State of Louisiana

Source Water Assessment Program

February 1999
(Revised April 2001)

The Louisiana Department of Health and Hospitals, the primacy agency for the Safe Drinking Water Act, entered into an interagency agreement with the Louisiana Department of Environmental Quality to develop and implement the State's Source Water Assessment Program. The program is funded by a set-aside of the Federal Drinking Water State Revolving Fund Grant awarded to the Department of Health and

Hospitals.

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Chapter 1: Overview

1.1 Introduction

The Safe Drinking Water Act (SDWA) Amendments of 1996 emphasize pollution prevention to ensure safe drinking water, focusing on the protection of the water sources. In order to achieve such protection, all states are required to develop Source Water Assessment Programs. This approach relies upon two key elements: a clear state lead in program development and management, and public involvement. Once completed, these assessments can be used to focus prevention resources on drinking water protection. **The ultimate goal of the State of Louisiana Source Water Assessment Program is to balance technical adequacy against cost and time, and still produce a useable product that the public can understand.**

1.2 Background

Section 1453 of the Safe Drinking Water Act (SDWA) Amendments of 1996 required each state to develop a Source Water Assessment Program (SWAP) that will; 1) delineate areas providing source waters for all Public Water Supplies PWSs, 2) inventory significant potential sources of contamination and their associated contaminants within those areas, and 3) determine the potential susceptibility of each PWS to contamination from those potential sources. A Public Water Supply (PWS) is defined as one that provides water for human consumption through constructed conveyances to at least 15 service connections or an average of 25 individuals daily at least 60 days per year. The State has involved the public during both the development and implementation phases of the SWAP by forming a Citizens and Technical Advisory Committee and by conducting statewide public meetings.

The State will build on the existing foundation established by the Wellhead Protection Program (WHPP). The SDWA Amendments of 1986 mandated that each state develop a WHPP to protect PWS wells from contaminants which may have any adverse effect on human health. The State of Louisiana Department of Environmental Quality (DEQ) began implementing the WHPP in 1991, targeting the most vulnerable PWS wells first. The requirements for the WHPP are: 1) Delineate wellhead protection areas (WHPAs) for each PWS well or wellfield, 2) Inventory significant potential sources of contamination within those delineated areas, 3) Develop contingency plans for each PWS indicating the location and provision of alternate drinking water supplies in the event of total or partial loss of water, and 4) Develop management approaches such as implementation of source control measures, technical assistance, and public education. The SWAP will include the delineation, inventory, susceptibility and public information phases, collectively referred to as the "assessment" phase. The goal of the U.S. Environmental Protection Agency (EPA) and the State is to complete the contingency plan and management phases, collectively referred to as the "protection phase", for each PWS once the SWAP is complete. Thus, a Source Water *Protection* Program will ultimately be developed to protect all sources of drinking water in the state. We expect the protection phase to occur by merging the completed SWAP water systems into the Louisiana Wellhead Protection Program with funding provided by Clean Water Act, Section 106 grant money.

The Louisiana Source Water Assessment program document was submitted to EPA Headquarters and Region 6 in February of 1999. Their comments are included in Appendix Y. After some minor revision, the program was approved in November of 1999. As the program has evolved it has undergone further minor revision to make it more effective and efficient. The document was updated in March of 2001 to reflect these changes.

1.3 Source Water Assessment Key Elements

A completed source water assessment for a PWS must include the following key elements:

1.) A delineation of the source water protection area (SWPA). The delineated SWPA defines the zone through which contaminants, if present, are likely to migrate and reach a drinking water well or surface water intake.

2.) A contamination source inventory for that SWPA. The inventory consists of regulated and unregulated significant potential sources of contamination and associated contaminants of concern within the SWPAs or any known existing contamination. This is in essence a vulnerability analysis.

3.) A determination of the PWS's potential susceptibility to contamination by sources inventoried within the SWPA. The potential susceptibility analysis has a hydrologic and hydrogeologic sensitivity analysis along with the vulnerability analysis within the delineated surface water and ground water areas respectively.

Chapter 2: Program Development and Public Participation

2.1 SWAP Citizens and Technical Advisory Committee

The Louisiana Source Water Assessment Program Citizens and Technical Advisory Committee was formed from the Safe Drinking Water Coalition, a broad group of citizen and technical representatives. This group was formed under the aegis of the Louisiana Department of Health and Hospitals. This state agency has primacy with regard to drinking water in the State. Although this group is the core of the SWAP Committee, others were asked to join the committee when it was felt their expertise or interest was pertinent. An initial meeting with all of the members of the coalition was held on March 20, 1998 in order to ascertain interest in serving on the SWAP Committee. An overview of the Source Water Assessment Program was presented. Also, Safe Drinking Water Activities was a major topic discussed at this meeting as well as the Drinking Water State Revolving Fund (DWSRF), the Capitalization Grant, and the Intended Use Plan. The agenda for this meeting and subsequent SWAP Committee meetings can be found in Appendix A. Subsequent committee meetings were held on July 8, 1998, August 4, 1998, and September 14, 1998. The minutes of the meetings, attendance lists, comments, questions, and responses are also included in Appendix A. A Comments and Suggestions form was also provided at the meetings as an additional means for the committee to provide input at any time during the course of program development. A copy of the form is included in Appendix B. The committee helped formulate the program prior to presentations to the public. The committee will continue to serve as a steering committee during the implementation process as needed.

It should be noted that all meetings were held as an open forum and several committee members brought guests as can be seen on the sign in sheets. A representative of the Sierra Club contacted DEQ about the committee meetings, and was invited to attend.

2.2 Source Water Assessment Program Committee Members

The following is a list of the members of the Source Water Protection Program Citizens and Technical Advisory Committee:

Last Name	First Name	Organization Name	City
Arabie	Greg	LA Rural Water Association	Rayne
Boydstun	Jan	LA Department of Environmental Quality	Baton Rouge
Branch	Bill	LA Cooperative Extension Service	Baton Rouge
Broussard	Don	City of Lafayette Water Department	Lafayette
Casanova	Keith	LA Department of Environmental Quality	Baton Rouge
Credeur	Patrick	LA Rural Water Association	Kinder
Daigle	Susan	LA Public Health Association	New Orleans
Hindrichs	Al	LA Department of Environmental Quality	Baton Rouge
Holmes	Joe	LA Department of Environmental Quality	Baton Rouge
Johnson	Doyle	LA Department of Natural Resources	Baton Rouge
Johnson	Louis	LA Department of Environmental Quality	Baton Rouge
King	L. Gordon	LA Municipal Association	Baton Rouge
Lejeune	Larry	LA Department of Agriculture and Forestry	Baton Rouge
LeMon	Les	LA Department of Health & Hospitals	New Orleans
Lovelace	John	U.S.G.S.	Baton Rouge
McIntyre	Evans	LA Department of Natural Resources	Baton Rouge
Metcalf	Richard	Mid Continent Oil & Gas Association	Baton Rouge
Naquin	Kent	SW AWWA, Baton Rouge Water Company	Baton Rouge
Subra	Wilma	LA Environmental Action Network	New Iberia
Sabins	Dugan	LA Department of Environmental Quality	Baton Rouge
Stegall	Butch	LA Department of Agriculture and Forestry	Baton Rouge
Toups	Prosper	Terrebonne Parish Water Works #1	Houma
Walker	Linda	League of Women Voters	New Orleans
Walter	Bill	LA Department of Transportation and Development	Baton Rouge

2.3 Public Participation

The League of Women Voters was represented on the Citizens and Technical Advisory Committee. That representative set up public workshops in some of the major cities through local League members and provided contacts for others. The cities included New Orleans, Lafayette, Lake Charles, Shreveport, and Monroe. The presentations consisted of an overview of the SWAP. However, the potential susceptibility analysis discussion included a discussion of the particular aquifer or water body serving the citizens of the area with drinking water. The League used their target audience contact list for a mail out of invitations that included a description of the program and a time and place for the meeting. Invitations were also sent to HIV/Aids program funded community based organizations in cities where they existed. A list of these organizations can be found in Appendix C. In addition, the meeting in the City of Monroe was held at the St.

Francis Senior Plaza. Announcements for each meeting were also posted on the DEQ Web Page Calendar, and announcements were printed in the newspapers in each city where a meeting was held. Meeting announcements are found in Appendix D. The League invited people that they considered to be interested stakeholders and several hundred invitations were sent. The local league representative arranged for a meeting place and the advertising of the program in the area. DEQ also invited local experts or interested parties that they were aware of. The New Orleans Office of Environmental Affairs and the Jefferson Parish Department of Environmental and Development Control organized the meeting for the New Orleans area, and again several hundred invitations were sent out. The City of Shreveport organized the meeting in Shreveport. Generally, the mailings went to civic associations, community activists, business organizations, local officials, water department personnel, trade groups, and those organizations on compromised immune system mailing lists.

The Comment and Suggestion Form used for the Citizen and Technical Advisory Committee members (see Appendix B) was also provided to all public meeting attendees to give them the opportunity to submit comments after attending the public meetings. Despite the distribution of hundreds of meeting announcements and newspaper advertising, there were only 15 to 27 people in attendance at each meeting. However, they had a genuine interest in the program and provided useful input. A responsiveness summary showing how the significant public comments and opinions were used in developing the program is included in Appendix D. In addition, two members of the DEQ SWAP staff presented an overview of the program at the Annual Louisiana Water Quality Technology Conference in December 1998. The conference is held in two locations, Alexandria and Baton Rouge, for water system operators, superintendents, managers, and engineers. The conference, developed by the Southwest Section of the American Waterworks Association (AWWA), the Louisiana Conference on Water Supply, and the Louisiana Department of Health and Hospitals (LDHH), is designed to give an update on the Amendments to the Safe Drinking Water Act. There were approximately 400 attendees at the conference. Copies of the announcement and agenda are included in Appendix E.

Chapter 3: Data Collection and Management

3.1 Database Acquisition and Data Synthesis

Data management is essential to the success of the Source Water Assessment Program. An exhaustive data search has been conducted to identify databases within and outside of DEQ, which are relevant to the SWAP. A list of these databases can be found in Appendix F. The organization, manipulation, and analysis of pertinent data for assessments will be accomplished primarily through the use of a Geographic Information System (GIS) and other analytical tools such as ArcView. All relevant databases will be incorporated into the GIS, along with all data collected in the field. The GIS is a very useful tool to conduct source water assessments, display data to stakeholders and the general public, and help water program managers target sensitive areas for protection. The GIS will be used to generate all maps, potential susceptibility analyses, and reports.

3.2 Field Data Collection Methodology

3.2.1 Ground Water Systems

3.2.1.1 General Field Data Collection

This project entails field data collection throughout the state from approximately 1,650 ground water systems. C-K Associates, Inc. (C-K Associates) will strategically mobilize personnel from its three offices within the state to perform the required field work. The standard operating procedure (SOP) for general field data collection methodology will be as follows:

(1) Typically, approximately three weeks prior to conducting the field survey of any given water system, C-K Associates will mail a letter of introduction provided by Louisiana Department of Environmental Quality (LDEQ) to each water system's local contact persons. The letter will explain the intent of the Source Water Assessment Program (SWAP), the benefits to the people served by the water system, and the authorization of the program through the Safe Drinking Water Act Amendments of 1996. A copy of the letter is provided in Appendix X.

(2) Assigned field crews will receive project-specific training on project tasks and procedures prior to starting any field work;

(3) Using the various electronic databases that will be provided by LDEQ, C-K Associates will prepare a "baseline map" for each water system. The baseline map will show the reported location(s) of the system's well(s) and of all potential contamination sources within the prescribed radius, as ascertained from the provided databases. A copy of this map will be provided to the water system contact for preliminary review. C-K Associates will conduct a reconnaissance visit to each system prior to completing the field survey. The purpose of this meeting will be to review the baseline map with the water system contact and to

further brief the water system contact regarding the intent of the SWAP, the benefits to the people served by the water system, and the authorization of the program through the Safe Drinking Water Act Amendments of 1996. C-K Associates will provide LDEQ with documentation of the meetings with each water system.

(4) After receiving the required training in field equipment and procedures and making the reconnaissance visit, the first task for field crews will be to obtain global positioning system (GPS) locations for water wells in the water systems in their respective areas of operations. GPS locations for all significant potential sources of contamination (SPSOC) identified within the delineated source water protection areas for the systems will also be obtained. A Standard Operating Procedure for Collection of Geographic Locational Data Using the Trimble Pro-XR GPS Receiver was developed for DEQ and will be used for the SWAP project for quality assurance. A copy of the SOP is included in Appendix G.

3.2.1.2 Field Methods and Geographical Information System Interaction

Each survey crew will be furnished with an Intel/Windows '98 based laptop computer, a registered version of ESRI ArcView®, Trimble Pathfinder Office, communication software, and a photo processing software package. The primary uses of the computers will be as follows:

- ?? The use of Trimble Quickplan software to plan for optimum satellite geometry.
- ?? Daily download of GPS data files into the Trimble Pathfinder Office software package.
- ?? Incorporation of digital camera images of the wells along with proper annotation using the photo processing software package.
- ?? ArcView® Graphical Information System (GIS) to establish predetermined radii along with relevant environmental databases that would aid the field survey.
- ?? ArcView® GIS to verify positional data while incorporating additional vector themes (point, line, and polygon features) overlaid on the raster based digital images. Base maps will be generated from the LDEQ supplied well database and combined with available databases that may be beneficial in determining the potential contamination sources (*e.g.* RCRA, TRI, Geographic Names Information System, GNIS, *etc.*). This data will be overlaid on digital raster images that will be geo-referenced to the datum and projection preferred by LDEQ. These include United States Geological Survey (USGS) Digital Raster Graphics (DRG) 1:250000, 1:100000, and 1:24000 quad maps, aerial photography, and satellite imagery.
- ?? Communication software packages that allow the easy transfer of files via a modem and a file transfer protocol (ftp) site.
- ?? Field maps will be generated as needed for assistance in preplanning and communication to local officials. Digital images will be delivered in the appropriate formats (JPG) along with digital, annotated photography.

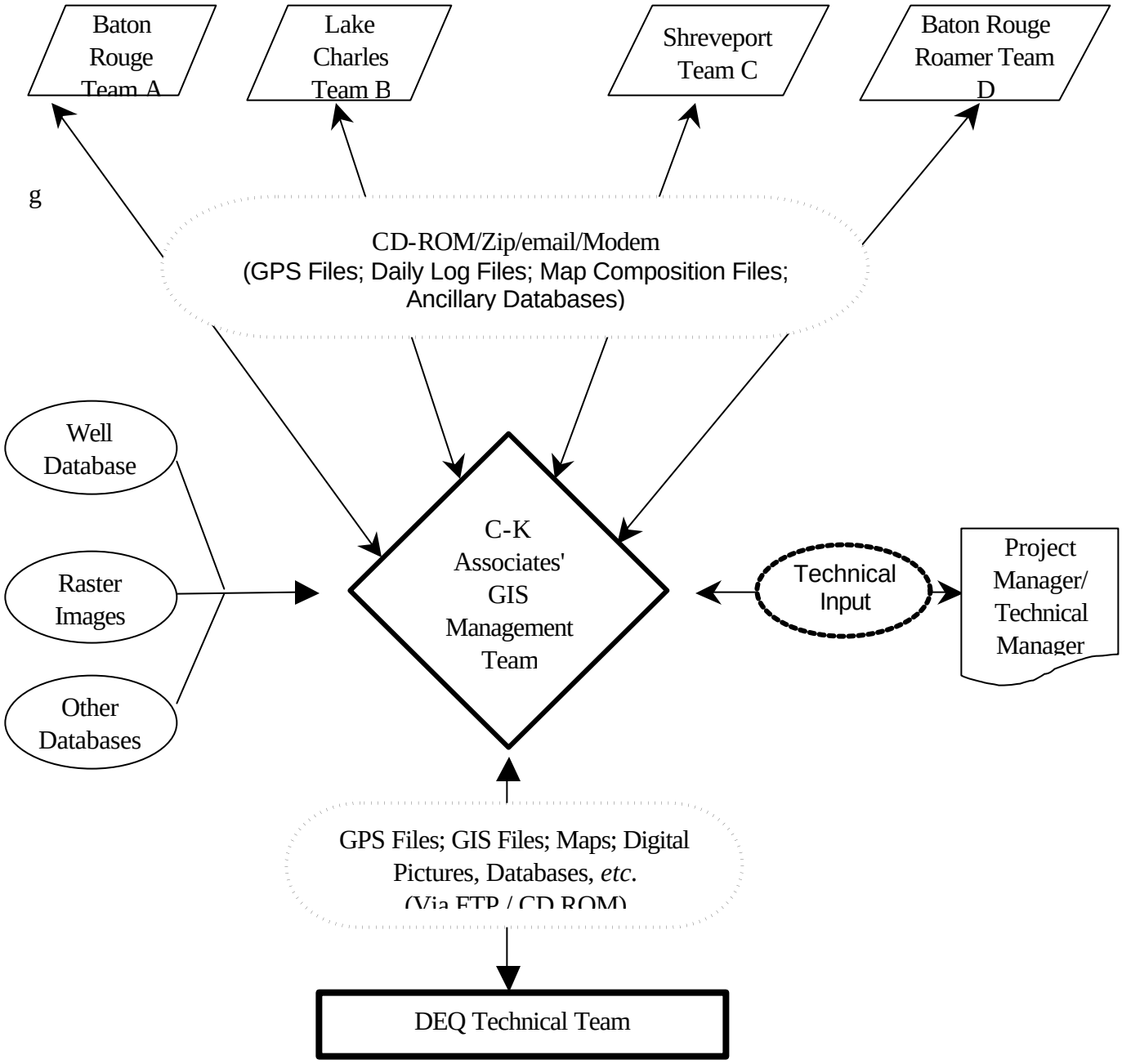
The GIS will consist of the ESRI products required by LDEQ. The GIS will house all field derived data obtained for the GPS, rangefinder, and digital camera images. The GIS will be

designed so the pre-defined data dictionary fields are stored in Microsoft® Access (Access) format and linked using Open Database Connectivity (ODBC). The parameters and formulas for the susceptibility analysis will be programmed so that GIS analysis can be performed and corresponding reports can be furnished. This analysis includes the use of ESRI GIS products as the primary GIS for field survey and map production. Images will be referenced and registered using Erdas Imagine image processing software.

3.2.1.3 Data Management

Data is the foundation of this project. Proper procedures will be outlined, documented, and followed so that the large amount of data that will be generated and/or acquired is managed efficiently and accurately. The data sources will be of various origins and will play different but collective project roles. While most data will be assembled and compiled by the GIS Manager (or under his direction), the raw data and the initial steps that transfer the raw data will be done by field crews. Every data transfer/translation procedure will be followed so that proper and accurate data flow is obtained. Below is an outline of the SOPs used to ensure that proper data management is performed.

Generalized Data Flow



A methodology has been developed for field data collection to ensure accuracy and consistency in the data. The methodology consists of the following steps:

1. The field personnel will receive project-specific training on project tasks and procedures, including how to work with local water system personnel, how to operate the Global Positioning System (GPS) equipment, computer equipment and laser rangefinders, and how to backup and transmit collected data to a central location. A standard Operating Procedure for Locating Wells and Significant Potential Sources of Contamination has been developed for quality assurance and can be found in Appendix G.

2. After training, the first task for field personnel will be to obtain GPS location for wells and intakes in the water systems in their areas of operations. As much documented data as possible will be collected from the water system operator on each well / intake. We will coordinate with the Department of Health and Hospitals regional staff in the process of collecting the data. ArcView software on the field laptop computers will be utilized by the field personnel to generate the appropriate 1000', 1/2 mile, or one mile radius circle to delineate the Source Water Protection Area for each well. For surface water systems, the upstream portion of the watershed within 5 miles of the intake, or "critical area" will be delineated for the ground truthing. Other available database coverages will be included on these field maps such as CERCLA sites, RCRA sites, etc. If it is not possible to generate these maps in the field, the coordinates of the wells / intakes will be transmitted to the Project Data Manager / GIS Operator (PDM/GISOP) so that a map can be generated and returned to the field personnel for use in the assessments.

3. After wells / intakes have been located using GPS and the SWPA has been delineated, the field personnel will begin collecting Significant Potential Source of Contamination (SPSOC) inventories in the SWPA. As in (2) above, the field personnel will collect data in each SWPA and forward the data to the PDM/GISOP daily. The PDM/GISOP will import the data into the master database and export it to the ArcView GIS. The GIS will allow queries for required quarterly report generation. The PDM/GISOP will generate maps (digital and hard copy) for each SWPA. The GPS file will be forwarded to the person in charge of coordinating field operations for review.

4. The PDM/GISOP will coordinate with the Project Manager (PM) to generate a potential susceptibility analysis for each system on an ongoing basis throughout the project. At the completion of all data gathering for ALL systems, a potential susceptibility ranking will be generated by the GISOP for all SWPAs.

Chapter 4: Delineation of Source Water Protection Areas

4.1 Ground Water Systems

For assessment and protection of ground water supplied PWSs, the State of Louisiana will use the Arbitrary Fixed Radius Method of Delineation in accordance with accepted methods for delineation under the Wellhead Protection Program (WHPP) of Section 1428 of the SDWA. The Arbitrary Fixed Radius Method is the established method for the State's EPA approved Wellhead Protection Program due to the highly variable nature of river laid deposits across the state and the lack of site specific hydrogeologic data.

During development of the State's WHPP, a study was conducted to assess methods for delineation of wellhead protection areas (Appendix H). The study concluded that simple analytical techniques such as the Calculated Fixed Radius Method are inappropriate for Louisiana geology due to the extreme heterogeneity and anisotropy (variability affecting flow rate and direction) of the aquifers. These variations occur over small areas and use of regional data can grossly misrepresent site-specific conditions. Numerical modeling is the most appropriate method for the geology. However, these models are quite complex and require a considerable amount of data and time for each site. Lack of site-specific data, time, and staff make this method unfeasible.

The radius of the SWPAs will be determined by well sensitivity based on the depth of the screened interval of the well and the age of the well for all community and non-transient non-community systems. Wells shallower than 1000 feet are considered to be the most vulnerable. A statewide average ground water velocity study (Appendix I) was conducted to determine an appropriate protection area size for these wells. (This study supports the extreme heterogeneity of the constantly shifting river laid deposits by exhibiting wide variations in velocity for each aquifer). A one-mile radius protection area is estimated to afford at least a 5-year time of travel to these wells.

Deep wells (deeper than 1000 feet) are protected by confining layers and are much less vulnerable to contamination than relatively shallow wells in unconfined or semi-confined aquifers. Due to the presence of this natural protection, the delineated protection areas for these wells will be reduced to 1000 feet. However, the age of the well also plays an important role in its sensitivity to contamination. As wells age, the grouting and casing can deteriorate. Also, wells constructed before the Louisiana Department of Transportation and Development *Water Well Rules, Regulations, and Standards* were promulgated in November 1985 may not have been grouted properly, if at all. A poorly grouted annular space provides a conduit for contaminant migration from the surface and shallow subsurface zones to the well screen. Due to this potential, the protection areas for these deep wells will be increased to a half-mile radius. Well integrity indicators that LDHH sanitarians look for during their sanitary surveys include sand or silting of water due to casing crack or failure, bacteriological contamination, cracked or rusted casing or sanitary seal, cracked foundation, and a "hanging" foundation which has subsided or eroded. Coordination between LDHH Sanitary Survey inspections and the SWAP staff through the DWSRF Program Manager, will further aid in well integrity determinations.

Limited exposure to chemical and biological contaminants can cause acute health effects. Accurate tracking of adverse health effects resulting from pathogens ingested at transient non-community wells may be difficult due to the transient nature of the population drinking water from these types of water supplies. State enforcement records indicate that problems with these systems have been pathogen-related. Furthermore, these problems have been in the distribution system and not the source water. Research indicates that pathogens have a finite life in the subsurface, estimating their viability to be from 18 months to 2 years. An average two-year time of travel was calculated for each major aquifer in the state and the results are shown on page 6 of Appendix I. Based on the statewide average ground water velocity study, a 1000-foot radius should be adequate for protection of such systems, with the exception of the Terrace Aquifer. Due to a higher ground water velocity in the aquifer, the radius will be increased to a half-mile for wells screened in the Terrace Aquifer.

Radius sizes based on sensitivity in order of priority are as follows:

1. A one-mile fixed radius for wells screened above 1000 feet.

2. A half-mile fixed radius for wells screened below 1000 feet and completed before Louisiana Department of Transportation and Development regulations promulgated November 1, 1985.

3. A 1000-foot radius for wells screened below 1000 feet and completed after LDOTD regulations were promulgated.

4. A half-mile radius for transient non-community wells completed in the Terrace Aquifer.

5. A 1000-foot radius for transient non-community wells.

If well information (depth and age) is not available from the public water system or the database the default delineation will be a one-mile radius with the exception of the transient non-community wells as discussed above.

4.1.1 Remote Recharge Areas

Louisiana's Source Water Assessment Program has stated that wells drawing from **confined** aquifers will have a maximum wellhead protection area defined by an arbitrary fixed radius of **1/2 mile**; and wells drawing from **unconfined** aquifers will have wellhead protection areas defined by an arbitrary fixed radius of **1 mile**. If a confined aquifer has a "remote" recharge area that is 1 mile or less from a drinking water well, then that recharge area could be considered as part of the source water protection area for that confined aquifer well. If the remote recharge area for the confined aquifer is greater than 1 mile from a well, then Louisiana does not consider the recharge area as part of the source water protection area for a well. The diagrams shown in Appendix J provide map view and cross-section illustrations of what would be considered as a remote recharge area. For the most part, beds dip very gently in Louisiana, and as result it is not likely that there will be many remote recharge areas. The diagram displays somewhat steeply dipping beds, and this may be found around some salt domes that have shallow expression. The maximum delineated area for ground water systems is a one-mile radius around the well. If the

remote recharge area for a confined aquifer falls within this delineation, or a lesser delineation, this remote recharge area for this aquifer will be considered part of the SWPA.

4.1.2 Conjunctive Delineation

In 1995, the Louisiana Department of Health and Hospitals, Office of Public Health (OPH) contracted with the U.S. Army Corps of Engineers to conduct a statewide study of community ground water public water supply systems to determine if the ground water was under the direct influence of surface water. Non-community systems were evaluated in 2000. Both of these reports are found in Appendix L. The U.S. Army Corps of Engineers (USACE) – New Orleans District created a Geographic Information System (GIS) coverage of all community public supply wells in the state. Well locations from the OPH and stream information supplied by the United States Geological Survey (USGS) were entered in the GIS. The contract called for the Corps to evaluate the community wells for being "under the influence of surface water" using the following criteria:

1. The first criteria used a setback distance of two hundred feet. To make valid determinations, all distance errors had to be included in the GIS. The USGS stream data had a potential forty-two foot error and the well location latitude and longitude data have a maximum error of 300 feet. Therefore a 242-foot boundary was drawn from each stream and a 300- foot boundary radius was drawn around each well. If a well did not intersect with a stream, then the well was exempted from being under the influence. There were 2,605 community wells evaluated using the first criteria. If a well did not meet the first criteria, then the second criteria was used.

2. The second criteria states that wells having screens below a confining layer are exempt from being under the influence. Well logs were reviewed for well depth, well construction and soil type.

The wells remaining, after the Corps study, were evaluated in the field by OPH regional staff. Also, there were several wells for which no electric log could be found. There were 204 wells remaining, and the OPH regional offices evaluated the remaining wells using a measured 200-foot setback distance. If a well did not meet the 200-foot setback distance from a surface water body, then the public water supply was requested to submit a well log. There were 171 wells eliminated by the field work. The remaining 33 wells were targeted for sampling using the Microscopic Particulate Analysis (MPA). Subsequent to the initial MPA, there were 7 wells requiring three rounds of MPA plus Bac-t samples. These wells were considered a medium to high risk and were sampled under a variety of conditions (i.e. high water table, seasonal fluctuations). A final determination was made that no ground water community systems were under the direct influence of surface water. Also, no confirmed or presumptive Giardia cysts or Cryptosporidium oocysts were identified in the Microscopic Particulate Analysis.

The study of the non-community systems was conducted in the same way using the same criteria. The total number of non-transient non-community and transient non-community wells in the state is approximately 829. It was determined that out of 829 total wells, 56 non-community PWS wells are located within 200 feet of a surface water-body. This list of 56 wells was sent to the

Army Corps of Engineers to begin the next phase of the project, being the ordering of the Driller's Logs from the DOTD by the ACOE's geotechnical department, to determine wells screened in fresh-water aquifers that are separated from the surface water feature by an extensive geologic unit of low permeability.

The Army Corps of Engineers used the list of 56 field-verified wells to determine if any satisfy Criteria 2, which is the presence of a geologically extensive, confining clay-type layer of low permeability. The complete analysis involved DOTD driller's logs, geologic maps, geologic cross sections defining the subsurface lithology, topographic maps, engineering geology maps, and borings information. Of the 56 water wells that were investigated, 48 have a confining clay layer and 8 water wells were MPA testing candidates, as they do not have a clearly delineated confining layer or there was no data available for this determination. After MPA testing on these 8 wells a final determination was made that no non-community ground water systems were under the direct influence of surface water. Also, no confirmed or presumptive Giardia cysts or Cryptosporidium oocysts were identified in the Microscopic Particulate Analysis.

It should be noted that there are well set-back distances in Louisiana defined in the Department of Health and Hospitals State Sanitary Code as well as the Department of Transportation and Development (LDOTD) Water Well Rules, Regulations and Standards (See Appendix K).

Other states have found sandstone, limestone and other porous material more vulnerable to the transport of particulates than sand and gravel aquifers. Louisiana's soils of intermittent sand and clay beds cause attenuation of the movement of larger particles such as Giardia and Cryptosporidium. Also, Louisiana's lack of springs, dug wells, infiltration galleries, and rock wells serving as public water supply sources eliminates these types of high-risk sources from consideration as GWUDI.

Additionally, a USGS study (Movement and Fate of Fecal-Coliform Bacteria through a Shallow Aquifer System in Southeastern Louisiana, 1991, Water Resources Technical Report No. 56, USGS and LDOTD) was conducted to determine the rate and direction of movement and fate of viable fecal coliform (FC) - bacteria in an aquifer. It was found that the "combined effects of dilution, sorption and filtration greatly attenuated FC-bacteria concentrations." The conclusion was that the rapid decrease in concentrations of FC-bacteria, compared to relatively slow ground water movement, substantially limits the extent of contamination of shallow aquifers.

The final report for Ground Water Under the Influence of Surface Water was issued in April of 1998 for community systems and August (see Appendix L). If future investigations show a system or systems to be GWUDI, then the OPH will require installation of filtration. In addition, conjunctive delineation of the zone of ground water contribution and the area of surface water contribution will determine the source water protection area for that system or systems. A conjunctively delineated source water protection area for a PWS well would include the WHPA plus the entire watershed area upstream of the intersection of the WHPA and the stream. The watershed would be segmented for inventory and assessment purposes as outlined in Section 4.2.

4.2 Surface Water Systems and Associated Watersheds

There are 85 intakes located within 27 water bodies in the State of Louisiana. A list of these intakes and the systems they serve can be found in Appendix M. In terms of watersheds, the state has delineated 12 basins and 473 drainage subsegments within the 12 basins. Surface water drinking intakes are located in 8 of the 12 basins and subsegments that influence the drinking water body.

Delineation of Source Water Protection Areas (SWPAs) for surface water bodies will include the entire watershed upstream of the public water supply (PWS) intake structure up to the boundary of the state border if necessary. However, for the purpose of the inventory of significant potential sources of contamination, the contributing watershed upstream of the intake or "non-critical area" will be delineated for a database search. The field assessment will be conducted in the "critical area" which is defined as the upstream portion of the watershed within 5 miles of the intake. The remainder of the watershed will be inventoried by a database search. The Mississippi River is an exception to this delineation method and is being handled distinctly as discussed in Section 5.4.2. Some systems may require a more in-depth look because of risk-ranking or screening processes used in the potential susceptibility phase of assessment. See the Potential Susceptibility Analysis Risk Ranking Matrix for Surface Water Systems in Appendix S for a graphic example of delineation.

There is isolated valid time of travel data available on some Louisiana streams, but after a meeting with the USGS in Baton Rouge and three former USGS hydrologists on contract to DEQ, it was determined that there is not reliable flow and velocity data for use in the SWAP with the exception of the Mississippi River and Bayou Lafourche, where dye studies have been done. Based on the low topographic relief in Louisiana, streams are relatively slow moving and we believe that there will be sufficient time to react to a pollution event beyond 5 miles from the intake and this distance will also allow time for dilution to take place. However within the critical area, reaction must be faster, and it is important to know with accuracy what is in the critical area and where it is within the area. In an EPA document, ***State Methods for Delineating Source Water Protection Areas for Surface Water Supplied Sources of Drinking Water,*** Salt Lake City, Utah is discussed as using the entire watershed area upstream of its surface water intakes as the basis for its management decisions (page A1-4). "Because of the mountainous nature of the region, drainage areas are smaller, and can thus be more easily managed than the drainage area of a river of similar size in the coastal plain of the U.S." In Louisiana, we have large watersheds and we are going to encourage water systems to manage critical areas. The keyword is manage, and we believe the critical areas chosen are manageable, yet still protective of the public water supplies.

Time of travel calculations can be applied to the Mississippi River. The Early Warning Organic Compounds Detection System (EWOCDS) is a cooperative program among the Louisiana Department of Environmental Quality (DEQ), five industrial water users, and three municipal users along the Mississippi River. Monitoring stations are located at each of the eight intakes and samples are analyzed for 20 volatile organic compounds twice daily. Based on river velocity data (related to river height) provided weekly by the Army Corps of Engineers, DEQ can calculate the

time of travel for the leading edge, peak, and trailing edge of a spill. Model results have been compared to actual travel times for several spills, and were found to accurately predict the peak travel times for several spills over the 100-mile industrial corridor from Baton Rouge to New Orleans. This provides sufficient time for early warnings to be issued.

Also, the Louisiana Department of Health and Hospitals has a Waterworks Warning Network Plan for water plant operators covering 50 surface water intakes from Baton Rouge to below New Orleans along the Mississippi River and Bayou Lafourche. The EPA is providing $100,000 in funding to optimize the network whereby an electronic communications system will link private, local, state and federal stakeholders in the event of an emergency. As stated by the EPA, the funding will help to protect the health of at risk populations by ensuring access to safe drinking water supplies as the latter populations are often more sensitive than healthy adults to contaminants in drinking water.

DEQ also has a time of travel model for Bayou Lafourche. Bayou Lafourche can be affected by the quality of the Mississippi River water as this water is pumped into Bayou Lafourche. Thus again, spills are to be noted and sufficient time given to water plants to close down intakes when necessary.

Louisiana is somewhat unique in how watersheds will be delineated. Many of our rivers are bound by man-made and natural levees; thus overland flow into the rivers is restricted. Many of our rivers have locks and/or dam structures, and this is a further control of the flow in the river. Many of our rivers also have pump stations whereby water from one water body is pumped into another water body. In the southern coastal zone part of the state, rivers and bayous come under the influence of Gulf of Mexico tides at certain times of the year and flow direction may actually reverse. Thus, the case is made for the iterative approach, and we will be guided strongly by our DEQ personnel who live and work in the areas of interest.

It is our intent to follow the protocol set for ground water systems and hire a contractor to conduct the surface water assessments and susceptibility analyses.

Chapter 5: Assessment of Significant Potential Sources of Contamination within Delineated Source Water Protection Areas

5.1 Contaminants of Concern

The contaminants of concern must include those raw water contaminants regulated under the Safe Drinking Water Act (SDWA) (those contaminants with a maximum contaminant level or "MCL"), contaminants regulated under the Surface Water Treatment Rule (SWTR), and the microorganism *Cryptosporidium*. The SWTR is designed to minimize risks from only a subset of microbial contaminants (*Giardia, Legionella,* and viruses). In addition, states may include those contaminants that are not federally regulated under the SDWA, but which the state has determined may present a threat to public health. A list of the parameters monitored by the state was presented to the SWAP Committee including the contaminants of concern outlined above, and some unregulated organic chemicals that the state tests for in addition to the forthcoming requirement to test for *Cryptosporidium.* The list of parameters monitored by the State Department of Health and Hospitals (LDHH) can be found in Appendix N. Louisiana does not grant monitoring waivers. The State, Office of Public Health, collects samples monthly from public water supply systems for bacteriological analysis. Other parameters monitored by the State are done on a three to five year cycle.

5.2 Significant Potential Sources of Contamination

A state program submittal needs to indicate what types of significant potential sources of the contaminants of concern will be considered significant and, therefore, inventoried in the assessments. The inventory needs to include a clear description of the significant potential sources of contamination (or categories of significant potential sources) by either specific or area location (can be location coordinates to assist in mapping). EPA defines a significant potential source of contamination as any facility or activity that stores, uses, or produces, as a product or by-product, the contaminants of concern and has a sufficient likelihood of releasing such contaminants to the environment. The release would be at levels that could contribute significantly to the concentration of these contaminants in the source water of public water supplies. DEQ has developed a list of significant potential sources of contamination for ground water and surface water and ranked them into a high, medium, and low risk category. The list of the significant potential sources of contamination and their risk ranking for ground water is found in Appendix O; the list for surface water is found in Appendix P.

Due to the limited funds and short mandated time frame of the Source Water Assessment Program, we relied on the State's experience in the Wellhead Protection Program to design an automated data collection system guided by the State's experience in the Wellhead Protection Program. We are confident that this system will cover 99% of the SPSOC found in the field. If any potential contamination sources are found in the field and are not on the list, the field personnel will call in to DEQ and will speak to a member of the State SWAP staff. The staff member will direct the field personnel to enter the unlisted SPSOC as a High, Medium, or Low

Generic Source. In this way, the unlisted SPSOC will be reported generically to the State and will be included in the phase I and phase II susceptibility analysis.

5.3 Databases

EPA recommends broad initial inventories, with a narrowing iterative focus based on protection goals and better information. Databases will be used to supplement ground truthing and to locate SPSOC within watersheds beyond the critical areas. A list of the databases used for SWAP surveys can be found in Appendix F.

5.4 Differential Approaches

5.4.1 Transient Non-Community Water Systems

For delineation of SWPAs for transient non-community water systems, DEQ will deviate from the established WHPP methods for delineation, which are based on well depth and age. Transient non-community systems are small systems with mobile populations. Since potential exposure time (to the water) is low, they are considered to be low priority systems. SWPAs for these systems will be delineated as a 1000-foot radius around the well or wells. For the most part, this affords at least a two-year time of travel from the edge of the delineated area to the well. A two-year time of travel using average aquifer velocities is shown in Appendix I. Based on the statewide average ground water velocity study, a 1000-foot radius should be adequate for protection of such systems, with the exception of the Terrace Aquifer. Due to a higher ground water velocity in the aquifer, the radius will be increased to a half-mile for wells screened in the Terrace Aquifer. There are 483 such systems in Louisiana.

5.4.2 Mississippi River

For drinking water supplies that have surface water intakes in the Mississippi River, the area to be delineated will be along the banks of the river from the Louisiana state line (northern boundary) to the lowest intake located at Port Sulphur, Louisiana (southern boundary). The delineation for each intake will include the portion of the overall delineation that is upstream of that intake. For example, the delineation for Port Sulphur will encompass the entire delineation for the Mississippi river; the delineation for New Orleans will encompass the delineation from the intake at New Orleans to the state line, etc. The west bank of the Mississippi River has a levee to the state border with Arkansas. The east bank of the Mississippi River has a levee as far north as a short distance north of Baton Rouge. Most drainage into the Mississippi River comes from the east side, and it is coming from the State of Mississippi. DEQ has requested information on SPSOC along the river from the State of Mississippi extending from their state border with Louisiana to where the Louisiana and Arkansas borders meet. We plan to meet with them at a later date to discuss this issue further and find out exactly what is available. This portion of the river will have a critical setback area of 1000 feet from the edge of the river if the State of Mississippi will cooperate to this extent. Where the river has levees, SPSOC will be assessed

within the batture. The batture area will be ground truthed from the ferry landing at St. Francisville to Port Sulphur by DEQ river boat pilots. The list of SPSOC to be identified in this area is located in Appendix P. A database search will be conducted for the area north of the ferry landing at St. Francisville to the Arkansas state line. The list of SPSOC to be identified by database search is also found in Appendix P. Thus, we are looking at the corridor as a whole from the state border southward. Problems with regard to drinking water intakes within the river in Louisiana have stemmed from spills and accidents on the river, so it is not just the batture area that we are concerned with. All of the drinking water intakes are south of Baton Rouge, and this portion of the river will be scrutinized closely.

The significant potential sources of contamination that will be assessed, including those on the state of Mississippi's side of the river, will be all facilities which discharge wastewater and storm water directly into the river and all other facilities which have the potential to contaminate the river. There are several types of significant potential contamination sources of contamination that will be assessed, and several databases will be used to identify these sources. For facilities that discharge into the Mississippi River, a list of facilities that are permitted by DEQ to discharge into the river is being utilized. These databases should identify most of the significant potential sources along the Mississippi River including the following: anchorage sites, docks, grain elevators, chemical plants, etc. In addition to those databases, the Louisiana Geological Survey has obtained Global Positioning System (GPS) coordinates of all pipeline crossings in the Mississippi River. This database will be used for the entire delineated area, both the ground-truth portion and the database search portion. The different port authorities along the Mississippi River can provide general river traffic information. Information on spill procedures has been obtained from DEQ, EPA, Louisiana Department of Health and Hospitals (LDHH), and the Louisiana Oil Spill Coordinator under the Office of the Governor.

Also, the U.S. Coast Guard has provided a list of significant potential sources that exist along the river south of Baton Rouge and has informed DEQ of an *Inland River Guide*, which contains information on what exists along the inland navigable waterways of the United States. The book contains information on Public Terminals along the Mississippi River and other waterways, as well as the nature of the terminal, and the river mile or other location. Fleeting and Harbor Service is also in the book in addition to other useful information.

A report, ***Contaminants in the Mississippi River,*** U.S. Geological Survey Circular 1133, contains the results of a five-year study (1987-1992) on the distribution of contaminants in the river and its main tributaries. It focuses on (1) contaminants transported in the dissolved phase, (2) contaminants transported in the absorbed phase, i.e. in association with suspended silts and colloids and (3) contaminants stored in the bottom sediments in the navigation pools of the Upper Mississippi River. Although this study reflected a snapshot in time, it would appear that the Upper Mississippi River has more contaminant problems than the Lower Mississippi. The "Industrial Corridor" of the Lower Mississippi River is heavily monitored today. Nevertheless **spills and accidents** have contributed to local short term contamination.

With regard to pesticides, the USGS report states that "The most notable feature of all the regional scale studies is the large increase in herbicide concentrations that occurs during spring flush. These conditions generally do not persist past mid-summer. Unfortunately, drawing

conclusions from the fact that atrazine concentrations exceed the Maximum Contaminant Level (MCL) at times is complicated by the consideration that MCLs for drinking water for example, are based on average annual concentrations and not on concentrations of short duration." Testing by Jefferson Parish Waterworks in Louisiana has confirmed the short term spikes of atrazine above the MCL, however drinking water standards have not been violated.

5.5 Specific Locations of Wells, Intakes, and Significant Potential Sources of Contamination

Each delineated area will include the locations of the wells by latitude and longitude. These locations will be determined by use of a Global Positioning System (GPS) accurate to one meter. Surface water intakes will also have a GPS latitude and longitude location (see Surface Water Intakes by Parish in Appendix M). Significant potential sources of contamination (SPSOC) will be also located by GPS and plotted on a map within the delineated area. In addition, physical addresses of the SPSOC will be included in the database where possible. Thus specific locations will be a part of the Louisiana SWAP. All of this information will be downloaded into the Geographic Information System (GIS) which will result in a map for each water system showing the location of wells or intakes within the delineated area as well as the significant potential sources of contamination.

5.6 Inventory of Septic Tanks

Septic tanks are listed as a significant potential source of contamination to both ground water and surface water. However, it would be an overwhelming task to count all of the septic tanks within the delineated areas. Therefore, they will be addressed as a density per square mile within a specified area of investigation rather than as individual point sources. The process will be to count the number of houses using septic tanks within the designated area after consulting with the water superintendent to determine if there are any septic tanks in the area.

For surface water systems, the area of investigation will be the delineated critical area. For ground water systems, a designated two-year time of travel will be used to determine the radius of investigation of septic tanks. The two-year time of travel estimates are averages derived from U.S.G.S. reports (see Appendix I). Research indicates that pathogens have a finite life in the subsurface, estimating their viability to be from 18 months to 2 years. The two-year time of travel also correlates with the proposed Ground Water Disinfection Rule. The intent of the ground water protection element of the Rule is to evaluated and, if appropriate, establish a natural hydrogeologic barrier to prevent fecal contamination of ground water that reaches the wellhead zone of influence. One approach used to determine the presence of such a barrier is to delineate a surface area that provides a minimum time of travel for the inactivation of pathogenic bacteria and viruses. The current proposed distance is a two-year time of travel.

The radius of investigation for septic tanks for wells in the Terrace Aquifer will be the delineated area of a half-mile due to the high ground water velocity in that aquifer. Where multiple subaquifers are present in a major aquifer system such as the Southern Hills we will default to the

highest velocity two-year time of travel in the system. If it cannot be determined which aquifer the well is completed in a default radius of 1000-feet will be used.

5.7 Link between the SWAP and the WHPP

Both DEQ and the Louisiana Rural Water Association (LRWA) will continue bringing community water systems into the WHPP. Each community with an approved Wellhead Protection Program (WHPP) will automatically be accepted into the SWAP. Most of data generated in these programs is outdated and was gathered using older GPS equipment and a different data dictionary. Therefore, the contractor will resurvey existing WHPAs using the new data dictionary and new equipment. We also intend to complete a potential susceptibility analysis for each of those communities within the time frame of SWAP as required by SDWA Section 1453. This can be easily accomplished for the Wellhead Protection Programs as we are resurveying WHPAs for existing programs and are currently administering the WHPP to the standards of SWAP. LRWA is currently doing the same. To be consistent with data quality, they are using the same GPS units and laser range finders the State is using and they have adopted our Standard Operating Procedure. LRWA has committed to keep DEQ informed of progress through monthly progress reports and quarterly meetings held at DEQ headquarters.

Public water supply systems in the SWAP will ultimately complete the remaining elements of the WHPP after the SWAP is completed for the state. This is considered to be the "protection phase" of the WHPP where best management practices are put in place as well as contingency plans. The ultimate goal is to implement complete protection programs for each PWS in the state after the initial SWAP work is complete. Initial assessments can be updated or modified as necessary during protection phase activities, providing a mechanism for keeping assessments current.

As part of the Wellhead Protection Program, all significant potential sources of contamination determined to be in need of further assessment are reported to the appropriate regulatory agency for investigation. For example, abandoned or unregistered underground storage tanks (USTs) identified during WHPP inventories are reported to the Environmental Remediation Services Division of DEQ for proper closure or registration. This is a very important pollution prevention and source management tool that will also be used in the Source Water Assessment Program. Any problems identified by field crews conducting source water assessments will likewise be reported to the appropriate regulatory agency for investigation. In addition, a list of regulatory contacts will be provided to each water system with their assessment report so that local water suppliers or communities may take steps to address SPSOC of particular concern by contacting the appropriate state regulatory agency.

Chapter 6: Potential Susceptibility Determination

For all water systems, potential susceptibility will take into consideration sensitivity and vulnerability factors. Sensitivity factors are inherent to the well or intake and the source water setting. The types and quantity of **significant potential sources of contamination** (SPSOC) found and their distance from the well or intake will influence the degree of vulnerability for the water system. A significant potential source of contamination is defined as any facility or activity that stores, uses, or produces, as product or by-product, the contaminants of concern and has a sufficient likelihood of releasing such contaminants at levels that could pose a concern relative to drinking water sources. **Contaminants of concern** are those contaminants regulated under the Safe Drinking Water Act, i.e. contaminants with a maximum contaminant level (MCL), contaminants regulated under the Surface Water Treatment Rule (*Giardia, Legionella,* and viruses), and the microorganism *Cryptosporidium,* which is to be regulated under the Enhanced Surface Treatment Rule. *Parameters Monitored by the State of Louisiana Department of Health and Hospitals* is given in Appendix N.

6.1 Sensitivity

6.1.1 Ground Water

Factors that will be considered in determining sensitivity include the depth of the well, the age of the well, average ground water velocity in the aquifer in which the well is screened, and the soil recharge potential. Depth of the screened interval of the well is the most important factor in determining its sensitivity to contamination. Because of the heterogeneous nature of the fluvial deposits in Louisiana, it is difficult to define the interconnection and extent of clays in the subsurface. Thus, it is difficult to determine whether an aquifer is confined, unconfined, or semi-confined. In most cases, wells screened below 1000 feet are likely protected by multiple layers of clay. To date, contamination of public supply wells in Louisiana has occurred in wells screened at a relatively shallow depth.

The age of the well plays a role in well sensitivity and is also taken into account in the SWPA delineation. The older the well, the more sensitive it is. As a well ages the grouting and casing can deteriorate. Also, the Louisiana Water Well Construction Standards were promulgated in November of 1985. Wells constructed prior to this date may not be properly completed and may therefore be more vulnerable to contamination. Deteriorated or improperly constructed wells can provide conduits for contaminants to enter the aquifer from the surface or shallow subsurface.

Aquifer characteristics are important to consider in determining groundwater sensitivity. Contaminants will move through aquifers having higher ground water velocities faster than through those with lower velocities. Average ground water velocities have been calculated for the major aquifer systems in the state and will be considered in the sensitivity analysis.

Soil recharge potential is another important factor that will be considered in the potential susceptibility analysis. The soil recharge potential is based on the ability of water (and dissolved contaminants) to infiltrate through the surficial soils. Soil recharge potential will be based on the

Louisiana Recharge Potential Map developed by the Louisiana Geological Survey for DEQ shown in Appendix Q. The recharge potential for each soil association within the geologic recharge areas is based on such soil characteristics as parent material; subsoil texture, permeability, and drainage; surface slope; and surface runoff. These characteristics affect the movement of water from the surface, through the soil horizons, and into the underlying hydrogeologic systems. The interpretations are based on the soil characteristics up to six feet below the surface.

A **sensitivity analysis** will be conducted using a risk ranking matrix for sensitivity that was developed as part of an overall Potential Susceptibility Analysis Risk Ranking Matrix, as shown in Appendix R. The sensitivity matrix will weight each of the sensitivity factors to determine an overall sensitivity value, and will be incorporated into the GIS for ease of application. The ranking system is described in Section 6.3. The well age and depth ranges used in the matrix were obtained from the Department of Transportation And Development Water Well Database, in order to conduct an initial or Phase I sensitivity analysis. Depth and age data will be collected in the field and used to refine the ranges in the matrix. The field data will be used in the final or Phase II sensitivity analysis.

6.1.2 Surface Water

Sensitivity consists of the structural integrity of the intake and the influence of natural features. The age of the intake as well as reliable maintenance records will be intake factors. LDHH sanitary surveys will be used where applicable by a coordinated effort with LDHH through the DWSRF Program Manager. Natural features will include the length of streams in the source water protection area and runoff into the water body or water bodies of interest. Runoff factors that will be considered will be precipitation, slope, vegetative cover, and soil permeability. There is a greater potential for negative impact on surface water when the length of streams per Source Water Assessment Area (SWAP) is high. High precipitation, steep slope, low vegetative cover, and low soil permeability contribute to high runoff. Levees serve as a protective mechanism relative to runoff in Louisiana where they are present.

A **sensitivity analysis** will be conducted using a risk ranking matrix for sensitivity that was developed as part of an overall Potential Susceptibility Analysis Risk Ranking Matrix, as shown in Appendix S. The sensitivity matrix will weight each of the sensitivity factors to determine on overall sensitivity value, and will be incorporated into the GIS for ease of application. The ranking system is described in Section 6.3. Some of the data necessary for the analysis will be gathered during the assessment for each system. Therefore, the sensitivity analysis for each surface water system will be conducted when all assessments have been completed.

6.2 Vulnerability

6.2.1 Ground Water

Significant potential sources of contamination have been ranked by degree of threat (low, medium, or high) and are given in Appendix O. All SPSOC in delineated SWPAs for ground water systems will be ground truthed. Databases will be used as a guide for the field staff to locate

SPSOC, except for oil and gas wells. A database search will be conducted for these wells and those found within the delineated area will be incorporated into susceptibility analysis as a density per square mile. The database search will likely be more accurate since oil and gas wells can be difficult to find in the field and are likely to be missed during ground truthing. A parish-wide map showing the locations of all oil and gas wells in the parish will be provided with the final susceptibility analysis, after all ground water systems have been assessed.

The ranking is based upon causes of contaminated ground water sites under investigation and remediation by the Louisiana Department of Environmental Quality (DEQ) as well as consideration of the causes of contamination of public water supplies and a literature review. Leaking underground storage tanks, above ground gasoline spills, body shop solvents and manufacturing plant solvents have caused contamination of public water supplies in Louisiana. Furthermore, members of the staff of DEQ will use their years of experience in the Wellhead Protection Program to rank the significant potential sources of contamination. The ranked list of SPSOC will be used in the **vulnerability analysis** for each ground water system. The vulnerability analysis risk ranking matrix, found in Appendix R, weights SPSOC according to whether the SPSOC is rated as a high, medium, or low threat, and whether the SPSOC is within 1000 feet of the well or further away. The matrix will also be incorporated into the GIS for ease of application.

6.2.2 Surface Water

As for ground water, the types and numbers of significant potential sources of contamination as well as their distance from the intake constitute the vulnerability portion of the equation. There are two lists of Significant Potential Sources of Contamination (SPSOC) with a ranking of high, medium and low included in Appendix P. (See the definition of significant potential source of contamination above.) One list contains SPSOC that will be located by field ground truthing. The other list contains SPSOC that will be identified from databases. In addition there is a list of SPSOC to be ground truthed for the Mississippi River since the SPSOC located near the Mississippi River are unique to the river. Due to limited time and funds, the field ground truth work will be conducted only in the "critical areas", or priority areas for contribution of contaminants to the water body. A critical area is defined as the upstream portion of the watershed within 5 miles of the intake. The ranked lists of SPSOC will be used in the **vulnerability analysis** for each surface water system. The vulnerability analysis risk ranking matrix found in Appendix S, weights SPSOC according to whether the SPSOC is rated as a high, medium, or low threat, and whether the SPSOC is within critical area or further away. The matrix will also be incorporated into the GIS for ease of application.

Of particular concern are the high and medium risk SPSOC. There is historical significance with regard to the following: a pesticide (Atrazine) has recently contaminated a surface water drinking body and, therefore, pesticide application is important; spills and accidents in the Mississippi River and other rivers over the years have been a problem in terms of contaminating drinking water. Furthermore, where bridges cross drinking water bodies there is concern for spills. Septic systems around the perimeter of surface water bodies that are drinking water sources have caused pathogen problems for source water, but are not a factor with regard to finished water. However, we will inventory septic systems as SPSOC. The 1998 State Louisiana Water Quality

Inventory Report – 305 (b) indicates that virtually all surface water bodies used for drinking water are fully supporting for that designated use. Only one was designated as partially supporting (Bayou Black) and this was for exceeding the color standard. Grand River is not supporting its designated use as a drinking water body. The input of Regional DEQ staff on vulnerability factors (some not mentioned above and peculiar to their region's watershed) will be of extreme importance.

6.3 Potential Susceptibility Analysis

6.3.1 Potential Susceptibility Ranking System

The objective of the ranking system is to establish a potential susceptibility ranking for each of the wells and surface water intakes in Louisiana and translate this into water system potential susceptibility to contamination. The potential susceptibility will be calculated as a numeric ranking of 1-10, with 10 representing a high potential susceptibility and 1 a low potential susceptibility.

We are able to establish the range within sensitivity categories for ground water (See Ground Water Potential Susceptibility Analysis Risk Ranking Matrix in Appendix R) in advance because the information is known from publications or databases. In the case of surface water, some of this information will be obtained during field visits from which we will generate appropriate ranges. See the Surface Water Potential Susceptibility Analysis Risk Ranking Matrix in Appendix S for surface water sensitivity categories and arbitrary weighting. The arbitrary weighting (e.g. well depth in the Ground Water Potential Susceptibility Analysis Risk Ranking Matrix in Appendix R is weighted at 50%) of ground water and surface water individual sensitivity categories was a collective decision made by the Louisiana Source Water Assessment Program Team.

Initially, the vulnerability ranking number will be based on the risk ranking of the significant potential source of contamination and its distance from a well or intake. Again, refer to a ground water example in Appendix R. It should be noted that the rankings for some individual vulnerability factors would be calculated as area weighted averages of occurrences or densities within the delineated areas. Examples of this would be the total miles of railroad tracks or the density or oil and gas wells per square mile in a Source Water Protection Area. See the Surface Water Potential Susceptibility Analysis Ranking Matrix in Appendix S. The range of the vulnerability ranking for all wells and intakes (and ultimately each water system as some water systems have more than one well and one intake) will not be known until all water systems are assessed. At that time, using the formula below, the raw vulnerability numbers for each water system will be converted to a 0 -10 numeric ranking. Ground water systems will be compared with one another and surface water systems with one another, as the components that make up the sensitivity and vulnerability factors of potential susceptibility to contamination in each are different. Thus, we will have a sensitivity ranking from 1 to 10 and vulnerability ranking of 0 to 10 for each well and intake that will then be translated into a water system potential susceptibility number between 1 and 10. If data for any sensitivity component is unavailable the default will be 10. An example of how the formula below takes a large spread of raw data and converts it into a 1 to 10 numerical ranking is given using the statewide aquifer velocity data, a sensitivity category for ground water.

6.3.2 Potential Susceptibility Ranking Formula

The Potential Susceptibility Ranking Formula is a mathematical formula that logarithmically distributes a spread of values into lower and upper ranges based on the number of segments (e.g. 1 to 10) chosen. It was provided by EPA Region 6 for use in the susceptibility analysis matrix. The example below is the sensitivity ranking assigned to aquifer velocity. Higher aquifer velocities would contribute to moving potential contaminants more quickly toward a water well. The rankings (from 1 - 10) will be calculated by logarithmically distributing the non-zero data values between 1 and 10. Accordingly, the sensitivity ranking, *I* (1 - 10) is assigned to the range of data.

> ? * 10^[((I-1)/i_{max}) * log (?/?)] determines the lower range of each sensitivity/vulnerability number

and

? ? * 10^[(I/i_{max}) * log (?/?)] determines the upper range of each sensitivity/vulnerability number

for each ranking number from 1 – 10 where

? = lowest non-zero data value
? = highest data value
i_{max} = 10

Using aquifer velocity data, the above formulas would generate the following low/high ranges for the 1 - 10 potential susceptibility ranking numbers:

Potential Susceptibility Rating Number	Low End of Range	High End of Range
0	0	0
1	31	44.4
2	44.5	64.0
3	64.1	91.94
4	91.95	132.0
5	132.1	189.7
6	189.8	272.6
7	272.7	391.6
8	391.7	562.8
9	562.9	808.6
10	808.7	1162.0

Using the above ranges, the aquifers of the state can be assigned a potential susceptibility ranking number as follows:

AQUIFER	Average Ground Water Velocity (ft/yr)	Potential Susceptibility Rating
Carrizo-Wilcox	31.0	1
Catahoula (Miocene)	47.3	2
Cockfield	87.1	3
Southern Hills	92.7	4
Sparta	99.3	4
Chicot	109.1	4
Miss. River Alluvial	126.1	4
Red River Alluvial	185.3	5
Evangeline	222.0	6
Jasper (Miocene)	435.4	8
Terrace	1162	10

Zero data values are given a potential susceptibility ranking of zero.

This method is a conservative approach, assigning increasingly higher susceptibility ranking numbers to the range of data based on a logarithmic scale. This method allows the data to be examined with greater resolution, taking into consideration differences in closely clustered data values. In summary, this is a mathematical formula that logarithmically distributes a spread of values into lower and upper ranges based on the number of segments (e.g. 1 to 10) chosen.

6.3.3 Relative Potential Susceptibility for All Wells in a System

Based on sensitivity ranking and vulnerability ranking, a potential susceptibility ranking number is assigned to a well and ultimately to a water system based on the number of wells it has. Large systems will automatically have large totals because of the number of wells. The potential vulnerability number divided by the unit area eliminates the bias introduced by large systems with a large number of wells.

6.3.4 Relative Potential Susceptibility for All Intakes in a System

Based on the sensitivity and vulnerability rankings, a potential susceptibility ranking number is assigned to an intake and ultimately to a water system based on the number of intakes it has.

6.3.5 Example of Determination of a Final Potential Susceptibility Number for a Well

POTENTIAL SENSITIVITY RANKING NUMBER		8
PLUS		
POTENTIAL VULNERABILITY RANKING NUMBER	6	
TOTAL		14

For a one well water supply system, this is the potential susceptibility number for that ground water system.

For a two well system, if the second well has a potential susceptibility number of 16, the water system potential susceptibility number is 14 + 16 = 30/2 = 15.

The above discussed formula is then applied to the range of ground water public supply system potential susceptibility numbers statewide for a final comparative ranking between **1 and 10**. The same approach will be used for a comparative analysis of surface water systems.

6.3.6 Application of the Potential Susceptibility Ranking

The SWAP susceptibility determination is the **potential** for the source water of public drinking water supplies to be contaminated by inventoried significant potential sources of contamination at concentrations that would pose concern. Furthermore, a potential susceptibility analysis provides insight into what actions should be taken by a public water supply to protect its drinking water source. It should be emphasized that the vulnerability numbers are based on significant **potential** sources of contamination. For example, if there are a large number of significant potential sources of contamination close to a well, the potential for susceptibility number will go up by the mere fact that they are there. This **does not** mean, however, that the well will ever become contaminated. The sole purpose of the potential for susceptibility numbers is to compare all water systems in the state to prioritize protection activities so areas that have higher numbers will actually be targeted for protection activities first, thereby reducing the potential for contamination. The numbers **should not** be used in any other context. It should be **emphasized** that it is the types of activities/facilities of most concern to the system that must be brought to the forefront, and **potential susceptibility numbers must not be used to undermine public confidence in their water system.** This type of information will be provided to the public along with the assessment maps and susceptibility analysis.

For ground water systems, a sensitivity analysis will be conducted based on the sensitivity scale developed for the sensitivity matrix shown in Appendix R. The relative vulnerability of the system to significant potential sources of contamination will be given as the number of high, medium, and low risk significant potential sources of contamination identified within 1000 feet of the well and greater than 1000 feet from the well. For significant potential sources of contamination within

1000 feet of the well, a tiered ranking matrix will be used to apply a weighting according to the distance from the well (see Appendix R).

For surface water systems, the vulnerability will be given as the number of significant potential sources of contamination designated as high, medium, or low risk within the critical area and outside of the critical area but within the delineated SWPA. The initial or Phase I assessment will, therefore, be based on a land use inventory of the delineated protection area. Since surface water sources are open to the atmosphere, they are considered inherently sensitive. However, data collected from each system during the source water assessments will be used to develop a comparative sensitivity ranking among surface water systems. Therefore, a Phase II assessment will also include sensitivity factors associated with the intake and source water. The Phase II assessment will be conducted upon completion of all source water assessments for surface water systems.

A comparative or Phase II potential susceptibility analyses will be conducted upon completion of **all** SWPA inventories to determine a relative risk ranking among all systems. The results of this analysis will be used to develop a prioritization scheme for implementing protection activities. The comparison is based on the sensitivity rating and the vulnerability rating for each well or intake. All ground water systems will be compared relative to one another. Likewise, all surface water systems will be compared with the exception of those using the Mississippi River as a source. The Mississippi River is being handled as a special case with a data dictionary of SPSOC created specifically for the river. Therefore, systems using the Mississippi river will be compared relative to one another only.

Chapter 7: Availability of Information to the Public

7.1 Making Assessments Available to the Public

The SWAP results will be portrayed as a map showing the well or intake locations, the delineated protection area (and watershed for surface water systems), and the locations of all significant potential sources of contamination identified. The maps will be generated by the Geographic Information System (GIS). The inventory results and potential susceptibility analysis must be in a format easily understood by the public. We intend that the maps will be of an appropriate scale to be useful, but at the same time be functional from the standpoint of size. A Phase I potential susceptibility analysis of the water system will also be provided. Standardized reporting forms for ground water systems and surface water systems will be used to report the information. Copies of these forms are located in Appendix T.

We will make the assessments available to the water systems for inclusion in their annual utility Confidence Reports per the requirements of the Consumer Confidence Report (CCR) rule (40CFR141.153(b)). Each community water system must mail or otherwise directly deliver one copy of the report to each customer. Systems serving 100,000 or more persons are required to post their current CCR to a publicly accessible site on the Internet. EPA allows the governor or his designee to waive the mailing requirement for community water systems serving fewer than 10,000 persons. LDHH sought, and Governor Foster approved, a waiver to waive the requirement for mailing to those community systems serving fewer than 10,000 persons. However, community systems serving fewer than 10,000 persons are still required to: 1.) publish the reports in one or more local newspapers serving the area in which the system is located; 2.) inform the customers that the reports will not be mailed, either in the newspapers in which the reports are published or by other means approved by the State; 3.) make the reports available to the public upon request. If the governor approves the waiver, community water systems serving 500 or fewer persons also would not have to comply with 1.) and 2.) of the preceding sentence if they provide notice at least once per year to their customers by mail, door-to-door delivery, or by posting a notice in an appropriate location that the report is available upon request. A summary of the CCR rule is provided in Appendix U.

Also, the assessments will be available on the DEQ Internet site on a quarterly basis as each system is completed and LDHH will be notified as such. We will also send the assessment results to the water system, as they are completed, on a quarterly basis. We will urge the water system to notify its customers of the availability at that time. Although it is our intent to assess every public water supply system in the state within the allotted time frame, any systems not assessed due to unforeseen problems or delays will be listed as susceptible in the Consumer Confidence Report with an accompanying explanation. The system will then be re-ranked upon completion of an assessment and susceptibility analysis. Phase II results will be reported to the public through the same channels as the Phase I results.

The entire program, and any ancillary information required, will be available to the public at the Louisiana Department of Environmental Quality Headquarters Office. The public will be notified that the information is available and a phone number (1-225-765-0578) will also be provided to

contact the Aquifer Evaluation and Protection Section for information. Hence, DEQ staff closely involved with the program can answer questions posed by the public.

7.1.1 Assessment Results for Ground Water Systems

For ground water systems, the potential susceptibility analysis includes the sensitivity analysis of the wells to contamination (e.g. depth and age of the well) in addition to aquifer characteristics. Considerations under aquifer characteristics are how fast the aquifer will transmit water and the relative degree of confinement of the aquifer. The latter consideration will be based on the depth of the well for Louisiana due to the extreme heterogeneity of the sediments. Viewing the electric log of a well does not indicate lateral extent of, or lithology changes in, subsurface sediments. In the case of ground water a high, medium, or low sensitivity analysis will be determined. The second part of potential susceptibility is a vulnerability analysis, i.e. the number, type, and distance of significant potential sources of contamination from a well or wells or a surface water intake. The number of significant potential sources of contamination designated as high, medium, or low risk within the delineated area and within 1000 feet of the well will be provided. Based on the natural breakdown and degradation of many contaminants beyond 1000 feet, there will be less risk from those due to the time of travel necessary to reach the well. The sensitivity analysis and vulnerability analysis combine to provide a potential susceptibility analysis. A sample report to be sent to each system is provided in Appendix V.

7.1.2 Assessment Results for Surface Water Systems

For surface water systems, the Phase I potential susceptibility analysis will consist of the vulnerability analysis. For the purpose of the Phase I assessment, all surface water systems will be considered sensitive based on the fact that they are open to the atmosphere. For the Phase II analysis, data collected during the assessments will be used to develop a comparative sensitivity among systems. The number of significant potential sources of contamination designated as high, medium, or low risk within the critical area and outside of the critical area but within the delineated SWPA will be given. A critical area is defined as the upstream portion of the watershed within 5 miles of the intake. As stated earlier, the results of the sensitivity analysis and vulnerability analysis will be combined to produce a potential susceptibility analysis. A sample report to be sent to each system is provided in Appendix V.

7.2 Sole Source Aquifer Program

The EPA Sole Source Aquifer program has been identified as an element of protection in the Source Water Assessment Program. For areas which have been designated as sole source aquifers the local water supply system is benefited by EPA review of projects with Federal financial assistance and the modification or denial of those projects which might contaminate the aquifer. This added level of protection provides a direct benefit for water systems which rely on ground water, but can also provide additional protection for systems relying on surface water because surface water flows are sustained by base flow from ground water during much of the year. Public water supply systems located within designated sole source aquifer areas may receive priority consideration for assessment and protection activities. Local water suppliers and the public who live within designated areas will be made aware of the benefits of this program and know that they may notify EPA of projects with pending federal financial assistance (Federal loans, loan guarantees, grants, etc) if those projects have a potential for contaminating the aquifer. This information is being made available to the public water supply systems through their completed assessments and is available to the public through the Consumer Confidence Reporting mechanism. Maps and other information on the sole source aquifer program in Region 6 are available on the Internet at http://www.epa.gov/earth1r6/6wq/swp/ssa. The EPA Region 6 contact for the Sole Source Aquifer program is:

Clay Chesney
Sole Source Aquifer Program Coordinator
Ground Water/UIC Section (6WQ-SG)
EPA Region 6
1445 Ross Avenue
Dallas, TX 75202
Tel. (214) 665-7128 FAX: (214) 665-2191
e-mail: chesney.claybourne@epamail.epa.gov

Sole Source Aquifer information will be included in the initial susceptibility analysis reports sent to all ground water systems in the state.

Chapter 8: Program Implementation

8.1 Timeline/Budget

The assessment and the susceptibility analysis for the ground water portion of SWAP have been contracted out. C-K Associates of Baton Rouge was awarded the contract to complete the work for a cost of $1,197,250. The contract runs through January 14, 2003. The table below shows anticipated expenditures by the contractor.

Schedule of Prices

Line No.	Activity	Unit	Maximum No. Units	Unit Rate	Line Total
1	Post-award conference at LDEQ	Each	1	$15,000.00	$ 15,000.00
2	Project Plan	Each	1	$85,000.00	$ 85,000.00
3	Initial System Assessment	Each	1650	$ 625.00	$1,031,250.00
4	Final Susceptibility Analysis	Each	1650	$ 40.00	$ 66,000.00
TOTAL PRICE					**$1,197,250.00**

Anticipated expenditure categories other than professional services are expenditures related to services performed by the Louisiana Department of Environmental Quality staff such as program creation, RFP preparation, overseeing contract fulfillment, checking on quality control and standard operating procedures, database coordination, website placement, review and mailing of susceptibility analysis reports to the public, consumer confidence reports, etc.

It is our intention to contract out the surface water assessments and susceptibility analysis of watersheds with intakes with the exception of the Mississippi River. The assessment of the Mississippi River is discussed separately. Since surface water assessments will be subject to public bid, details of budget money available and anticipated expenditures are not available at this time.

8.2 Additional Discussion of Some Program Elements

As discussed earlier, there will be an Intra-system Phase I potential susceptibility analysis and ultimately an Inter-system Phase II potential susceptibility analysis. The latter will compare the potential susceptibility of like water supply systems statewide and rate them for prioritization relative to the protection activities that will follow the SWAP. Also, as mentioned previously, problems found through field work needing immediate attention will be reported to the proper agency for correction.

Quarterly reports will be sent to LDHH and EPA, and will be used to assess the progress and success of the program. The reports will consist of identifying the total number of PWSs categorized as ground water, surface water, or combined. The number of PWSs by category with various phases of completed requirements will be reported, i.e. delineations, significant potential source of contamination inventories, and potential susceptibility determinations. Also included in the reports will be the populations served by PWSs in source water protection areas and how the completed projects have been made available to the public.

The key to the success of the program is whether goals are accomplished. However, it must be remembered that the success cannot be measured solely by completion of the SWAP, but whether SWAP Programs are absorbed into a Protection Program. This allows the community or water system to put Best Management Practices (BMPs) into place, develop Contingency Plans, and more fully inform and educate the public (highway signs, outreach programs etc.). These are all aspects of protection of public water supplies that must be done after the assessment phase is complete. Ultimately, if the public health is protected because public water supplies are protected from contamination, the program is a success.

8.3 Request for Extension of Timeline

The funding for SWAP allows for the hiring of people to do field assessment and GPS work. There are 2002 public water supply systems in Louisiana, and 107 of these have approved Wellhead Protection Programs. It is expected that an additional 92 water systems will be approved for WHPPs during the interval of SWAP (42 months assuming an extension). There are 81 systems that purchase water. There are 50 multiple systems in surface water bodies. Thus 2002 systems less the systems accounted for above amounts to 1672 systems requiring the SWAP. A public water supply fact sheet is included in Appendix W. By hiring people and training them to do the field work, it appears that based on our calculations and considering the amount of money we have devoted to field work, 5 to 6 systems will have to be completed per month, even with the 18 month extension. This will amount to one system per week per person. We feel the ground truthing is extremely important due to the lack of complete databases, or usable databases in some cases. We intend to ground truth all delineated areas for ground water systems, and a critical area for surface water systems due to the large size of watersheds. Ground truthing is very time consuming; thus we require the 18-month extension in order to implement our program in a timely manner. Note from our budget that a large amount of funds are allotted to field work and we will require the 18 month extension based on the enormity of the task.

8.4 Resources Allocated to SWAP

The resources that the State plans to allocate to the SWAP are shown in the budget above in the amount of $2,042,30 from the DWSRF set aside for Source Water Assessment. These funds have been passed through the Louisiana Department of Health and Hospitals, Office of Public Health via an Interagency Agreement with DEQ.

8.5 Delegated Portions of SWAP

As was discussed in Section 8.1, the assessment and the susceptibility analysis for the ground water portion of SWAP have been contracted out to C-K Associates of Baton Rouge. It is our intention to contract out the surface water assessments and susceptibility analysis of watersheds with intakes with the exception of the Mississippi River.

The EPA in Region 6, Source Water Protection Branch, had previously conducted a Region 6 vulnerability study. While the scale was too small to be of practical use, the methodology was sound. The mathematical formula used in our potential susceptibility ranking matrices that logarithmically distributes a spread of values into lower and upper ranges based on the number of segments (e.g. 1 to 10) chosen was adapted from this study. This saved Louisiana from "reinventing the wheel" so to speak.

8.6 Coordination through Working Partnerships

Numerous state agencies are represented on the Citizens and Technical Advisory Committee as well as the federal agency USGS. The list of databases in Appendix F indicates the cooperation and coordination that has taken place in developing the SWAP. We will continue to work with these agencies and stakeholders as the program proceeds. One of the keys to the success of the program will be future cooperation among state and federal agencies and stakeholders in general.

8.6.1 DEQ Non-Point Source Section

There is a Non-Point Source Section within DEQ. The head of this section was on the Citizens and Technical Advisory Committee. One or more staff members from this section also attended the SWAP statewide public meetings. We have a statewide Land Use Map that was referred to us by the non-point staff for use in the SWAP. This map will be used for both surface water and ground water purposes and is listed in Appendix F under databases. With regard to agriculture, we will use the aforementioned map along with current information from the network of pesticide and herbicide monitoring wells around the state obtained from the Louisiana Department of Agriculture and Forestry. The Non-Point Source (NPS) Section of DEQ is compiling an assessment of the impacts of sand and gravel mining operations on the waters of the state. Since these are often large pits, there is an advanced potential for ground water pollution due to their depth. Thus, the map and coordinated effort with the NPS Section will enhance the identification of this kind of ground water threat. Septic systems are considered a NPS threat also, not only to ground water, but to surface water. These are being addressed as part of the SWAP.

8.6.2 Louisiana Department of Agriculture and Forestry (Pesticides)

Non-point source of contamination from agricultural practices may represent a significant potential source of contamination to both ground water and surface water sources of drinking water. The Louisiana Department of Agriculture has developed a State Management Plan for pesticide use which addresses specific pesticides, their use, and areas of the state that are particularly vulnerable to these pesticides.

We have acquired the database of the Louisiana Department of Agriculture and Forestry (LDAF) that locates all of the Pesticide Monitoring Wells in the state. The State's Pesticide Management Plan has as its goal to manage the use of pesticides in order to prevent adverse effects on human health and the environment and to protect the environmental integrity of the State's water resources. The emphasis of this approach is on the prevention of contamination over remedial treatment. Priorities of the strategy focus on current or reasonably expected sources of drinking water and ground water that may be hydrologically connected to surface water. To insure the quality of the resource, the LDAF uses MCLs under the Safe Drinking Water Act (SDWA), water quality standards under the Clean Water Act (CWA), EPA Health Advisory (HA) numbers, or other approved health-based reference points as levels to activate appropriate mechanisms to protect ground water resources. Wells have been sampled on an annual basis since 1987. Originally there was a network of 50 wells. There are 2 out of service now, but replacement is intended.

For surface water, all of the pesticides used in the area of the surface water body are sampled for. LDAF has also provided a list of surface water pesticide monitoring stations by site. There is a surface water atrazine problem in an area of the state that is being attended to. However, the average annual MCL for drinking water was not violated.
For ground water, all of the currently used pesticides in the state, as well as arsenic, are sampled for. Ground water problems in the state have not been from the application of pesticides, but from formulation sites, an improperly grouted domestic well, and the use of a hose in the process of sampling that was contaminated.

8.6.3 Louisiana Department of Natural Resources (UIC)

The Louisiana Department of Natural Resources (LDNR) Underground Injection Control (UIC) Program can help in the implementation of SWAP in the state. A cooperative meeting determined that if the field assessment teams find injection wells and associated equipment in a SWPA, we would notify UIC staff of such. They can then do a file review in this sensitive drinking water area and perform inspections and mechanical integrity tests if necessary. The UIC staff would also like to do a detailed pilot study on injection wells in Calcasieu Parish. If this comes to fruition, any information obtained by the study will be helpful to the SWAP. DEQ has obtained the LDNR injection well database for Class I, III, IV, and V injection wells and this information will be used in the field assessments. As result of the meeting, DEQ has provided LDNR-UIC with the Wellhead Protection Program database and DEQ in turn has been provided with data showing all

of the injection wells relative to the Wellhead Protection areas in the state. Thus, the Wellhead Protection Program has benefited from information exchange as will the SWAP.

8.7 Interstate Coordination

The SWAP will be coordinated with the **Lower Mississippi River Conservation Committee (LMRCC)** relative to Mississippi River issues**.** As the name implies, the committee is composed of states bordering the river at the lower end. Missouri, Kentucky, Tennessee, Arkansas, and Louisiana are active members of the committee at the present time. It is expected that Mississippi will also become an active member. This committee focuses on the water quality of the river, and in this mode is concerned about contamination of the river and the origin of contaminants found in the river. The stated mission of the LMRCC is to promote protection, restoration, enforcement, understanding, awareness, and wise use of the natural resources of the Lower Mississippi River.

With regard to the rest of the water bodies that are of interstate interest, a meeting was held in Dallas at EPA Region 6 offices in April of 1998, and it was determined that all Region 6 states use ArcView /ArcInfo relative to their GIS. Watershed information can be exchanged among states when final stages are reached on each watershed of common interest. One suggested method of exchanging information was via the Internet. EPA could possibly accelerate the process by creating and maintaining a shared database on interstate water bodies. Louisiana intends to use the Internet to inform water systems and the public about SWAP, and will use the Internet to provide pertinent information to bordering states.

8.8 Updating Assessments

The State will use the same approach that it has with the WHPP. The SWAP will be the local community's program, and the State will provide technical assistance whenever asked to provide it. However, updates and the ultimate success of the program will be the responsibility of the community or water system. The State will definitely pursue bringing these entities into the WHPP or "protection phase" after the SWAP is complete. The State will also encourage all public water supply systems to update their programs at least every three years. We hope to send a newsletter periodically providing current information to the systems and reminding them of the need for updates. An annual newsletter is already distributed to all systems in the WHPP.

If a system submits an update, we will rank them again based on the susceptibility analysis formula. Our experience with the WHPP is that after the problems found during the field assessment are addressed, the remaining sources are *potential* sources of contamination, and those that are highest risk are generally regulated. It is the unregulated sources that can be troublesome due to lack of attention, even though they may be of lower risk. These can be controlled perhaps by ordinances if a community is willing. Also, an educated community, local government, and water supply are a first line of defense. The latter is the main thrust of protection in Louisiana as result of some difficulty in getting local governments to pass ordinances under the voluntary WHPP. Once the public becomes aware of their source of water, and how and what can contaminate it, they should become "watch dogs" that protect the community. Once the assessment and protection phases are completed, and the State has disseminated information

to the community, it is the community that must be vigilant in protecting its drinking water source. The State is always available to provide technical assistance and has on many occasions over the years of the WHPP.

As we approach the end of the contract with the firm doing ground water field assessments, we will request an update of the PWS database from LDHH. We intend to assess any new ground or surface water systems found in the database.

List of Acronyms

AEPS ~ Aquifer Evaluation and Protection Section

AWWA ~ American Waterworks Association

BMP ~ Best Management Practices

CDC ~ Centers for Disease Control and Prevention

CERCLA ~ Comprehensive Environmental Response, Compensation, and Liability Act

COD ~ Chemical Oxygen Demand

COE ~ Corps of Engineers

DEQ ~ Louisiana Department of Environmental Quality

DGPS ~ Differential Global Positioning System

DNAPL ~ Dense Non Aqueous Phase Liquid

DWSRF ~ Drinking Water State Revolving Fund

EIS ~ Emission Inventory System

EPA ~ Environmental Protection Agency

EWOCDS ~ Early Warning Organic Compound Detection System

EQIP ~ Environmental Quality Incentives Program

FC-bacteria ~ Fecal Coliform

GIS ~ Geographic Information System

GISOP ~ Geographic Information System Operator

GPS ~ Global Positioning System

GWDR ~ Ground Water Disinfection Rule

GWUDI ~ Ground Water Under the Direct Influence (of Surface Water)

HUC ~ Hydrologic Unit Code

LDAF ~ Louisiana Department of Agriculture and Forestry

LDHH ~ Louisiana Department of Health and Hospitals

LDNR ~ Louisiana Department of Natural Resources

LDOTD ~ Louisiana Department of Transportation and Development

LMRCC ~ Lower Mississippi River Conservation Committee

LNAPL ~ Light Non Aqueous Phase Liquid

MCL ~ Maximum Contaminant Level

Mg/L ~ Milligrams Per Liter

MPA ~ Microscopic Particulate Analysis

NAWQA ~ National Water Quality Assessment

NPDES ~ National Pollutant Discharge Elimination System

NRCS ~ Natural Resource Conservation Service

OPH ~ Office of Public Health

OWR ~ Office of Water Resources

PDM ~ Project Data Manager

PDOP ~ Potential Dilution of Precision

PM ~ Project Manager

PRP ~ Potential Responsible Party

PWS ~ Public Water Supply

RCRA ~ Resource Conservation and Recovery Act

SDWA ~ Safe Drinking Water Act

SPSOC ~ Significant Potential Source of Contamination

SWAP ~ Source Water Assessment Program

SWPA ~ Source Water Protection Area

SWTR ~ Surface Water Treatment Rule

TSS ~ Total Suspended Solids

USACE ~ U. S. Army Corps of Engineers

USEPA ~ U. S. Environmental Protection Agency

USGS ~ United States Geological Survey

UST ~ Underground Storage Tank

WHPA ~ Wellhead Protection Area

WHPP ~ Wellhead Protection Program

Glossary of Terms

Alluvium	A general term for clay, silt, sand, gravel, or similar unconsolidated material deposited during comparatively recent geologic time by a stream or other body of running water as sediment in the bed of a stream or its floodplain.
Annular Space	In a water well, the space between the drill hole and the well casing.
Anthropogenic	Man-made
Aquifer	A water-bearing rock, sand, or gravel layer that will yield water in a usable quantity to a well or spring.
Arbitrary Fixed Radius	A set distance chosen for the radius of a Source Water Protection Area based on the best available data on aquifer velocity, soil recharge, and depth of the water well for groundwater systems.
ArcView / Arc Info	Geographic Information software. See Geographic Information System below.
Assessment	Delineation of a sensitive area around a drinking water well or intake, the inventory of that area for PSOC, analysis of susceptibility to contamination of wells and/or intakes in a water system, and informing the public and water system of the results.
Attenuation	The tendency to diminish over time or distance.
Basin	The portions of land that drain to a particular water body. Basins are usually divided by natural or man-made high ground structures such as levees.

Best Management Practices	Methods used by communities with issues pertaining to Source Water or Wellhead Protection. Examples of Best Management Practices are local ordinances and prohibitions of certain activities in Source Water or Wellhead Protection Areas.
Brownfield	Land areas formerly utilized for industrial purposes.
Calculated Fixed Radius	Delineation of a SWPA using the calculated fixed radius method would involve drawing a circle for a specified time of travel criterion threshhold. A radius is calculated using an analytical equation that is based on the volume of water that will be drawn into a well in the specified time.
Capitalization Grant	The funding of the Drinking Water State Revolving Fund. Under the 1996 Amendments to the Safe Drinking Water Act, states are allowed to set aside up to 10 percent of their Fiscal Year 1997 capitalization grant for Source Water Assessment Program activities.
Community Water System	A public water system that provides water through constructed conveyances to at least 15 service connections or an average of 25 individuals daily at least 60 days per year.
Computer Modeling	A method used to forecast the movement of surface water or ground water through mathematical formulas. Several variables are entered into the equations and a computer is routinely used to process the calculations.
Confined Aquifer	An aquifer under greater than atmospheric pressure bounded above and below by less permeable layers such as clay.
Conjunctive Delineation	The consideration of surface water contribution and zones of groundwater contribution during the delineation process.
Contamination Source Inventory	Locating and identifying the names and addresses of potential sources of contamination.

Contingency Plan	A plan of action adopted by a community or water system to deal with a long or short term partial or total loss of their normal water supply. The plan outlines alternative water sources and priority users in emergencies.
Critical Area	A high priority setback area around a public supply well or surface water body containing a drinking water intake. A ground search for potential sources of contamination will be conducted within this area.
Cryptosporidium	A single-cell microscopic organism that can cause disease if transmitted through ingestion of contaminated drinking water.
Delineation	Determining the outline or shape of a Source Water Protection Area.
Differential Delineation	Alternative methods with differing levels of assessments as exceptions to standard methods of determining the outline or shape of a Source Water Protection Area. States are allowed this flexibility in order to address a wide range of Source Water Protection Area scenarios.
Digital Ortho Photo	Georectified digitized aerial photographs. These are aerial photographs that have had all distortion removed and can have maps overlaid on them accurately. Accurate latitude and longitudes can be obtained from these types of photographs. Useful in land use determination.
Drinking Water State Revolving Fund	Under section 1452 of the Safe Drinking Water Act, the United States Environmental Protection Agency awards capitalization grants to states to develop drinking water system infrastructure improvements through this fund.
Fluvial Deposits	River deposited sediments.

Geographic Information System	A computer program that is able to store, retrieve, display and analyze data linked to geographic coordinates.
Giardia	*Giardia lamblia.* A single-cell microscopic organism associated with the disease giardiasis. Drinking water contaminated with this organism can cause giardiasis.
Global Positioning System	A Department of Defense program that uses satellites to transmit data that can be received to determine the latitude and longitude of a point on the earth.
Ground Water	The water contained in the interconnected pores located below the water table in an aquifer.
Ground Truth	On the ground search and verification.
Hydraulic Conductivity	A term that describes the rate that a fluid can move through a permeable medium such as sand or gravel.
Hydraulic Gradient	A term that describes the slope of the water table or potentiometric surface; that is, the change in water level per unit of distance along the direction of maximum head decrease. It is determined by measuring the water level in several wells.
Hydrogeologic	The interrelationships of geologic materials and processes with water.
Intended Use Plan	A component of the Capitalization Grant that describes how a state intends to use available Drinking Water State Revolving Funds to meet the objectives of the Safe Drinking Water Act.
Intake	The point where water is withdrawn from a surface water source.
Inventory	The list of potential sources of contamination in a Source Water Protection Area found by database search, aerial photography interpretation, or by a physical visit.

Maximum Contaminant Level	The maximum permissible level of a contaminant in water, which is delivered to any user of a public water system.
Microscopic Particulate Analysis	A technique to determine the path and extent of migration of microscopic entities such as Giardia and Cryptosporidium by use of tracer studies.
Non-Community Water System	A public water system that is not a community water system. There are two types of Non-Community Water Systems: Transient and Non-Transient.
Non Transient Non-Community Water Systems	A water system that serves at least 25 of the same non-resident persons per day for more than 6 months per year. Typically schools, factories.
Pathogen Viability	The ability of a protozoa, virus or bacteria to survive in a particular set of conditions over time. Their sources are sewage disposal areas, including on-site septic systems and landfills.
Permeability	The measure of the relative ease with which porous media such as sand or gravel can transmit a liquid under a specified gradient.
Phase I	Intra-system potential susceptibility to contamination of each water supply system
Phase II	Inter-system potential susceptibility to contamination of each water supply system relative to one another.
Porosity	The measure of the percentage of open space between the grains in a rock or other media such as sand, gravel, or clay.
Potential Source of Contamination	Any facility, location, or activity that stores, uses, or produces as a product or by-product, the contaminants of concern and has sufficient likelihood of releasing such contaminants at levels that could pose a concern relative to drinking water sources.

Potential Susceptibility Analysis	A process that measures and takes into consideration the sensitivity of a water well or intake and the number, types and proximity of potential sources of contamination to that well or intake. In the Source Water Assessment Program, an "Index and Overlay" system is used to assign numerical values to all criteria. The values for each criterion is totaled and divided by the number of square miles in the Source Water Protection Area. These values will then be compared to determine the water wells or intakes that are most susceptible to potential contamination.
Potential Susceptibility Ranking Formula	A mathematical formula that logarithmically distributes a spread of values into lower and upper ranges based on the number of segments (e.g. 1 to 10) chosen.
Primacy State	A state that has the responsibility for ensuring a law is implemented, and has the authority to enforce the laws and related regulations. This indicates that a state has adopted rules at least as stringent as federal regulations and has been granted primacy enforcement responsibility.
Public Water Supply	A water supply that provides water through constructed conveyances to the public for at least 15 service connections or regularly serves an average of at least 25 individuals daily for at least 60 days per year.
Purchased Water Systems	A water system that purchases and transports its water supply from another Public Water Supply System.
Recharge Area	A land area in which water reaches the zone of saturation from surface infiltration (e.g., an area where rainwater soaks through the earth to reach an aquifer)
Risk Ranking	An "Index and Overlay" method of assigning a numerical value and weighting percentage to each factor considered in the total "Sensitivity" value applied to each water well. Higher values indicate a more sensitive well.

Safe Drinking Water Act Amendments of 1996 This legislation requires each state to establish and implement a Source Water Assessment Program.

Sanitary Survey A water supply evaluation conducted by the Office of Public Health (sanitarians) that considers disinfection, source information, treatment, production/storage, distribution, and management.

Screened Interval See Well Screen below.

Semi-Confined Aquifer An aquifer confined by a low-permeability layer that permits water to slowly flow through it. During pumping of the aquifer, recharge to the aquifer can occur across the confining layer.

Sensitivity for Ground Water The combined characteristics of well depth and age, soil recharge, and aquifer velocity. A numerical value is assigned to each factor and summed to assess the relative sensitivity of each well to contamination.

Sensitivity for Surface Water The combined characteristics of intake integrity, and runoff factors such as precipitation, slope, vegetative cover and soil permeability.

Soil Recharge Potential The relative ability of a soil to transmit water (e.g. rainfall) downward to an aquifer or saturated zone.

Sole Source Aquifer An aquifer designation assigned by the United States Environmental Protection Agency. This designation indicates that the aquifer supplies 50 percent or more of the drinking water to the geographical area overlying the aquifer.

Source Water Assessment Program	Section 1453 of the Safe Drinking Water Act Amendments of 1996 required each state to develop a Source Water Assessment Program that will: delineate areas providing source waters for all Public Water Supplies (ground water and surface water), inventory potential sources of contamination and their associated contaminants within those areas, and determine the susceptibility of each Public Water Supply to contamination from those potential sources.
Source Water Protection Area	The surface and subsurface area surrounding a source of drinking water (a water well, wellfield, or surface water intake), supplying a public water system, through which contaminants are reasonably likely to move toward and reach the source of drinking water.
Surface Water	For the purposes of the SWAP it is rivers and streams and lakes and reservoirs.
Subsegment	A portion of a stream. An example of a segment of a stream is the portion of that stream between two of its tributaries. A segment can be further divided into subsegments by other physical criteria of the adjoining landscape such as drainage patterns and artificial structures such as dams.
Time of Travel	The length of time that it takes for water to move from one point to another.
Transient Non-Community Water System	A non-community water system that serves 25 non-resident persons per day for 6 months or less per year. Typically rest areas, campgrounds.
Unconfined Aquifer	An aquifer in which the water is under atmospheric pressure and the water table is free to rise and fall within the aquifer. An unconfined aquifer typically has no clay layer between it and the surface.
Underground Storage Tanks	Metal or fiberglass tanks, typically 500-1500 gallons each, that are used to store underground gasoline and diesel fuel at gas stations

Vulnerability	The numbers, types, and proximity of potential sources of contamination to public water supply wells or intakes.
Watershed	A topographic boundary area that is the perimeter of the catchment area of a stream. The area within a line drawn connection the highest points uphill of a drinking water intake, from which overland flow drains to the intake.
Wellfield	Two or more wells located in close proximity to each other.
Wellhead Protection Program	Section 1428 of the Safe Drinking Water Amendments of 1986 required each state to submit and implement a voluntary program to protect public water supply wells (ground water) from contaminants, which may have adverse effects on human health. The goals of the program are achieved by delineating wellhead protection areas, inventorying and controlling potential ground water contaminating sources in those areas, assessing the relative threats to public water supplies posed by these various potential sources, and educating the stakeholders on methods they can use to protect their drinking water resources.
Well Screen	The slotted or perforated pipe typically at the bottom of a water well through which the formation water enters the water well.