program Manager decides that an advisory should be issued, notify local authorities of advisory.	24	78
Beach site is posted, and BEACH Database Manager notified that posting is complete	18	96

References

USEPA. 2002. *National Beach Guidance and Required Performance Criteria for Grants.* June 2002. USEPA 823/B-02-004. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

DEPARTMENT OF HEALTH AND HOSPITALS
OFFICE OF PUBLIC HEALTH / DIVISION OF LABORATORIES

LOUISIANA'S BEACH PROGRAM WATER SAMPLE FORM

Lab

TIME REC'D:_____ DATE REC'D:_____ ANALYST_____

PROJECT CODE:_____

Temperature Control TC_1_____ TC_2_____

General

COLLECTED BY _____ DATE_____ TIME_____

Environmental

TIDE_____WEATHER_____ RIVER STAGE _____

WIND DIRECTION_____ WIND SPEED _____

SAMPLE NO.	STATION NO.	WATER TEMP	LAB NO.	POSITIVE TUBES	F.C.* MPN/100 ml	POSITIVE WELLS	ENTERO-COCCI** MPN/100 ml	SALINITY PPT

*A-1-M METHOD. OFFICIAL METHODS OF ANALYSIS OF THE AOAC, 15th EDITION 1990, P. 436-437; **Enterolert

TIDE CODE	
01	High tide
02	High tide falling
03	Low tide
04	Low tide rising
05	Normal
06	High tide rising
07	Low tide falling
08	Extreme low tide
09	Extremely high tide
01	High tide

WEATHER	
1	Clear
2	Scattered clouds
3	Partly cloudy
4	Cloudy
5	Mist
6	Fog
7	Light shower
8	Rain
9	Undetermined

WIND DIRECTION	
00	Calm
01	North
02	North-Northeast
03	Northeast
04	East-Northeast
05	East
06	East-Southeast
07	Southeast
08	South-Southeast
09	South
10	South-Southwest
11	Southwest
12	West-Southwest
13	West
14	West-Northwest
15	Northwest
16	North-Northwest
17	Variable
18	Undetermined

WIND SPEED	
0	Calm (0) mph
1	Light (0-5) mph
2	Moderate-Light (5-10) mph
3	Moderate (10-15) mph
4	Moderate-Strong (15-20) mph
5	Strong (20-35) mph
6	Gale or > (35 or more) mph
7	Not reported

Appendix B. Summary of Version Modifications.

Appendix B

Summary of Version Modifications
Louisiana's Beach Program Quality Assurance Project Plan

Version 1 to Version 2

Changes documented in *Louisiana's BEACH Grant Report, Grant Year 2002-2003*:

- The criterion that no more than 10% of samples shall exceed fecal coliform densities of 400 cfu/100ml was eliminated in late May 2004.
- Non-independent samples, or samples collected on the same date at a sample location, were averaged, and their mean was used in weekly determinations of compliance with the Program's water quality decision rule.
- Samples with indicator organism densities less than detection limits, shown as fecal coliform density "<2" or enterococci density "<10" on datasheets, shall be recorded as 2 and 5, respectively.
- Samples shall be collected in waist-deep (1m) rather than knee-deep (0.5m) water.
- Samples shall be collected between 7:00 AM and 11:30 AM to limit temporal variability.
- In the event that the source of an exceedance has been identified and eliminated, intensive sampling may be conducted and the most recent 5 samples used to determine compliance with the Program's water quality decision rule rather than all samples collected during the most recent 30-days.
- IDEXX Enterolert Quanti-Tray will be used instead of Enterolert Quanti-Tray 2000.
- The precision goal for enterococci was adjusted from a sample precision of 10% to 60% and laboratory precision from 5% to 30%.

Changes documented in the *Final Louisiana's BEACH Grant Report, 2005 Swim Season*:

- The precision goal for salinity was adjusted from a sample precision of 5% to 10% and laboratory precision from 2.5% to 5%.

Version 2 to Version 2.b

Version 2.b documents personnel changes that occurred since publication of Version 2, and clarified the DQO precision goals (Section A7, Louisiana BEACH Program DQOs, Precision). No other changes were made to the QAPP.

Version 2.b to Version 2.c

Version 2.c documents personnel changes that occurred since publication of Version 2.b. No other changes were made to the QAPP.

Version 2.c to Version 2.d

Version 2.d documents personnel changes that occurred since publication of Version 2.c, and altered the DQO precision goals for enterococci and fecal coliform, changing their "lab" Mean RPDs from 30% to 45% (Table 7.1). The original "lab" precision goals were hypothesized values established at the beginning of LA's BEACH Program's implementation. Recent analysis of field split results collected by the Program through 2010 indicate that 30% Mean RPD is not achievable using the current method (IDEXX Enterolert; n = 242, enterococci lab mean RPD = 44.9 [SE = 2.8], and fecal coliform mean RPD = 41.8 [SE = 3.0]. Completion of the annual technical report was also changed from January to March, which includes evaluation of tier assignments. No other changes were made to the QAPP.