MISSISSIPPI SOURCE WATER ASSESSMENT PROGRAM

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CHAPTER I

OVERVIEW

1.0 INTRODUCTION

In 1996, the Federal Safe Drinking Water Act (SDWA) was reauthorized by Congress. Included in this legislation are amendments that mandate states with Public Water Supply Supervision Program primacy to develop and implement Source Water Assessment Programs (SWAPs). By including SWAP provisions in the legislation, the clear intent of Congress was to compel states to devise and adopt measures that would enhance the protection of all public water systems (PWSs) from potential contaminant sources and would emphasize the benefits of public involvement. Although most states have been actively pursuing the protection of public ground water systems through Wellhead Protection Programs established a number of years ago, the reauthorized SDWA represents the first attempt at addressing the protection of public surface water systems from contamination. The SWAP-specific amendments provide states the flexibility to adopt programs that will meet their individual needs and capabilities.

The Mississippi State Department of Health (MSDH) has been granted primacy over the Public Water Supply Supervision Program which regulates all of the approximately 1,500 PWSs operating in Mississippi. As a result of this primacy, the MSDH is recognized as the lead agency with program oversight of the State SWAP. In 1997, the Mississippi Department of Environmental Quality (MDEQ) agreed to assist the MSDH in the development and implementation of the new SWAP. This decision was based on several factors including MDEQ's hydrogeologic expertise; MDEQ's past experience in administering the State Wellhead Protection Program; and MDEQ's primacy over most of the other Federal environmental programs. The cooperative relationship between the two agencies during program development has been an essential element in the creation of a successful program approach. Both agencies are committed to implementing an effective State SWAP that will be beneficial to the public and lead to the adoption of protective measures that will become part of a constructive Source Water Protection Program.

One of the factors that has limited past efforts to implement ground water protection efforts in Mississippi was the lack of available funding. The SDWA Amendments provide new funding sources that states can pursue for SWAP-related activities. A 10 percent set-aside of the State's 1998 fiscal year allotment for the newly created Drinking Water State Revolving Fund (DWSRF) will be used to finance source water assessment and protection activities in Mississippi. Funding requests for SWAP activities and proposed program workplans must be approved by the Local Governments and Rural Water Systems Improvement Board which oversees the DWSRF.

The Board has approved the budget requests and workplans for SWAP-related activities through fiscal year 1999.

1.1 PROGRAM PLAN

The purpose of this document is to provide a detailed plan of how the State will develop and implement SWAP in Mississippi as mandated by Sections 1453 and 1428(b) of the SDWA Amendments of 1996. To assist States in their developmental process and to ensure that the legislative goals of SDWA are met, the Environmental Protection Agency (EPA) published a SWAP guidance document, "State Source Water Assessment and Protection Programs Guidance." This guide and three post-guidance clarification documents distributed by EPA serve as the framework for Mississippi's SWAP plan.

1.2 REQUIRED PROGRAM ELEMENTS

Amendments to the SDWA listed certain statutory requirements of all SWAPs. The SWAP guidance information prepared by EPA also identified additional content areas that must be addressed by States in their program plans. The program elements and content areas for SWAP include the following:

1.2.1 Public Participation

The 1996 Amendments placed a strong emphasis on public awareness and involvement throughout the development and implementation of SWAPs. In response to this requirement, the State incorporated various approaches (e.g., advisory committees, public hearings, etc.) to develop a successful application of public information and involvement during the SWAP decision-making process. A more detailed narrative of the public participation process is provided in Chapter II of this document.

1.2.2 Delineation of Source Water Protection Areas

Like the Wellhead Protection Program, a required component of SWAPs is the delineation of protection areas around all PWS wells and surface water intakes. MDEQ developed a new delineation methodology for addressing public ground water systems which is a significant improvement over the old methodology incorporated into the State Wellhead Protection Program. A new methodology for the delineation of protection areas around surface water intakes was also devised to address program requirements. A description of the delineation components used in SWAP is provided in Chapter III.

1.2.3 Potential Contaminant Source Inventory

After protection areas are delineated around wells and intakes, the next required element of SWAP is the identification of significant potential contaminant sources (PCSs) that may impact public water supplies. States are allowed the flexibility to designate the PCSs they consider significant. The experience gained during the implementation of the State Wellhead Protection Program allowed MDEQ to propose a realistic approach to inventorying for PCSs (Chapter IV). SWAP will focus on a number of unregulated sites and facilities that were found to routinely exist throughout the state. Special attention will be given to those sources where material storage and operating concerns are found to exist.

1.2.4 Susceptibility Analysis

Another required element of SWAP is the determination of the relative susceptibility for all PWSs in Mississippi. The State has developed a practical and useful approach to provide individual PWS wells and surface water intakes with a relative ranking of their susceptibility to inventoried PCSs in delineated protection areas. Details on how the susceptibility is determined and what the susceptibility rankings symbolize are included in Chapter V of this document.

1.2.5 Making Assessments Available to the Public

States are required to make the results of the susceptibility assessments available to the public when completed. The intent of this SWAP requirement is to educate the public about their PWSs and to encourage involvement in developing community-based protection measures. Chapter VI of the State SWAP plan includes a process for notification and distribution of the assessments to individual PWSs, their consumers, and the general public.

1.2.6 Program Deadlines

One of the primary factors considered during the establishment of the State SWAP strategy was the imposed program deadlines contained in the SDWA. The timeframe for program development and implementation is quite compressed which necessitates addressing the program requirements in a timely fashion using the best available data (Chapter VII). Thus, time will not permit development of detailed hydrogeologic investigations of areas surrounding PWS wells, extensive field inventorying around all PWS wells and surface water intakes, or considerable redesign and/or correction of existing databases containing information related to PCSs. The SWAP strategy adopted for Mississippi allows for the incorporation of better data as new and/or improved databases become available from other programs.

To meet the tight timeframe and program deadlines imposed on States by the SDWA, Mississippi has developed a detailed four-year workplan that addresses development and implementation of the State SWAP. This workplan is included in Appendix N. Program deadlines of note include the following:

(1)	February 6, 1999	Submittal of State SWAP plan document to EPA
(2)	November 7, 1999	EPA approval/disapproval of State SWAP
(3)	November 7, 2001	Compete implementation of SWAP in Mississippi
(4)	May 7, 2003	Complete implementation of SWAP in Mississippi with 18 month extension allowed in SDWA

With the inherent fiscal and staffing limitations imposed on MDEQ, the 2001 deadline for completion of the susceptibility assessments and program implementation for all PWSs in the state is not realistic. Although every attempt will be made to complete all of the required SWAP elements by the November 7, 2001 deadline, the State is formally requesting an extension from EPA that will allow until May 7, 2003 for completion of its program implementation. The extension will allow for maximum coordination of the SWAP approach for public surface water systems with the Mississippi Basinwide Approach to Water Quality Management that also is under development at MDEQ.

1.2.7 Source Water Protection Program

SWAP represents the initial phase of a comprehensive goal to protect PWSs in the United States and to prevent the degradation of source water from contamination. The second phase of this effort, Source Water Protection Program, will include the adoption of effective measures to enhance the protection of PWSs from PCSs. Because the theme of prevention is interwoven throughout the 1996 Amendments to the SDWA, the concept was a major consideration during SWAP development in Mississippi. Chapter VIII provides additional details on how SWAP will be coordinated with source water protection efforts.

1.3 PUBLIC WATER SYSTEMS IN MISSISSIPPI

Over 95 percent of the inhabitants in Mississippi obtain their potable water supply from ground water sources. The availability of good quality drinking water from the fourteen major aquifers and numerous minor aquifers in the state has contributed to a dependency on ground water. Of the 1,535 PWSs operating in Mississippi, only three systems use surface water as their drinking water source.

1.3.1 Public Ground Water Systems

With the State's dependency on ground water as its primary drinking water source, SWAP-related activities in Mississippi initially will focus on addressing public ground water systems. The existence of deep confined aquifers in much of the state provides most PWSs with the option of using these layers with inherent natural protection. Because most of the PWS wells in the state are screened in confined aquifers, significant ground water contamination events have been rare in Mississippi.

1.3.2 Public Surface Water Systems

The program requirement to address the three public surface water systems operating in Mississippi necessitated the involvement of groups, agencies, and MDEQ programs that focus on the protection of surface water bodies to assist in development of an effective SWAP approach. An overriding factor during this developmental phase was an attempt to coordinate and incorporate SWAP components with the new basinwide management approach currently being developed by MDEQ. As the basinwide approach develops over the next few years, the exact coordination mechanisms between the strategy and SWAP will become more apparent.

1.3.3 Community Versus Non-Community Water Systems

Public water systems are divided into community and non-community water systems. Community water systems are the larger PWSs that regularly provide service to at least 25 residents or 15 connections and sell their water supply. There are 1,248 community water systems operating in Mississippi which include both municipal and rural water (association) systems.

The smaller water systems operating in the state are classified as one of two types of non-community water systems. Transient/non-community water systems serve at least 25 non-resident persons per day for less than 6 months per year. Examples of the 163 transient/non-community water systems operating in the state include restaurants, motels, campgrounds, and welcome centers. Non-transient/non-community water systems include those suppliers that regularly serve at least 25 non-resident persons per day for more than 6 months per year. Schools, churches, and various commercial establishments are some examples of the 124 non-transient/non-community water systems operating in Mississippi.

1.4 DATA SOURCES AND MANAGEMENT

The State performed a detailed review of all known data sources to determine their format, accessibility, and relevance to SWAP. A number of State and Federal databases currently exist that contain large amounts of water quality and other relevant data related to regulated facilities and sites. Unfortunately, not all of the available data meet the accuracy standards Mississippi has established for its SWAP. These data problems are an indication of the limitations that can be expected in SWAP implementation. However, in keeping with SDWA requirements and EPA guidance, the State will focus on using the best available data to address the individual SWAP elements. The principal criteria used for determining data use were the spatial accuracy and the capacity for integration with ArcInfo, the Geographic Information System (GIS) software used for SWAP development and implementation.

A tremendous amount of information will be generated during the implementation phase of SWAP. Data management of this information is critical if the State SWAP is to be effective and meet program objectives. MDEQ developed a GIS that is designed to assist not only in implementation of SWAP and dissemination of related information to the public but also in development and implementation of a useful Source Water Protection Program.

CHAPTER II

PUBLIC PARTICIPATION

2.0 INTRODUCTION

Amendments to the Safe Drinking Water Act (1996) clearly emphasize Congress' intent that public participation components be included in all aspects of the Source Water Assessment Program (SWAP). The SWAP guidance document prepared by EPA reiterates this intent by recommending the inclusion of public participation during development and implementation of program elements. Mississippi has adhered carefully to these recommendations by incorporating a variety of public participation approaches into its SWAP development.

2.1 SOURCE WATER ASSESSMENT PROGRAM ADVISORY COMMITTEE

One of the major public participation components of SWAP was the formation of an advisory committee to assist the State in program development and to provide a public perspective on related issues. EPA recommended in its guidance document that representation on SWAP advisory committees be extended to a broad range of special interest groups. A particular emphasis was placed on the inclusion of groups that represented the interests of the vulnerable population and others who are considered at public health risks. To ensure that the State SWAP Advisory Committee was properly represented, MDEQ received EPA approval on the representatives selected for the group in April, 1998. Table 2-1 contains a list of the various groups EPA recommended for inclusion on advisory committees and also a list of the thirty agencies, groups, and organizations that were invited to participate on Mississippi's SWAP Advisory Committee. The addresses and telephone numbers for each Advisory Committee member is provided in Appendix B.

Table 2-1 SWAP Advisory Committee

Group		Invited Constituency	
A.	Public Health Groups (e.g., medical associations)	**1.**	*Mississippi State Medical Association*
B.	Local Governments	**1.** **2.**	*Mississippi Municipal Association* *Mississippi Association of Supervisors*

Table 2-1 (continued) SWAP Advisory Committee	
Group	**Invited Constituency**
C. Public Interest Groups (e.g., river and watershed organizations) **D.** Land Conservation Groups	**1.** *Sierra Club* **2.** *League of Women Voters* **3.** *National Association for the Advancement of Colored People* **4.** *Pearl River Valley Water Supply District* **5.** *Natural Resources Conservation Service* **6.** *Mississippi Wildlife Federation* **7.** *Mississippi Soil and Water Conservation Commission* **8.** *Delta Council*
E. Vulnerable Population Groups (e.g., elderly; transplant, dialysis, chemotherapy patients; people with HIV/AIDS)	**1.** *Mississippi State Department of Health/Community Health Service Division* **2.** *American Association of Retired Persons (AARP)*
F. Business Groups (e.g., agricultural chemical manufacturers and small businesses)	**1.** *Mississippi Manufacturers Association* **2.** *Mississippi Economic Council* **3.** *Mississippi Petroleum Marketers Association*
G. Tribes	**1.** *Choctaw Health Center*
H. Drinking Water Suppliers **I.** Wastewater Treatment Plant Operators	**1.** *Mississippi Water & Pollution Control Operator's Association* **2.** *Mississippi Rural Water Association* **3.** *Mississippi State Department of Health/Division of Water Supply* **4.** *Mississippi State Department of Health/Division of Sanitation*
J. Developers	**1.** *Home Builders Association of Mississippi*
K. Farmers	**1.** *Mississippi Farm Bureau Federation* **2.** *Delta Council* **3.** *Mississippi Department of Agricultural and Commerce/Bureau of Plant Industry*

Table 2-1 (continued) SWAP Advisory Committee	
Group	**Invited Constituency**
L. Others	**1.** *Mississippi Cooperative Extension Service* **2.** *Mississippi State Oil and Gas Board* **3.** *Mississippi Emergency Management Agency* **4.** *Jackson State University School of Science and Technology*

2.1.1 Role And Key Issues of Committee

The initial role of the SWAP Advisory Committee was to address the programmatic and public health issues that are contained in the SWAP guidance document and to assess other SWAP-related elements during program development. Participants were encouraged to offer their views and professional expertise on a host of different issues related to the development of an effective SWAP strategy. The agenda for most of these committee meetings included addressing the following key specific program issues that were catalogued in the SWAP guidance document (Tables 1 - 6):

(1) Public Participation (Table 1)
(2) State's Strategic Approach (Table 2)
(3) Delineation, Source Inventory, and Susceptibility (Table 3)
(4) Boundary Waters, Multi-State Rivers, and the Great Lakes (Table 4)
(5) Making the Assessments Available to the Public (Table 5)
(6) State Program Implementation (Table 6)

2.1.2 Committee Meetings/Agenda

Six meetings were held with the SWAP Advisory Committee during program development to discuss various required elements and related issues. A brief synopsis of each meeting agenda is included in Table 2-2, and an attendance record of those Advisory Committee members attending each meeting is provided in Appendix B.

Table 2-2 Agenda of SWAP Advisory Committee Meetings		
No.	**Agenda**	**Date**
1	• Overview of SWAP • Role of SWAP Advisory Committee • State's strategic SWAP approach - Table 2* • Role of GIS	5/5/98
2	• Delineation methodology for ground water sources • Public participation element - Table 1* • State program implementation - Table 6*	6/11/98
3	• Delineation methodology for ground water sources • Public participation element - Table 1* • State program implementation - Table 6*	8/13/98
4	• Delineation methodology for surface water sources • Delineation, source inventory, and susceptibility - Table 3* • Boundary waters and multi-state rivers - Table 4* • Review of SWAP development (GIS emphasis)	9/30/98
5	• Presentation of initial draft of SWAP document and request for written comments	12/3/98
6	• Presentation of final draft of SWAP document and report on public hearing process	1/21/99

* Tables 1 - 6 included as specific issue areas by EPA in SWAP guidance document.

2.1.3 Committee Comments and Recommendations

All of the SWAP Advisory Committee meetings were recorded on audio cassette tapes and substantive oral comments offered by committee members were transcribed. Advisory Committee members also were encouraged to provide written comments on SWAP issues when they thought appropriate. The requests for written comments were made to ensure that all comments would be carefully considered in terms of how they relate to each specific issue. To encourage written comments on the six issue areas EPA included in the guidance document as Tables 1 - 6, MDEQ prepared responses to each of the issue questions listed in the tables and presented the information to the Advisory Committee at its meetings. Both written and substantive oral comments made by the Advisory Committee were subsequently addressed by the State. The State's response to both the issues presented by EPA's guidance document (Tables 1 - 6) and to comments by the Advisory Committee are contained within Appendix C of this document.

2.1.4 Future Role of Committee

The State intends to maintain the public participation process by continuing its relationship with the SWAP Advisory Committee after obtaining program approval. After the developmental phase, the role of the committee will change to one of program implementation oversight. This involvement will probably occur as annual or biannual meetings where the Advisory Committee reviews program status and general performance to ensure that program goals and required timelines are being met. Another future role of the Advisory Committee may be to recommend source water protection measures.

2.2 DELINEATION (TECHNICAL) WORK GROUPS

The State sought out technical expertise to serve on two SWAP work groups that were responsible for addressing highly technical delineation issues for ground water and surface water sources. These groups assisted in the development of effective methodologies to address the delineation of Source Water Protection Areas (SWPAs) around PWS wells and surface water intakes. Recommendations from the work groups were presented to the SWAP Advisory Committee for consideration.

The delineation work groups included representation from the following agencies and/or universities: (1) MDEQ's Office of Land and Water Resources, the state agency responsible for addressing water quantity issues; (2) MDEQ's Office of Pollution Control, the state agency that administers water quality programs; (3) the U.S. Geological Survey, the federal agency involved in addressing water resource issues in the state; and (4) two academic representatives -- one from Mississippi State University and another from Alcorn State University. These two institutions are recognized for their involvement in the areas of hydrology and soil science respectively and their participation in ground water quality-related activities. Lists of participants in the two work groups are included in Appendix B.

2.3 OTHER STATE EFFORTS TO INVOLVE PUBLIC PARTICIPATION

A concerted effort was made by the State to make the proposed SWAP document available to the public for review and comment. To ensure the broadest outreach potential, MDEQ held three public hearings to present the proposed State SWAP plan and to request public review and comment. In addition, MDEQ mailed copies of the program document directly to identified stakeholders and provided copies of the proposed program document to citizens upon request (Appendix E).

2.3.1 Public Hearings

During January of 1999, three SWAP public hearings were held in strategic locations to offer statewide coverage. The first SWAP public hearing was held in Hattiesburg to include the southern tier of Mississippi; the second hearing was in Jackson to cover central Mississippi; and the final hearing was conducted in Oxford to provide coverage of northern Mississippi. Each public hearing began with a presentation by MDEQ personnel to identify the scope, goals, and components of the proposed SWAP. This introductory session was followed by an open forum to allow for public comment on the SWAP plan. All public comments at the hearings were recorded and transcribed by a Court Reporter. Summaries of these comments and the State's follow-up responses to them are included in Appendix D.

2.3.2 Targeting of Additional Stakeholders and Response to Stakeholder Comments

In addition to the SWAP Advisory Committee representatives, the State compiled a list of additional/potential stakeholders who were contacted regarding the proposed program. Copies of the program document were mailed to this group of stakeholders to ensure additional public coverage and to provide an opportunity for review and comment on the proposed SWAP document. Another method used to maximize public participation in SWAP was the issuance of press releases which proclaimed the new program, announced the availability of the proposed program plan from MDEQ, and requested the submittal of public comments.

All submitted public comments have been assimilated by MDEQ and catalogued according to the topic of concern. These comments were considered and appropriate responses were prepared to address them. All of the submitted comments and the corresponding responses are included in the State's responsive summary (Appendix D).

CHAPTER III

DELINEATION OF SOURCE WATER PROTECTION AREAS

3.0 INTRODUCTION

A required fundamental element of the Source Water Assessment Program (SWAP) is the delineation of protection areas around all water wells and surface water intakes used for public water supply. These designated areas, referred to as Source Water Protection Areas (SWPAs), will be inventoried to identify potential contaminant sources (PCSs) and evaluated to determine the relative susceptibility of public water systems (PWSs) to the migration of contaminants and pathogens. SWPAs are the focal point of the State SWAP efforts to enhance the protection of community and non-community water systems.

3.1 PUBLIC GROUND WATER SYSTEMS

3.1.1 Ground Water Dependency

There are 1,535 PWSs operating in Mississippi. With the exception of three surface water systems, the remaining PWSs are totally dependent on ground water for potable water supply. Fortunately, most of the estimated 3,400 PWS wells operating in the state utilize deep confined aquifers that are afforded significant natural protection from overlying clay layers of sufficient thickness. The number of shallow unconfined PWS wells operating in the state is estimated to be only 5 to 10 percent of the 3,400 total.

3.1.2 State Hydrogeology and Aquifer Recharge Areas

With the exception of the northeast corner of the state, the aquifers used for public water supply in Mississippi consist predominately of unconsolidated sands with some gravels. Because of diverse depositional environments, the stratigraphy of the state is often characterized by rapid changes in facies over short distances which result in discontinuous beds of unconsolidated sediments. The state geologic map indicates only those areas where geologic formations are exposed at the surface, but these exposures are not necessarily actual aquifer recharge areas. Without detailed geologic mapping on a local scale, the complexity of the natural hydrogeologic setting in most areas of the state does not allow for the determination of actual recharge areas for specific aquifer sands. This situation is especially true in areas where the local stratigraphy is dominated by a mixture of surficial clays intermingled with sands, such as the outcrop areas of Miocene-aged and earlier sediments found in the southern third of the state.

Because the geologic information required to identify noncontiguous recharge areas for aquifers currently is unavailable and the recharge areas for confined aquifers are typically located quite some distance away from the actual wells, Mississippi will not pursue the delineation of noncontiguous recharge areas for public water supplies using these aquifers. The delineation methodology that will be utilized for PWS wells using unconfined aquifers in Mississippi (Section 3.1.4.B.2) will offer adequate protection so additional measures will not be required.

3.1.3 Aquifer Confinement Verification

Mississippi's SWAP has been designed to take full advantage of the natural protection provided by the state's favorable hydrogeologic setting. Because of this importance, one of MDEQ's initial SWAP efforts (early 1998) has been to assimilate all of the available well completion and hydrogeologic information pertaining to the PWS wells in the state. After this information is reviewed, MDEQ personnel verify the adequate confinement of the aquifers being used for public water supply and summarize their findings (Appendix G). This information is entered into the SWAP Geographic Information System (GIS) which delineates an appropriate SWPA scenario "on the fly" in most cases for public ground water systems. To implement a conservative approach, **one** of the following criteria must be satisfied for an aquifer to be classified as confined (listed in order of priority):

(1) Confining layer(s) overlying a source aquifer must have a minimum total thickness of 30 feet;
(2) A source aquifer must be capable of demonstrating a head (pressure) differential of 10 feet or greater than aquifers overlying its confining layer;
(3) A significant difference in water chemistry must be demonstrated between a source aquifer and any overlying aquifers.

3.1.4 Protection Areas

The original Wellhead Protection Program stipulated the delineation of three zones of protection for PWS wells based on aquifer confinement and distance from the wells. The new delineation methodology for SWAP and the revised Wellhead Protection Program uses only two protection areas for most public water system wells and requires only one protection area for wells in some cases. Although the new delineation methodology recommends that all community and non-community water system wells be surrounded by a fence with a locked gate and/or a building with a locked door as a protective measure, these areas will not be designated formal protection zones as they were previously in the Wellhead Protection Program. Area-wide assessments described in the EPA guidance

document will not be used in Mississippi. Separate protection areas will be delineated around each PWS well instead.

A. Priority Protection Areas

The State SWAP requires the delineation of a 500-foot fixed radius for Priority Protection Areas in the following cases:

(1) All community water system wells using unconfined aquifers;
(2) All community water system wells using confined aquifers drilled prior to January 1, 1975 which are assumed to not have met the Mississippi State Department of Health (MSDH) minimum design criteria for PWS wells, unless proven otherwise; and
(3) All non-transient/non-community water system wells.

Priority Protection Areas are not required around community water system wells using confined aquifers verified by MDEQ which meet the MSDH minimum design criteria for PWS wells (drilled after January 1, 1975). The delineation approach recognizes aquifers as either confined or unconfined. If there is any uncertainty as to the confinement of an aquifer, it will be considered as unconfined, and the affected community or non-transient/non-community water system will be obligated to meet the appropriate requirements of the State SWAP.

B. Source Water Protection Areas

It became apparent during SWAP development that MDEQ's GIS could be competently designed to accommodate a calculated fixed-radius (circular) approach for SWPA delineations. However, using a fixed-radius approach in the traditional manner would require inventorying for PCSs in a large area extending down gradient past the null (stagnation) point of a capture zone for a well. In reality, any PCSs identified in those down-gradient areas should not adversely impact the capture zones.

MDEQ modified the calculated fixed-radius approach to make it more representative of actual ground water flow patterns. Because the WHPA code is an EPA-approved delineation tool which yields results typically skewed in the up-gradient direction from which ground water is naturally moving, the results generated from the model were adapted to a new calculated fixed-radius approach (Scenarios 1 - 8).

The following scenarios will be used to delineate SWPAs for the outermost protection areas around community and non-transient/non-community water system wells:

1. Scenarios 1 - 8

Eight basic scenarios have been developed for the delineation of SWPAs around wells using aquifers that exhibit ground water flow in a discernable direction. Since the methodology is based on the WHPA code, which does not take into account aquifer confinement, the scenarios are applicable to both unconfined and confined aquifers in most cases. Although this approach requires using eight different calculated fixed radii, all of the scenarios were developed using the same fundamental delineation approach:

(a) The WHPA code (Multiple Well Capture Zone module) was run using established input parameters (Appendix F). Available data from the U.S. Geological Survey and the MDEQ's Office of Land and Water Resources and Office of Geology were used to identify representative examples and characteristic patterns and trends associated with Mississippi's aquifers and PWS wells. The data were incorporated into various computer runs and pumping scenarios.

(b) The overall length of the various capture zones was determined by measuring the center axes of the WHPA-generated plots. These lengths were divided in half to establish the fixed radii and center point of the delineated SWPAs (Figure 3-1).

(c) Circles were drawn from the center point of the capture zone plots using the established fixed radii; the circles correspond to the delineated SWPAs (Figure 3-2). The resulting delineations are circular in shape yet still closely resemble the plots generated using the WHPA code. Thus, most of their encompassed areas are projected up gradient from the wells with more realistic (smaller) areas projected down gradient past the wells. A noticeable and very important difference between the two delineation methods is that the fixed-radius approach typically includes somewhat larger protection areas along the periphery than the plots generated using the WHPA code. This concession allowed the adoption of a more prudent approach when addressing the protection of community and non-transient/non-community water systems.

Footnote: The center points of the circular SWPA delineations do not correspond with the established locations of PWS wells as determined by using Global Positioning System (GPS) technology. Instead, the delineations must be shifted, or offset, a prescribed distance directly up gradient from the actual wellheads depending upon the scenario. These distances are determined by subtracting the fixed radii of the SWPAs from the calculated null points of each scenario (Figure 3-3).

Figure 3-1 Capture Zone Generated by WHPA Code

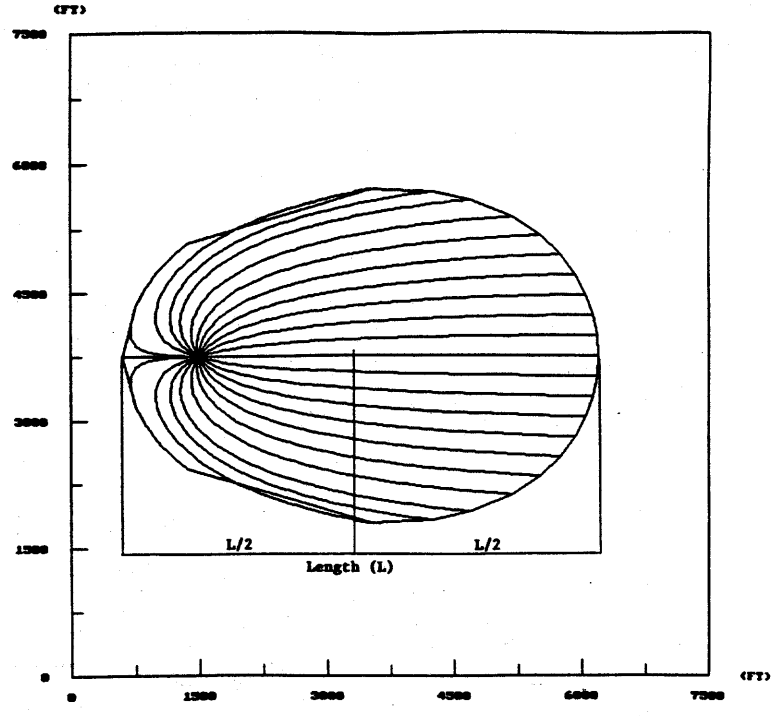


Figure 3-2 SWPA Delineation - Calculated Fixed Radius Versus WHPA Generated Zone

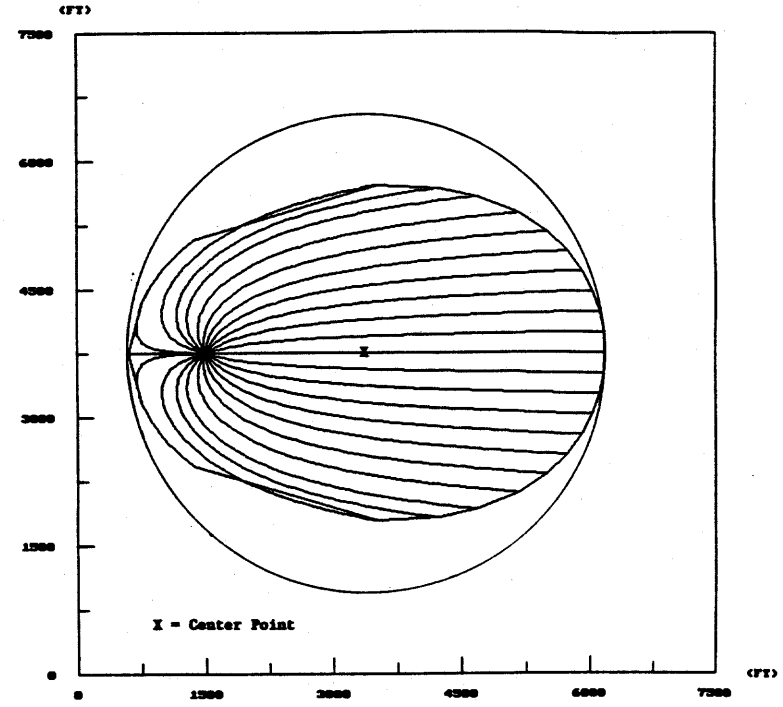
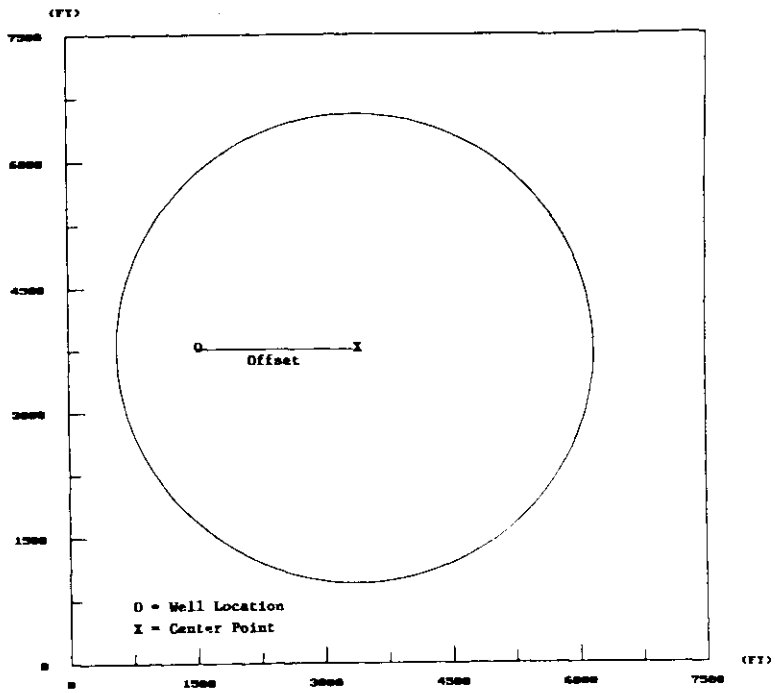


Figure 3-3 SWPA Delineation -- Offset Calculate Fixed Radius



(d) The many model runs generated during the evaluation process of this methodology were compared to the results obtained from solving basic ground water equations (e.g., Theis equation, uniform flow equation, and volumetric flow equations). Comparing the results obtained from solving the equations with various proposed calculated fixed-radii for the circular areas allowed for some necessary adjustment of the SWPAs to ensure good fits for the various adopted pumping scenarios.

The SWAP GIS is designed to delineate the eight fixed radii based on the pumping rates of the wells and to calculate automatically the required well offsets ("on-the-fly") so that the delineated areas are moved the correct distances up gradient to conform with the adopted methodology. The adopted sizes of the resulting delineated SWPAs using the prescribed methodology are provided in Table 3-1.

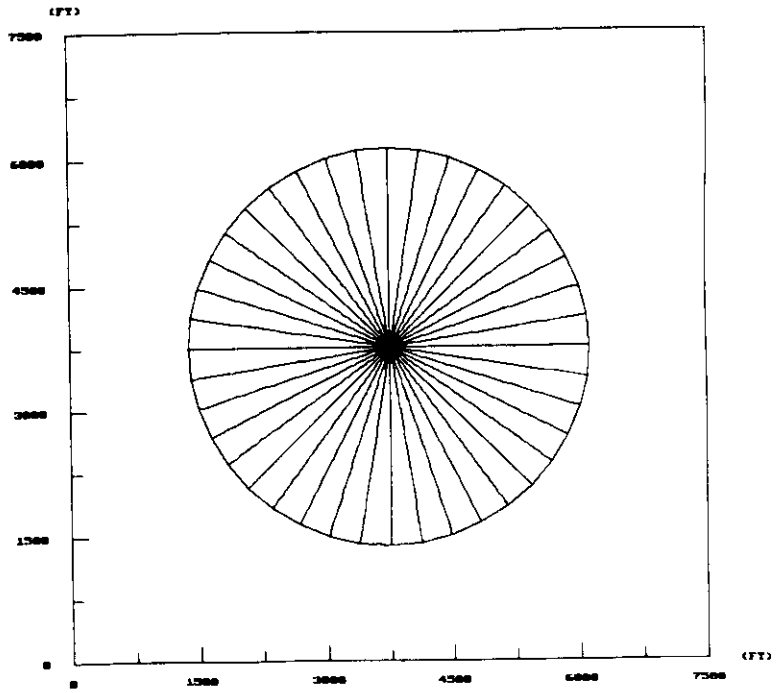
Table 3-1 Source Water Protection Area Delineation Scenarios 1 - 8					
Scenario	**Discharge Rate (gpm)**	**Radius (feet)**	**Null Point (feet)**	**Offset (feet)**	**Area (sq. miles)**
#1	0 - 100	1,285	505	775	0.19
#2	101 - 250	1,700	514	1,186	0.33
#3	251 - 500	2,250	654	1,596	0.57
#4	501 - 750	2,590	714	1,876	0.76
#5	751 - 1,000	3,040	836	2,204	1.04
#6	1,001 - 1,500	3,415	981	2,434	1.32
#7	1,501 - 2,000	3,685	1,054	2,631	1.53
#8	> 2,001	4,040	1,122	2,918	1.84

Footnote: Additional information regarding development of the scenarios and a detailed justification for the various criteria selected are included in Appendix F.

2. Scenario 9

In certain circumstances it is impossible to establish a single hydraulic gradient direction for unconfined aquifers in Mississippi. Such cases exist if the ground water flow direction either cannot be determined or is highly variable depending upon local factors and conditions. Examples of situations where this type of hydraulic gradient is anticipated are those PWS wells located on the crests of topographic hills and ridges or those wells that may be influenced by surface water. Since the promoted delineation methodology for Scenarios 1 - 8 only relates to aquifers with reasonably stable hydraulic gradients with discernable directions of constant ground water flow, Scenario 9 addresses those unique cases that do not meet these gradient criteria. To compensate for these situations, a standard calculated fixed-radius approach will be utilized for the delineation of SWPAs around PWS wells in such identified cases. The calculations involved in determining the proper fixed-radius size will be based on aquifer-specific and well-specific data, as well as the standard 5-year time-of-travel parameter that is used in all delineation scenarios. An example exhibiting this delineation methodology is provided in Figure 3-4.

Figure 3-4 SWPA Delineation -- Scenario 9



C. Conjunctive Delineations

The SWAP guidance document prepared by EPA recommends that states identify Ground Water Under Direct Influence (GWUDI) public ground water systems that may be under the direct influence of surface water. "Conjunctive use" designations are intended to be applied to situations where aquifers are clearly connected hydraulically to streams, lakes, or reservoirs and which obtain significant recharge from such waters in proximity.

Contaminants are naturally directed away from most shallow ground water supplies in Mississippi because effluent (gaining) streams are the dominant flow regime. Thus, only two PWSs in Mississippi have the potential of being classified as GWUDI systems. The City of Vicksburg and Eagle Lake Water Association obtain their source water from the Mississippi River Valley alluvial aquifer which is hydraulically connected to the Mississippi and/or Yahoo Rivers to some extent. While water levels in these wells and the hydraulic gradient in the aquifer fluctuate according to the stages of the Mississippi and/or Yahoo Rivers, it appears to involve primarily changes in pressure which is not necessarily an indication of actual recharge from the streams. Since Vicksburg and Eagle Lake continue to meet all of the water quality parameters in Title 40 CFR § 141.71, neither of the systems has been formally classified as GWUDI. The delineation methodology prescribed in Scenario 9 was developed with this type of hydrogeologic setting in mind and should offer adequate source water protection for Vicksburg and Eagle Lake.

It is anticipated that in the event any PWSs are designated as GWUDI systems in the future, they more than likely will involve wells located along the western boundary of the state and pump from the Mississippi River Valley alluvial aquifer. If any such systems are formally classified as GWUDI, conjunctive delineations will be required. Conjunctive use will involve utilizing Scenario 9 in conjunction with the 24 hour time-of-travel approach detailed in Section 3.2.2.A.1.

D. Transient/Non-Community Water Systems

In most cases, transient/non-community water systems rely on small-capacity wells to furnish moderate supplies of water. Because these systems typically are found in rural settings, the number and type of PCSs typically existing in the immediate vicinity of the wells are limited. Often the on-site septic systems associated with the operation of these types of facilities represent the only ground water contamination source of concern. Based on these factors, the delineated SWPAs around all transient/non-community water systems will consist of set 500-foot fixed radii. Although these protection area do not correspond to a 5-year time-of-travel for ground water flow, the zones should adequately address the protection of such systems.

3.2 PUBLIC SURFACE WATER SUPPLIES

3.2.1. Surface Water Intakes

Many of the southeastern states which comprise EPA Region IV obtain almost half of their public water supply from surface water bodies such as streams and reservoirs. This dependancy is not shared by Mississippi which presently has only three community water systems and no non-community systems using surface water. The small number of surface public water systems is a reflection of the abundance and overall quality of the ground water resources in the state and the high costs associated with treating surface water. The City of Jackson operates one intake structure on the Ross Barnett Reservoir and another downstream in the Pearl River; the City of Tupelo obtains its water supply from the old Tombigbee River channel which is supplemented with water diverted from the Tennessee-Tombigbee Waterway; and the Short-Coleman Park Water Association diverts water from Pickwick Lake. However, since several areas of the state have expressed some interest recently in pursuing the diversion of water from streams, lakes, or reservoirs, the number of PWSs relying on surface water is expected to increase in the future.

Although the MDEQ has administered various programs through the years that have focused on activities related to the cleanup and protection of the state's surface waters, a strategy was never been devised to specifically address the protection of surface water intakes used for public water supply. With the development and implementation of

SWAP coinciding with the adoption of a new basinwide management approach, MDEQ is afforded the opportunity to establish coordination among various water-related programs that will result in the evolution of effective management planning and enhanced protection of PWSs using surface water.

3.2.2 Protection Areas

Susceptibility to contamination is a function of the hydrogeologic setting, slope, water management practices, land use activities, and soil coverage within a water supply's contributing watershed area. The State SWAP approach regarding the protection of public surface water systems is to address the entire watershed area upstream of intakes that fall within the hydrologic boundaries of the drainage area or to the boundary of the state border as determined using the U.S. Geological Survey 8-digit Hydrologic Unit Code (HUC). Due to the large area encompassed in some of the watersheds in the state, a segmentation approach to subdivide the areas into smaller, more manageable units (protection areas) will be used in implementing SWAP.

A. Primary Protection Areas

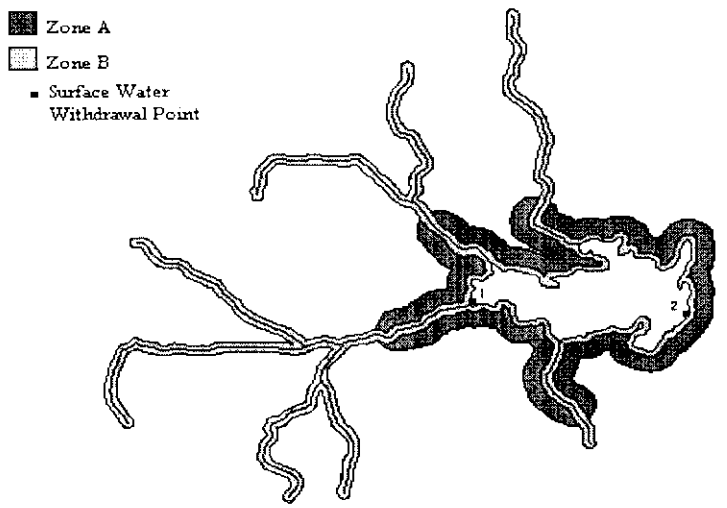
A major consideration in addressing public surface water systems is to devise an approach that will ensure their protection in the event that a catastrophic spill occurs upstream of their intakes. Typically, a time-of-travel designation is used in such scenarios to provide the intake operators with a sufficient amount of time to initiate protective measures that will minimize the potential impacts on downstream PWSs. The identification of these types of PCSs during the assessment phase should prove beneficial to PWSs when contingency plans associated with the Source Water Protection Program are developed to address appropriate responses to potential releases. The protection of public surface water systems in the state should be enhanced with the adoption and implementation of the Mississippi Basinwide Approach to Water Quality Management (Section 3.2.3) as well. This approach will include such activities as the formation of local advisory committees and the development and implementation of applicable best management practices.

1. Streams

The designated Primary Protection Areas for public surface water systems diverting water from streams will consist of the stream segments located between the intakes and the 24-hour time-of-travel distance computed at bank-full (flood) stage. In Figure 3-5, this area is depicted as the upstream limit of Zone A for Intake #1. This delineation methodology will be applied to the larger tributaries of the main streams actually containing the intakes, where applicable, and may include the entire drainage areas of smaller watersheds as well.

To ensure that the potential influence of stream "ponding" is considered, the Primary Protection Areas will extend 0.25 miles downstream of intakes on streams.

Figure 3-5 Primary and Secondary Protection Areas - Public Surface Water Systems



2. Reservoirs and Lakes

The time constraints associated with SWAP preclude the performance of detailed studies of reservoirs and lakes that would involve the development of complex computer models to determine the travel time through large "ponded" surface water bodies used for public water supply. As a result, Primary Protection Areas have been established that include the entire surface area of all affected reservoirs or lakes and a 24-hour time-of-travel distance (at flood stage) from the headwaters of all major streams and tributaries entering the surface water bodies. In Figure 3-5, this area is depicted as the "ponded" surface water body and the upstream extent of Zone A for all contributing streams that potentially could impact Intake #2. This delineation methodology will ensure that a conservative approach is used for PWSs diverting water from lakes and reservoirs.

B. Secondary Protection Areas

Another component of the State's segmented approach to address the delineation of surface water SWPAs is the establishment of Secondary Protection Areas. These areas

include all subwatersheds within the hydrologic boundaries of the USGS 8-digit HUC that are located upsteam of Primary Protection Areas up to the boundaries of the state border. Contaminants introduced in these reaches of streams will experience long travel distances which should allow for the occurrence of volatilization, dilution and attenuation of concerned constituents.

1. Protection Strips

Some types of land-use activities, when practiced on property adjacent to streams, lakes, and reservoirs, may serve as potential sources of point and non-point pollution that can contribute to the degradation of surface water quality. Such activities are especially significant since they can contribute to non-point pollution problems if runoff occurs from sites and contaminants are transported by overland flow. For years, some states have designated buffers or riparian zones along stream banks and focused efforts to initiate best management practices in those sensitive areas. The establishment and use of buffers or protection strips represent another important component of the overall SWAP strategy that emphasizes the adoption of a holistic approach for the protection of surface water intakes used for public water supply.

Established buffers that effectively address non-point sources of pollution through surface water quality programs typically extend out only several hundred feet from the edge of a surface water body. However, ground water can move appreciably longer distances before discharging into effluent streams, lakes, and reservoirs. Because of this concern, significant consideration was given to the potential influence ground water quality could have on the degradation of surface water bodies. To address this issue, the following criteria will apply to the delineation of protection strips adjacent to surface water bodies used for public water supply:

(a) To compensate for the natural ground water flow regime, protection strips of 1,000 feet will be established from the edge of any surface water body used for public water supply. This width will apply only to those areas included within the Primary Protection Area with its 24-hour time-of-travel (Zone A, Figure 3-5).

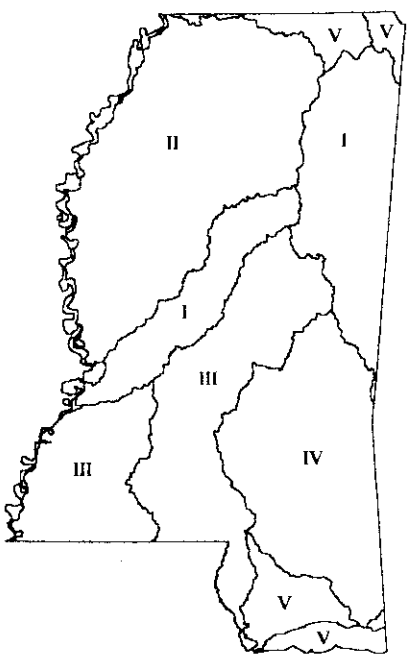
(b) Protection strips of 250 feet will be established within Secondary Protection Areas (Zone B, Figure 3-5).

(c) The protection strips will be extend from the top of banks surrounding the water bodies.

3.2.3 Basinwide Approach

The MDEQ is currently developing a new water protection strategy referred to as the Mississippi Basinwide Approach to Water Quality Management. This approach is an attempt by the State to plan comprehensively and to implement practices that will result in water quality protection on a basinwide scale. The nine basins in the state have been divided into five work management groups (Figure 3-6).

Figure 3-6 Mississippi Basin Management Groups



Basin Rotation

Group I	Big Black Basin
	Tombigbee Basin
Group II	Yazoo River Basin
Group III	Pearl River Basin
	South Independent
Group IV	Pascagoula River Basin
Group V	Coastal Streams
	North Independent
	Tennessee Basin

An established 5-year management cycle will be used to address the basinwide management and protection in a staggered arrangement (Table 3-2). Every 5 years the following five progressive phases will be applied to the development of basinwide management plans:

(1) Planning in Year 1 of the cycle;
(2) Data gathering in Year 2 of the cycle;
(3) Data evaluation in Year 3 of the cycle;
(4) Plan development in Year 4 of the cycle; and
(5) Plan implementation in Year 5 of the cycle.

Table 3-2 Basin Rotation Cycle

Basin Rotation*	1998	1999	2000	2001	2002	2003
I	Planning	Gather Data	Evaluate Data	Develop Plan	Implement Plan	Planning
II		Planning	Gather Data	Evaluate Data	Develop Plan	Implement Plan
III			Planning	Gather Data	Evaluate Data	Develop Plan
IV				Planning	Gather Data	Evaluate Data
V					Planning	Gather Data

*** Basin Rotation:**

I The Big Black and Tombigbee River Basins
II The Yahoo River Basin and adjacent tributaries of the Mississippi River
III The Pearl River Basin and South Independent Streams
IV The Pascagoula River Basin
V The Coastal Streams, North Independent Streams, and the Tennessee River Basins

A source water assessment/protection component was included in the list of goals that MDEQ will address during implementation of the basinwide approach for those basins containing surface water intakes used for public water supply. Because the basinwide approach is still under development and the methodology to be used is still not established, uncertainty remains as to exactly how this strategy will coincide with the development and implementation of SWAP. Every effort will be made to coordinate an effective management strategy and pool the available resources to achieve the ultimate goal of fully supporting the designated use of surface water bodies as source water supplies.

The established basin cycle/rotation schedule that MDEQ has adopted does not equate well with the compressed time constraints mandated by SWAP. This situation will be improved to some extent if the State obtains the allowable 18-month extension for the completion of SWAP that is specified in the 1996 Amendments to the SDWA. Although SWAP efforts to address the intake used by the Short-Coleman Park Water Association on Pickwick Lake, included in the Tennessee River Basin (Basin Group V), will not match up with the first iteration of the rotation cycle for that basin (Table 3-2), all required SWAP components for the PWS will be completed for the system by May 7, 2003.

CHAPTER IV

POTENTIAL CONTAMINANT SOURCE INVENTORY

4.0 INTRODUCTION

The second major component required in the implementation of the State Source Water Assessment Program (SWAP) is the identification of significant potential contaminant sources (PCSs) that may impact source waters used for public water supply. This process typically involves inventorying for PCSs within designated Source Water Protection Areas (SWPAs) that were delineated in accordance to the methodology prescribed in Chapter IV. Inventorying in this sense includes not only performing actual field inspections to identify PCSs but also searching existing databases to identify regulated facilities that may represent sites of concern and reviewing inspection reports (sanitary surveys) on public water systems that are compiled by the Mississippi State Department of Health (MSDH). Much of the success achieved during the inventory process will be dependent on the accessibility and accuracy of the available data.

During development of the State's strategy to address the inventory process, it became apparent that other broader issues needed to be considered besides just the completion of SWAP inventory requirements. The following four fundamental issues are considered program priorities and have been incorporated into the PCS inventory process:

Priority #1 -- **Assuring the usefulness of the inventory data.** A primary focus of Mississippi's SWAP is to ensure the usefulness of the information gathered during the inventory process. This focus is in keeping with the stated goal of EPA and Congress for the SWAP susceptibility analysis which is ". . . to be the means for a state to make the inventory useful for decisions regarding Source Water Protection Programs and other uses." The inventory approach adopted by the State will provide valuable information not only to MDEQ, the MSDH, and the local public water systems (PWSs) but also to a host of other potential users, including related governmental programs, private industry, and the general public. A list of the anticipated users and uses of the PCS inventory information is provided in Table 4-1.

Table 4-1 Potential Users and Uses of PCS Inventory Information	
Potential Users	**Potential Uses**
Local Public Water Supplies	Source water protection (management)
MSDH/Division of Water Supply	Source water protection (management); emergency response
MS Rural Water Association	WHPA Management Plan development
MDEQ/Wellhead Protection Program	WHPA Management Plan development
MDEQ/UST Program	Environmental assessments
MDEQ/CERCLA Program	Environmental assessments
MDEQ/RCRA Program	Environmental assessments
MDEQ/Permitting Division	Permitting reviews
MDEQ/Compliance & Enforcement Division	Compliance assessments
MDEQ/Legal Division	Environmental justice issues
MS Emergency Management Agency	Emergency response; SARA Tier II reporting compliance
MS Automated Resource Information System	Database resource for other state agencies
MS Department of Economic Development	Economic studies and planning
MS Planning and Development Districts	Planning
Private environmental and engineering firms	Assessments, studies, research, planning

Priority #2 -- Coordinating the inventory data with the susceptibility analysis requirements. Section 1453(a)(2)(B) of the Safe Drinking Water Act states that the susceptibility analysis should ". . . determine the susceptibility of the public water supply systems in the delineated [protection] areas to the identified contaminants inventoried." Since the PCS inventory process is such a fundamental element in determining the final susceptibility assessments of public water supplies, it was important to understand this complex relationship while developing the overall strategy adopted by Mississippi.

Priority #3 -- Assuring data integrity. During SWAP development, MDEQ will devote a significant effort to ensure a high level of data integrity and spatial data accuracy are maintained in respect to the PCS inventory. Quality assurance and quality control (QA/QC) measures will be applied throughout the inventory process during data entry into the SWAP Geographic Information System (GIS).

Priority #4 -- Coordinating with future source water protection and management activities. The final goal after SWAP implementation is to address the PCSs of concern to source waters and to develop and implement appropriate management practices. The SWAP guidance document states -- "However, because EPA's goal is to implement full Source Water Protection programs for at least 60 percent of the population served by CWSs [community water systems] (144 million Americans) by the year 2005, EPA will also encourage states and localities to implement preventative programs."

4.1 PCS INVENTORY PROCESS

The inventory component of the State SWAP uses an approach that is based on previous experience gained in inventorying for PCSs during implementation of the State Wellhead Protection Program, and therefore, is representative of existing conditions in Mississippi. Both regulated and unregulated facilities and sites located within delineated SWPAs will be addressed during the inventory process. Completing this required program element will be the most time consuming aspect of SWAP and will dictate how successful the program is in determining the relative susceptibility of PWSs.

4.1.1 Preliminary Inventory

Prior to field inspections, the State will assimilate all available relevant information in existing databases to identify any PCSs that may be located within delineated SWPAs. This process involves assembling the best available data on facilities and sites of interest from databases maintained at MDEQ, the MSDH, the U.S. Geological Survey, and other sources. Applicable data will include information related to permit or identification numbers assigned to facilities and sites, latitudes and longitudes, addresses, etc. (A list of the PCS information and data sources that have been identified for possible use during the preliminary inventory process is provided in Table 4-2.) Only databases that exist in digital format, that are compatible with ArcInfo software, and that have spatial and informational integrity will be used during SWAP implementation.

Table 4-2 Potential PCS Information and Data Sources

PCS Information	Data Sources
PWS Well Locations	MSDH/DWS
Water Wells	USGS, MDEQ/OLWR
Oil & Gas Well Locations	State Oil & Gas Board
RCRA Facilities	MDEQ/OPC

Table 4-2 (continued) Potential PCS Information and Data Sources	
PCS Information	**Data Sources**
CERCLA/State Uncontrolled Sites	MDEQ/OPC
Underground Storage Tanks (USTs)	MDEQ/OPC
NPDES Discharge Points	MDEQ/OPC
Surface Water Impoundments	MDEQ/OPC
Nonhazardous Waste Facilities	MDEQ/OPC
Air Emission Facilities	MDEQ/OPC
Concentrated Animal Feeding Operations (CAFOs)	MDEQ/OPC
Toxic Release Inventory (TRI) Data	MDEQ/OPC
Surface Mines	MDEQ/OG
Land Use	MARIS
Transportation Corridors	MARIS
Certified Sewered Areas	MARIS

4.1.2 Regulated PCS Facilities and Sites

The existing information related to the regulated facilities and sites of interest will be compiled during the preliminary inventory process (Table 4-2). Because there is some uncertainty regarding the accuracy of locations assigned to regulated facilities and sites in the databases of other programs, this data will be maintained separately from the SWAP database in different GIS coverages or layers. The inventory approach Mississippi has adopted does not include field inspecting regulated facilities and sites during the initial implementation phase of SWAP. This decision is based upon the existence of State and EPA regulatory oversight already in place at these PCSs and the limited resources available to field inspect all of them. However, the location of regulated facilities and sites potentially located within delineated SWPAs will be verified and corrected, if needed, during SWAP field inspections. Following this verification step, the appropriate regulatory program will be notified regarding the occurrence of those regulated facilities and sites that are found to exist within delineated SWPAs.

4.1.3 Unregulated PCS Sites

The experience MDEQ acquired over the past 6 years in directing and performing PCS inventories while implementing the State Wellhead Protection Program was instrumental in formulating a practical approach for performing SWAP inventories. Previous inventories clearly indicated that since regulated facilities and sites are already subjected

to State and EPA oversight, they are not as great of a concern to the overall protection of source waters as many unregulated sites. Therefore, the approach Mississippi adopted is to concentrate the SWAP inventory process on unregulated sites.

A. PCS Types

During implementation of the Wellhead Protection Program, MDEQ documented several recurring PCS types that were found to exist throughout the state. These potential point sources of pollution are often associated with the operation of facilities and sites handling petroleum products and organic solvents. Other ground water-related concerns identified during the Wellhead Protection-related activities are the inherent danger associated with the large number of improperly plugged or abandoned water wells in the state and the common occurrence of some types of Class V injection wells. Although these wells are not actually PCSs, they do serve as potential conduits for contaminants to enter source waters and will be designated as PCSs in SWAP.

The following significant PCS types generally represent the greatest current unregulated threats to public water supplies in terms of their widespread occurrence in Mississippi and have been designated for inventory activities:

(1) Above ground storage tanks (ASTs);
(2) Class V injection wells;
(3) Automotive and equipment maintenance shops;
(4) Container/drum storage sites;
(5) Improperly plugged or abandoned water wells;
(6) Oil and gas production facilities (e.g., tank batteries, saltwater disposal pits, etc.); oil and gas wells are excluded.

Many of the surface water quality problems found in Mississippi can be traced to non-point sources of pollution. Agricultural and silvacultural activities that occur on property adjacent to surface water bodies are the two examples most often associated with this type of pollution problem. Septic systems are considered non-point sources of pollution as well and can contribute significantly to the degradation of both ground water and surface water quality.

B. Field Inspections

All required SWAP inventory components will be performed by MDEQ personnel initially. As the field inspection process progresses, it may become necessary to involve trained personnel from other MDEQ programs and divisions or to outsource certain inventory components to ensure completion within the prescribed program deadlines.

Field inspections to identify PCSs located within delineated Source Water Protection Areas will involve the following steps:

1. Windshield Survey

An initial "windshield survey" will be performed by MDEQ personnel to identify unregulated sites for future field inspection and to verify and correct the location of regulated facilities and sites on base maps. Table 4-3 lists the types of PCSs designated for field inspection within the various delineated protection areas incorporated into the SWAP approach.

Table 4-3 Field Inspection of Designated PCSs

PCS Type	In Unconfined Aquifer SWPAs	In Confined Aquifer Priority Protection Areas*	In Surface Water Primary Protection Areas	In SWPAs for Transient/Non-Community Water Systems
ASTs	X	X	X	
Class V Injection Wells	X	X	X	X**
Auto/Equipment Shops	X	X	X	
Container/Drum Storage Sites	X	X	X	
Oil & Gas Production Facilities	X	X	X	
Septic Systems				X

* In confined aquifers, Priority Protection Areas of 500 feet will exist only when PWS wells have not met the MSDH minimum design criteria (Appendix M).

** Large-capacity septic systems (i.e., serve 20 or more persons).

2. Identification of Potential Contaminants

During the field inspection process, general determinations of the potential contaminants found at designated inventory sites will be made by field inspectors. This activity will focus on identifying the designated chemical constituents and/or organisms that are regulated under the Safe Drinking Water Act and the Surface Water Treatment Rule. To assist in this exercise, field personnel will be provided with a correlation table, "Regulated Contaminants Commonly Found at Potential Contaminant Sources for SWAP Inventory Efforts" (Appendix I). This table allows contaminants to be easily crossed-referenced or correlated with the common activities in which they are most often associated. It also will

assist in designating future management and protection applications. In addition, potential sources of pathogens (e.g., Cryptosporidium, coliform bacteria, etc.) will be noted.

The identified contaminants and the estimated volume of each being stored on site at each field inspected facility will be listed in the space provided on the PCS Inventory Form adopted by MDEQ (Appendix H). Often the contaminants found may be recognized as common materials (i.e., motor oil, gasoline, solvents, etc.) since the field inspectors may be unfamiliar with some of the regulated contaminants and/or may not be able to determine the actual constituents contained in inventoried substances.

3. Sites of Concern

Field personnel who inspect the designated unregulated sites to identify potential contaminants will complete a PCS Inventory Form for each site within delineated SWPAs. This form facilitates an assessment of material storage and operating practices observed during the field inspection process and allows for the "flagging" of PCS sites where poor management practices and material storage and/or operating concerns are observed (e.g., spillage, uncovered containers, etc.). To ensure consistency and avoid arbitrary determinations every effort will be made to properly train all field inspectors. The identification of these sites of concern are a major factor in the final susceptibility determination of public water supplies and will provide a foundation for future source water protection and management efforts. It is important to recognize that the existence of material storage and/or operating concerns noted at inventoried PCS sites should not be construed as an indication of imminent ground water or surface water problems.

4. PCS Siting Accuracy

Personnel will use Global Positioning System (GPS) technology to locate all field inspected PCS sites (Table 4-3) to within 3 meters of accuracy. The spatial data for PCSs will be entered into the SWAP Geographic Information System (GIS) using established quality assurance and quality control (QA/QC) procedures.

C. Designated PCSs to be Addressed Through Existing GIS Coverages

The deadlines imposed on SWAP implementation and funding constraints preclude the State from conducting field inspections to identify all types of unregulated PCSs. Existing GIS coverages of designated PCSs will be used when available (Table 4-4). The large number of septic systems and abandoned wells in the state is an especially significant challenge in this regard. Although a separate GIS coverage of locations for septic systems

is not available, a coverage of certified sewered areas does exist which will allow important assumptions to be made in regards to the susceptibility of PWSs.

Table 4-4 Designated PCSs Addressed Through Existing GIS Coverages

PCS Type	In Unconfined Aquifer SWPAs	In Confined Aquifer Priority Protection Areas*	In Confined Aquifer SWPAs	In Surface Water Primary Protection Areas
Improperly Plugged & Abandoned Wells	X	X	X	X
Transportation Corridors	X	X		X
Pesticide Application Sites	X	X		X
USTs	X	X		X

* In confined aquifers, Priority Protection Areas will exist only when PWS wells have not met the MSDH minimum design criteria (Appendix M).

4.1.4 Special Considerations

The SWAP strategy was designed ultimately to protect source waters while accurately reflecting the unique hydrogeologic setting and special circumstances that exist in the state. The relative threat to source waters used by PWSs varies according to the natural protection afforded them. Because of these considerations, the PCS inventory activities will be based on the following factors:

(1) Ground water versus surface water PWSs;
(2) Aquifer confinement;
(3) Proximity of identified PCSs to PWS wells and/or surface water intakes; and
(4) Community versus non-community water systems.

A. PWS Wells Screened in Confined Aquifers

Confined aquifers are afforded a significant level of natural protection due to the existence of overlying confining layer(s) usually composed of thick beds of clay. The low hydraulic conductivities and attenuative capacities of these clay layers represent a significant barrier to any contaminants related to surficial activities, even for those in proximity to wells. Because of this protective hydrogeologic setting, the greatest threat facing confined aquifers in the state is the large number of abandoned wells that have not been properly plugged. These wells represent potential conduits for the introduction of contaminants into aquifers, regardless of their confinement. During preliminary inventory activities, lists of potential wells located within SWPAs will be generated using databases maintained by the USGS and MDEQ. However, the large number of wells in these

databases and their unreliable locations precludes any attempt to conduct actual field inspections to locate improperly plugged and abandoned wells during the initial phase of SWAP implementation. Lists of these wells will be included in the susceptibility assessment package made available to PWSs. Systems will be strongly encouraged to initiate "field truthing" efforts to verify these well lists and initiate source water protection measures.

B. PWS Wells Screened in Unconfined Aquifers

Without adequate confinement from overlying clay layers, unconfined aquifers are vulnerable to contamination from spills or other discharges that occur at or near land surface. Because of the inherent vulnerability associated with using unconfined aquifers, the accompanying inventories around wells using these aquifers will be very comprehensive. The designated unregulated facilities and sites found in the delineated SWPAs will be field inspected to identify contaminants and material storage and/or operating concerns and will be accurately located using Global Positioning System (GPS) technology. If any sites of concern are identified, they will be "flagged" accordingly and noted for the susceptibility ranking process.

Although sewer lines represent obvious sources for microbial contaminants in shallow aquifers, they will not be included as significant PCSs. This approach is justified since virtually all of the PWSs in Mississippi already disinfect their finished water supplies. The PWSs that do not disinfect are subjected to a more rigorous sampling schedule than those systems that chlorinate or ozonize. Another consideration is the unavailability of sewer line GIS coverages for most communities.

C. Surface Water Intakes

The vulnerability of surface water bodies to spills and the relatively rapid times of travel associated with these type situations will be addressed by establishing Primary Protection Areas based on 24-hour time of travel as described in Chapter III of this document. Surface water bodies that serve as transportation corridors for barge trafficking or are in proximity to or are crossed by major highways, pipelines, and railroads are especially vulnerable to spills. Existing databases will allow for the compilation of information related to these significant PCSs which can be easily field verified.

The inventory process for the established 1,000 foot buffer zone associated with Primary Protection Areas for surface water intakes will include performing field inspections to identify the occurrence of all significant PCS types and to locate the facilities/sites accurately. In the case of the 250 foot buffers associated with Secondary Protection Areas, the inventory process will concentrate on the identification of non-point sources of

pollution (e.g., agricultural and silvacultural activities, etc.) through existing GIS coverages.

Footnote: MDEQ has held preliminary discussions with the Tennessee Valley Authority (TVA) about initiating a SWAP-related contract to obtain its assistance in addressing the Tennessee-Tombigbee Waterway system (including Pickwick Lake). This contractual agreement would be similar to one already in effect between TVA and the State of Alabama. TVA may be able to assist the State in delineating SWPAs and protection zones, as well as locating PCSs within those areas by using aerial photography.

Footnote: Because of the ongoing development of MDEQ's Basinwide Management Approach, the State's SWAP strategy to address public surface water system intakes may change in order to ensure coordination of effort.

D. Transient/Non-community Water Systems

Transient/non-community water systems are typically small rural systems that furnish moderate supplies of water. These systems do not require the level of detail prescribed for the PCS inventories associated with community water systems to provide adequate protection of their source waters. As a result, PCS inventories for transient/noncommunity water systems will consist of field inspections to identify only septic systems or other sources of nitrates and/or pathogens within the Priority Protection Areas (500 foot radii) delineated around these types of wells (Table 4-3).

CHAPTER V

SUSCEPTIBILITY ANALYSIS

5.0 INTRODUCTION

The final phase of SWAP implementation, assessing the relative susceptibility of PWS wells and surface water intakes to the inventoried potential contaminant sources (PCSs), addresses the program objective mandated by Congress to provide benefit to the systems and their users. The State chose to rank individual PWS wells and surface water intakes; to identify various PCSs; and to focus on material storage and/or operating concerns that would benefit from better management practices. Source water assessments are intended not only to educate the public regarding the relative susceptibility of PWSs but also to motivate stakeholder involvement in developing and implementing source water protection measures. The susceptibility analysis serves as the mechanism to incorporate all of the other SWAP-related components into a ranking that the public can easily understand.

Because most of the ground water used for public water supply in Mississippi is obtained from deep confined aquifers, the State decided to take full advantage of this most favorable position. This strategy is clearly reflected in the approach that MDEQ formulated for determining the susceptibility of PWSs. MDEQ was careful to devise a susceptibility methodology that is very logical and practical for Mississippi, yet possibly quite unique when compared to other states. Realizing that the final susceptibility rankings assigned to the PWS wells and intakes will be highly scrutinized, MDEQ developed an approach that will be meaningful and useful, yet easily understood by the general public.

5.0.1 Definition of Susceptibility

Although there are various definitions of susceptibility and the EPA guidance document allows some flexibility on how states approach this issue, the State selected to be consistent with the definition provided in the 1996 Amendments to the Safe Drinking Water Act (SDWA) which states that the susceptibility process is "to determine the susceptibility of the public water systems in the delineated [Source Water Protection] area to the identified contaminants." In keeping with Congress' enabling legislation and EPA's guidance, the susceptibility analysis methodology adopted by the State focuses on the elements that individually or collectively determine the ability of a public water supply to resist becoming contaminated from the inventoried PCSs. The resulting susceptibility rankings from this process and accompanying data will convey useful information to PWS purveyors and their users.

5.0.2 Linkage to SWAP Potential Contaminant Source Inventory

The susceptibility approach the State adopted is consistent with the stated goal of EPA and Congress for the susceptibility analysis to "be the means for a state to make the inventory useful for decisions regarding source water protection programs and other possible uses." By determining which PWS wells and intakes are most susceptible to contamination, the State can focus its limited resources on addressing those specific systems and the identified significant PCSs of concern. This information will lead to the implementation of source water protection measures designed to reduce the threat posed by the inventoried PCSs. Completing the susceptibility analysis process also will assist the State in determining if there are other PCSs that should be considered significant and whether or not adjustments should be made in the inventory process or methodology.

5.1 ELEMENTS OF SUSCEPTIBILITY

The SDWA and the guidance offered by EPA specified and/or suggested that states address a host of different issues and elements related to the susceptibility of PWSs. While some of the issues raised by EPA were broad and comprehensive, others were very specific. The State has attempted to address and incorporate all of these issues into its susceptibility approach.

5.2 RELATIVE RANKINGS

In order to meet legislative and EPA requirements, the State established a susceptibility ranking scheme which represents a relative comparison of how likely PWS wells and surface water intakes are to being contaminated as a direct result of activities associated with the inventoried PCSs. Based on the relative vulnerability of the wells and intakes and the sensitivity of the areas surrounding these structures, the following three susceptibility rankings will be applied in Mississippi: (1) **higher**, (2) **moderate**, or (3) **lower**. These ranking should not be interpreted as indications that wells and intakes with higher susceptibility rankings are unsafe sources for public water supply. Likewise, it should not be construed that those PWS wells and intakes with lower susceptibility rankings are totally immune from contamination events.

As susceptibility assessments are made available to the public, the PWSs will be allowed to petition the State to have their rankings reconsidered. These requests will be entertained in the event that one of the following scenarios can be demonstrated: (1) management practices have been adopted that address PCSs of concern; (2) there has been a notable change in PSC activities in the SWPAs; or (3) other particular significant changes should be considered (e.g., new wells in deeper aquifers).

5.2.1 Higher Susceptibility Ranking

Those PWS wells and surface water intakes deemed the most susceptible to contamination from the inventoried PCSs located within the corresponding SWPAs will receive a higher susceptibility ranking. This designation is made for specific wells and intakes that have been identified as having a higher than normal potential to be affected by the inventoried PCSs. This means that they are deemed more susceptible than other PWS wells or intakes with a moderate or lower susceptibility ranking. A higher ranking should not be interpreted as an indication of unavoidable contamination or that PWSs are in imminent danger. The inherent nature of surface water bodies will automatically place many of the public surface water intakes in the higher susceptibility category. It is anticipated that most PWS wells screened in unconfined aquifers will receive a higher susceptibility ranking and that only a relatively small number of PWS wells relying on confined aquifers will receive a higher susceptibility ranking.

5.2.2 Moderate Susceptibility Ranking

A moderate susceptibility ranking signifies that specific PWS wells and surface water intakes have an average chance of drawing contaminated water as a direct result of activities associated with the inventoried PCSs. This is a relative ranking that serves as the norm or standard from which all of the other PWS wells and intakes are compared. Because the State has adopted a conservative approach for its susceptibility methodology, it is anticipated that many of the PWS wells and some of the intakes will fall within the moderate susceptibility ranking by default.

5.2.3 Lower Susceptibility Ranking

Lower susceptibility rankings will be designated for PWS wells or intakes where there is only a slight possibility of source waters being adversely affected by contamination from inventoried PCSs. Because of the hydrogeologic setting in Mississippi, many of the PWS wells that use confined aquifers for source water in the state will be ranked in this category as compared to moderate or higher susceptibility rankings.

5.3 PUBLIC GROUND WATER SYSTEM SUSCEPTIBILITY

With the state's dependence on deep confined aquifers for sources of public water supply, ground water contamination events have rarely impacted PWS wells in Mississippi. This situation is primarily a result of the natural protection (confinement) afforded most of the PWS wells operating in the state. However, the unconfined aquifers associated with many of the shallow

PWS wells operating in the state are susceptible to many nearby PCSs that are not being properly managed. The susceptibility approach the State has adopted incorporates hydrogeological, physical, chemical, and management considerations.

5.3.1 Susceptibility Criteria

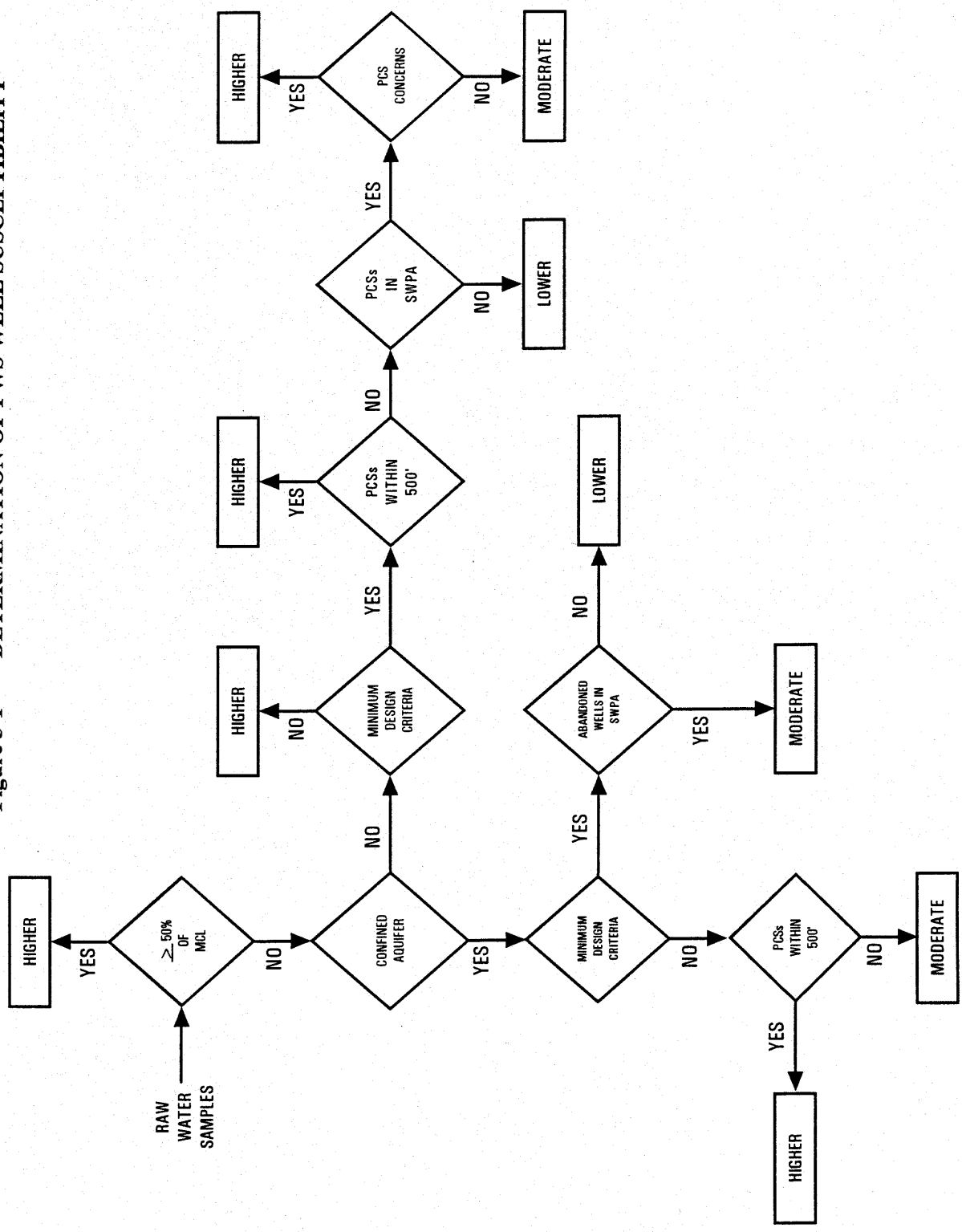
The SWAP susceptibility ranking determination focuses on various elements that either individually or collectively determine the ability of a PWS to resist becoming contaminated by the inventoried PCSs within its delineated SWPAs. To assist in this determination, the State developed a flow chart that illustrates the process of determining the relative susceptibility of PWS wells in Mississippi (Figure 5-1). Some of the information required to answer the questions associated with the flow chart include PCS data on sites that were field inspected; regulated facilities/sites data available from existing databases at MDEQ; hydrogeological data; and well construction information. The susceptibility determination (i.e., higher, moderate, or lower) for ground water systems is based on the criteria listed in Table 5-1.

Table 5-1 Criteria for Determination of PWS Well Susceptibility

1.	**MSDH Detects** -- Concentrations of detected contaminants in raw water samples (≥50% of MCLs or <50% of MCLs).
2.	**Aquifer Confinement** -- Does the source water originate from a confined or unconfined aquifer?
3.	**Minimum Design Criteria** -- Does the PWS well meet MSDH minimum design criteria, including the proper grouting of its annular space?
4.	**PCSs Within 500'** -- Are significant PCS types located within 500 feet of a PWS well?
5.	**PCSs Within SWPA** -- Are designated PCSs located within the delineated SWPA?
6.	**PCS Concerns** -- Do material storage and/or operating concerns (i.e., poor management practices exist at inventoried PCS sites?
7.	**Abandoned Wells** -- Are there any improperly plugged or abandoned wells located in the delineated SWPA?

Criterion #1 allows for chemical and biological vulnerability characteristics to be considered by using available analytical quality data from raw water samples collected by the PWSs and analyzed by the MSDH. Since most contaminant detections in raw water samples are found at very low concentrations, an arbitrary threshold value of ≥50% of the

Figure 5-1 DETERMINATION OF PWS WELL SUSCEPTIBILITY



Maximum Contaminant Level (MCL), as established by EPA for each contaminant, was selected to differentiate a higher level of concern for those contaminants detected. The selection of this value (≥50% of MCLs) is also consistent with past reporting requirements of the Clean Water Act 305(b) report.

Consideration of the hydrologic and hydrogeologic characteristics (aquifer confinement) of the source water aquifers is directly reflected in **Criterion #2**. As discussed in Chapter III, one of the first SWAP-related steps MDEQ initiated was the verification of aquifer confinement for all PWS wells. Appendix G, the Aquifer Confinement Classification Form, contains the hydrologic and hydrogeologic information that was considered in making this determination. The hydrologic and hydrogeologic characteristics are indirectly considered in **Criterion #4** which pertains to the relationship of distance to travel-time of potential contaminant movement and the existence of PCSs within the 500 foot Priority Protection Areas around wells.

Criterion #3 effectively considers the related physical characteristics of whether or not the Mississippi State Department of Health's minimum well design criteria have been met (Appendix M). Two of the more important considerations in including this criterion are the proper grouting of annular space in wells and the assurance that the surface casing in wells extends above the established 100 year flood level. These completion requirements pertain only to community water systems. Unless documentation can be furnished to indicate otherwise, it will be assumed that only those community water system wells drilled after the minimum design criteria became effective on January 1, 1975 have met the intent of the regulations.

Criteria #5 and #6 deal with the identification of PCSs and sites with material storage and/or operating concerns within delineated SWPAs. The existence of improperly abandoned wells in delineated SWPAs is considered in **Criterion #7**.

5.3.2 PWS Well Susceptibility

The PWS well susceptibility flow chart (Figure 5-1) is designed so that the process initiates in the upper left corner of the figure with the analysis of raw water samples collected from PWSs.

A. PWS Wells with Higher Susceptibility Rankings:

(1) Any well with detected contaminants of ≥50% of MCL in raw water samples.

(2) Wells in unconfined aquifers with detected contaminants of <50% of MCL that:
   (a) do not meet MSDH minimum design criteria.
   (b) meet MSDH minimum design criteria but have PCSs located within 500 feet of the well.
   (c) meet MSDH minimum design criteria; do not have any PCSs located within 500 feet of the wells; but have PCSs located within their SWPAs with material storage and/or operating concerns identified during field inspections, ground water remediation projects, and/or verifiable contaminant releases to ground water.

(3) Wells in confined aquifers that do not meet MSDH minimum design criteria and have PCSs located within 500 feet.

B. PWS Wells with Moderate Susceptibility Rankings:

(1) Wells in unconfined aquifers that meet all of the following criteria:
   (a) have detected contaminants of <50% of MCL;
   (b) meet MSDH minimum design criteria;
   (c) do not have PCSs located within 500 feet of the well;
   (d) have PCSs located within its SWPA without material storage and/or operating concerns (field inspected), ground water remediation projects, and/or verifiable contaminant releases to ground water.

(2) Wells in confined aquifers with detected contaminants of <50% of MCL which do not meet MSDH minimum design criteria and do not have PCSs located within 500 feet.

(3) Wells in confined aquifers that meet the following criteria:
   (a) have detected contaminants of <50% of MCL;
   (b) meet MSDH minimum design criteria; but
   (c) have improperly abandoned well(s) located within their SWPAs.

C. PWS Wells with Lower Susceptibility Rankings:

(1) Wells in unconfined aquifers that meet all of the following criteria:
   (a) have detected contaminants of <50% of MCL;
   (b) meet MSDH minimum design criteria;
   (c) do not have PCSs located within 500 feet of the well; and
   (d) do not have any PCSs located within SWPAs.

(2) Wells in confined aquifers that meet all of the following criteria:
   (a) have detected contaminants of <50% of MCL;
   (b) meet MSDH minimum design criteria; and
   (c) do not have any improperly abandoned wells located within their SWPAs.

5.4 PUBLIC SURFACE WATER SYSTEM SUSCEPTIBILITY

The susceptibility assessments for the few public surface water systems operating in Mississippi will be determined in a similar manner as detailed in Section 5.3. The diversity of surface water bodies on which these intakes are located allow for the adoption of an almost site-specific methodology for each diversion point.

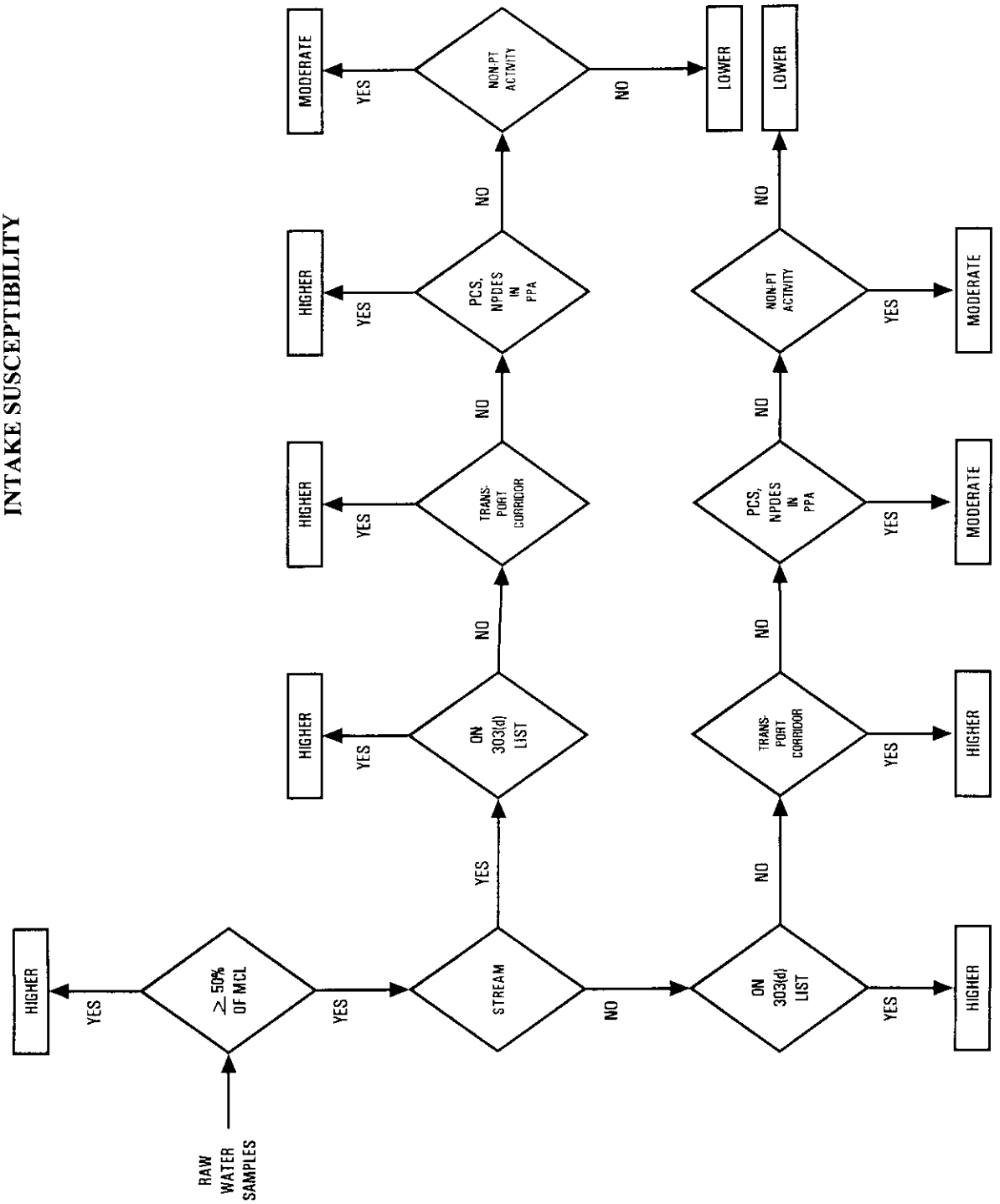
5.4.1 Susceptibility Criteria

Table 5-2 lists the criteria that will be considered in determining the relative susceptibility of PWSs to contamination. These criteria correlate with a flow chart (Figure 5-2) that was developed by MDEQ to expedite the susceptibility determination for surface water intakes used in the state.

Table 5-2 Criteria for Determination of PWS Surface Water Intake Susceptibility	
1.	**MSDH Detects** -- Concentrations of detected contaminants in raw water samples (≥50% of MCL or <50% of MCL).
2.	**Intake in Stream** -- Is the PWS intake located in a stream (i.e., creek, river, etc.) versus a reservoir or lake?
3.	**303(d) List** -- Is the water body included on the Clean Water Act 303(d) list of impaired waters in the state?
4.	**Transportation Corridor** -- Is the water body used for barge trafficking and/or are major highways, pipelines, railroads located within the delineated SWPA?
5.	**PCSs in Primary Protection Areas** -- Are significant PCSs located within the 1,000 foot buffer zone for the area included in the Primary Protection Area (24-hour time of travel)?
6.	**PCS Concerns** -- Were material storage and/or operating concerns (i.e., poor management practices) found to exist at inventoried PCS sites?
7.	**Non-Point Pollution Sources** -- Do non-point sources of pollution (e.g., agricultural and silvacultural activities) exist within the 250 foot buffer zone in the Secondary Protection Area?

The same **Criterion #1** is used to determine the susceptibility for both ground water and surface water PWSs. **Criteria #5 and #6** in Table 5-2 are similar to the ground water

Figure 5-2 DETERMINATION OF PWS SURFACE WATER INTAKE SUSCEPTIBILITY



criteria considered previously that address the occurrence of PCSs within delineated SWPAs and the identification of PCSs with material storage and/or operating concerns.

Surface water bodies with distinct flows (i.e., streams) are susceptible to contamination from releases that may occur upstream of intakes. Unlike reservoirs and large lakes, streams may have limited dilution capacity during low flow events to effectively handle such releases before public surface water system intakes are adversely impacted. **Criterion #2** takes this scenario into account.

Section 303(d) of the Clean Water Act requires states to prepare a list of surface water bodies that do not meet their intended or designated use because of water quality problems. Mississippi's 303(d) list of impaired waters is considered in **Criterion #3** of the table. Since non-point sources of pollution are a primary contributor to the impairment of many of the streams in the state, this factor is considered in **Criterion #7**. However, it is important to note that the surface water quality problems attributed to non-point sources of pollution in the past have been almost exclusively sedimentation issues and have not involved contamination from chemical constituents or pathogens.

Another important consideration in determining the susceptibility of surface water bodies to contamination is whether or not they serve as transportation corridors for barge traffic and other large vessels. The location of major highways, pipelines, and railroads in protection areas also is a consideration, especially if these structures cross surface water bodies used for public water supply. **Criterion #4** considers the occurrence of these PCSs.

5.4.2 PWS Intake Susceptibility

Like Figure 5-1, the flow chart for determining the susceptibility of PWS intakes (Figure 5-2) is designed so that the process initiates in the upper left corner of the figure with the analysis of raw water samples collected from PWSs.

A. PWS Intakes with Higher Susceptibility Rankings:

(1) Any intake with detected contaminants of ≥50% of MCLs in raw water samples.

(2) Intakes in streams with detected contaminants of <50% of MCLs that:
- (a) are on the 303(d) list.
- (b) are not on the 303(d) list but serve as transportation corridors.
- (c) are not on the 303(d) list, do not serve as transportation corridors, but have PCSs and/or NPDES discharges of concern located within Primary Protection Areas.

(3) Intakes in reservoirs or lakes with detected contaminants of <50% of MCLs that:
   (a) are on the 303(d) list.
   (b) are not on the 303(d) list but serve as transportation corridors.

B. PWS Intakes with Moderate Susceptibility Rankings:

(1) Intakes in streams with detected contaminants of <50% of MCLs that meet all the following criteria:
   (a) are not on the 303(d) list;
   (b) do not serve as transportation corridors;
   (c) do not have PCSs or NPDES discharges on concern within Primary Protection Areas; but
   (d) do have non-point pollution source activities occurring in Primary and/or Secondary Protection Areas.

(2) Intakes in reservoirs or lakes with detected contaminants of <50% of MCLs that are not on the 303(d) list or serve as transportation corridors but:
   (a) have PCSs and/or NPDES discharges of concern in Primary Protection Areas.
   (b) do not have PCSs and/or NPDES discharges of concern in Primary Protection Areas and have non-point pollution source activities occurring in Primary and/or Secondary Protection Areas.

C. PWS Intakes with Lower Susceptibility Rankings:

Intakes on any water body that meet all of the following criteria:
   (a) detected contaminants of <50% of MCLs;
   (b) are not on the 303(d) list;
   (c) do not serve as transportation corridors;
   (d) do not have PCS and/or NPDES discharges of concern in Primary Protection Areas; and
   (e) do not have non-point pollution sources activities accruing in Primary and/or Secondary Protection Areas.

5.5 STATE APPROACH VERSUS SDWA/EPA REQUIREMENTS AND SUGGESTIONS

Besides the required SWAP elements in the SDWA, EPA either specified or suggested that states address a number of additional elements in their program plan. Table 5-3 identifies all of those elements, indicates their source of origination, and addresses the State's response to each required, specified and/or suggested component.

TABLE 5-3. COMPARISON OF STATE'S APPROACH TO EPA/SDWA REQUIREMENTS AND SUGGESTIONS

SUSCEPTIBILITY ANALYSIS ELEMENTS SPECIFIED/SUGGESTED BY EPA		STATE'S RESPONSE	
1.	Presence and nature (toxicity) of contaminant -- (*Specified in EPA SWAP guidance & guidance clarifications*)	**a.**	SDWA and SWTR contaminants/related materials will be inventoried during the field inspection process for the designated unregulated PCS types.
		b.	A review of the concentrations of contaminants detected in PWS raw water quality data will be made to establish relative toxicity (≥ 50% of MCL=higher susceptibility).
2.	Establishment of regulatory or nonregulatory controls -- (*Specified in EPA SWAP guidance & guidance clarifications*)	**a.**	Because of the existing regulatory oversight, regulated facilities and sites will not be field inspected. However, these PCSs will be field identified.
		b.	The absence of non-regulatory controls, such as the implementation of best management practices, will be assessed during the field inspection process for the designated unregulated facilities and sites by focusing on material storage and operating concerns.
3.	Potential or likelihood for entry of contaminant into PWS (apparently a surface water application ?) -- (*Specified in EPA SWAP guidance & guidance clarifications*)	**a.**	Material storage and operating concerns will be assessed during the field inspection process for the designated unregulated facilities.
4.	Hydrogeologic characteristics and potential for movement of contaminant into PWS (apparently, a ground water application) -- (*Specified in EPA SWAP guidance & guidance clarifications*)	**a.**	Confining layer and aquifer information assimilated and developed during the aquifer confinement classification process will be a fundamental consideration in the determination of PWS well susceptibility to the inventoried contaminants/materials.
5.	Amount/volume likely to be released to ground water -- (*Included as example in EPA SWAP guidance clarifications*)	**a.**	The amounts/volumes of potential contaminants/materials will be estimated during the field inspection process for the designated unregulated facilities.

6.	Time-of-travel -- (*Included as example in EPA SWAP guidance clarifications*)	**a.**	The boundaries of all ground water SWPAs are based on a 5 year time-of-travel with the exception of the 500 foot radius approach used for transient/non-community water systems. A 24 hour time of travel will be used as the Primary Protection Areas for surface water intakes.
7.	Physical (hydrogeology, distance) -- (*Included in EPA Region IV example presented at December, 1997 SWAP meeting in Murfreesboro, TN*)	**a.**	Confining layer and aquifer information will be assimilated and developed during the aquifer confinement classification process and used for delineation and susceptibility analysis purposes.
		b.	The distances from GPS'd PCS sites to GPS'd PWS wells will be calculated by the SWAP GIS application under development. PCS sites within a 500' radius of PWS wells will be a major consideration in the determination of PWS well susceptibility to the inventoried contaminants/materials.
8.	Site (operation, containment, volume) -- (*Included in EPA Region IV example presented at December, 1997 meeting in Murfreesboro, TN*)	**a.**	Material storage and operating concerns will be assessed during the field inspection process for the designated unregulated facilities. The absence of secondary containment will be considered an operating/material storage concern.
		b.	The amounts/volumes of potential contaminants/materials will be estimated during the field inspection process for the designated unregulated facilities.
9.	Chemical (mobility, toxicity, solubility, degradability, adsorption) -- (*Included in EPA Region IV example presented at December, 1997 meeting in Murfreesboro, TN*)	**a.**	Various chemical properties will be addressed generically through the states approach to use of MSDH raw water quality analytical data. The detection of a contaminant in a raw water sample indicates that it is a mobile chemical. Toxicity will be addressed through detected contaminant concentrations (i.e., ≥ 50% of MCL=higher susceptibility).

10.	MSDH well minimum design standards (Were they met?) -- (*Additional elements under consideration by the State*)	**a.**	A fundamental consideration in the determination of PWS well susceptibility to the inventoried contaminants/materials focuses on whether PWS wells have met the MSDH minimum design standards which were implemented January 1, 1975.
11.	Existence of PCSs within a SWPA -- (*Additional elements under consideration by State*)	**a.**	Since the focus of the susceptibility analysis is the determination of the susceptibility of PWS wells/surface water intakes to inventoried potential contaminant sources, in some rural areas of the state PCSs may not be found within a delineated SWPA. Such wells will be considered to have a lower susceptibility to potential contamination.
12.	Existence of improperly abandoned wells within a SWPA -- (*Additional elements under consideration by State*)	**a.**	In confined aquifer settings, the existence of improperly abandoned wells within a SWPA is a fundamental consideration in the determination of PWS well susceptibility.

CHAPTER VI

MAKING SUSCEPTIBILITY ASSESSMENTS AVAILABLE

6.0 INTRODUCTION

After susceptibility assessment determinations are completed for public water systems (PWSs), the information must be made available to the public. This required Source Water Assessment Program (SWAP) component was emphasized throughout the 1996 Amendments to the Safe Drinking Water Act (SDWA) and also in all of the EPA guidance information furnished to the states. The State has developed a plan that will ensure that the public has several avenues available to access SWAP-related information and that the information will be provided expeditiously.

6.1 SUSCEPTIBILITY ASSESSMENT REPORT

It is the goal of the State to furnish as much useful susceptibility assessment information as possible to the PWSs and the general public in an effective and efficient manner. To accomplish this objective, the State has developed a standard reporting format, the Susceptibility Assessment Report. This standardized report provides a significant amount of useful information related to all of the major elements considered during the susceptibility determination.

6.11 Report Format

The comprehensive report contains water well and surface water intake information, hydrogeologic data, potential contaminant sources (PCSs) inventory information, raw water quality analytical data, and other pertinent information. Additional information includes a map element to identify spatially the locations of Source Water Protection Areas (SWPAs), PWS wells and/or intakes, and PCS sites. The report also lists the susceptibility concerns for each PWS well and/or surface water intake, and contains abundant information that PWS purveyors should find useful for planning and emergency response applications. The standard format used for the Susceptibility Assessment Report is contained in Appendix J of this document.

6.1.2 Report Narrative

There is real concern that the more technical elements contained in the Susceptibility Assessment Reports may not be understandable and/or useful to the general public. To address this concern, the State will include a brief narrative with the report to explain

the more technical information. An appropriate disclaimer regarding the useablility of the information provided in the report will be included in the narrative as well.

6.1.3 Geographic Information System

A Geographic Information System (GIS) application has been developed by MDEQ to assimilate and manage the large amount of information contained in the SWAP database. Numerous query and reselect options have been developed and incorportated into the GIS to provide access to the information in a useful format for as many applications as possible. The generated data can be queried or reselected on the basis of PWSs, counties, multi-counties, aquifers, various sized radial searches, and state-wide coverages. Auto-scale maps with attributes related to this information can be spatially displayed and printed for distribution with the other components of the Susceptibility Assessment Report. Information on these maps includes delineated SWPAs with displayed protection zones, inventoried PCS sites, and other selected base data.

6.1.4 Ancillary Information

Ancillary information for each PWS will be maintained in files located at the offices of the Mississippi Department of Environmental Quality at Southport Center, 2380 Highway 80 West, Jackson, Mississippi. This supplemental information related to the susceptibility assessment will be made available to the public upon request.

6.2 REPORT NOTIFICATION

The MDEQ and the Mississippi State Department of Health/Division of Water Supply (MSDH) will coordinate efforts to ensure the proper notification of PWS purveyors and consumers, the general public, and source water-related State and Federal agencies and programs occurs once the SWAP activities are completed for an entire county.

6.2.1 Public Water Supply Consumers

Public water systems will be required to distribute notices to all customers appraising them of their susceptibility (assessment) rankings after receiving the Susceptibility Assessment Reports from MDEQ. The notification process will most likely be in the form of bill stuffers or letters that the PWSs will include with bills when they are mailed on the month following receipt of their SWAP reports. These notices also will inform customers that the Susceptibility Assessment Reports are available for public viewing. Individual PWSs will be responsible for providing complete copies of the reports to consumers who request to view them.

Another available medium that will be utilized to notify PWS consumers of the completion and availability of susceptibility assessments is the Consumer Confidence Report (CCR). The 1996 Amendment to the SDWA require community water systems to distribute CCRs to notify their customers regarding detections of contaminants in water supplies. In Mississippi, these reports will be prepared by the MSDH and then delivered to the community water systems for distribution to their customers. The MSDH has included a field in the CCRs for the inclusion of susceptibility rankings of each PWS. The CCRs will include information on where copies of the Susceptibility Assessment Reports can be obtained as well.

6.2.2 General Public

MDEQ and MSDH will coordinate the issuance of press releases to the general public targeting the counties in which Susceptibility Assessment Reports have been distributed. The press releases will be targeted for local newspapers, radio stations, and television stations. Notificiation of these releases also will be provided via the internet on appropriate links on home pages maintained by MDEQ and MSDH.

6.2.3 State and Federal Agencies and Programs

As assessments are completed, MDEQ and MSDH will coordinate the effort to notify all State and Federal agencies and programs with known connections to source water-related matters. A master notification list of this effort will be compiled and maintained by MDEQ.

6.3 REPORT AND MAP DISTRIBUTION

In an effort to ensure the broadest and most expeditious distribution of the Susceptibility Assessment Reports to the public as possible, MDEQ will distribute hard copies of the reports to individual PWSs, public libraries, and any interested parties requesting the information. In addition, the State is developing the capability to provide the reports through Internet access.

6.3.1 Distribution to Individual Public Water Systems

Releases of individual Susceptibility Assessment Reports will be made on a random county-wide basis to ensure that all regions of the state are being addressed and to spread out the effort involved in addressing the most populous counties. Upon completion of all source water assessments within a county, the State will promptly distribute the reports (i.e., PCS lists, maps, narrative, etc.) to each PWS. The release and distribution of the completed reports will be coordinated through MDEQ and MSDH.

6.3.2 Internet Access

A. MDEQ and MSDH Home Pages

Susceptibility Assessment Reports will be made available electronically for those who have computer access with compatible hardware and software. This information can be accessed via MDEQ's home page (**http://www.deq.state.ms.us/**) or MSDH's home page (**http.//www.msdh.state.ms.us**).

B. Links with Other State and Federal Agencies and Programs

Attempts will be made to coordinate SWAP and Source Water Protection Program activities with other related agencies and programs. By establishing appropriate links with other home pages, coverages or layers of relevant SWAP information can be made more readily available through the Internet.

6.3.3 Distribution of Hard Copies

It is intended that most of the requests for copies of the Susceptibility Assessment Reports will be handled by the PWSs or by the public accessing the Internet. For those individuals and/or groups without Internet capability, MDEQ and MSDH will make hard copies of the reports available upon request. Hard copies of the Susceptibility Assessment reports also will be supplied to the appropriate municipal and/or county public libraries for public viewing after the assessments are completed for all of the PWS in the corresponding county. This effort will be facilitated through the Mississippi State Library Commission in Jackson.

CHAPTER VII

PROGRAM IMPLEMENTATION

7.0 INTRODUCTION

The timeframe for Source Water Assessment Program (SWAP) development and implementation is dictated by the Safe Drinking Water Act (SDWA) Amendments of 1996. The State has worked closely with members of the SWAP Advisory Committee, various workgroups and agencies, other MDEQ programs, and the Mississippi State Department of Health (MSDH) to develop an effective SWAP that is implementable within the prescribed timeframe. The Environmental Protection Agency (EPA), the Local Governments and Rural Water Improvements Board, and the SWAP Advisory Committee will provide oversight during the implementation process.

7.1 IMPLEMENTATION PROJECTIONS

7.1.1 Projected Work Plan

One of the initial program-related requirements MDEQ faced was developing a projected four-year workplan that would address the development and implementation of SWAP in Mississippi. A workplan was developed that describes the State's sequential approach for completion of all SWAP components by the intended 2001 deadline (Appendix N) and was submitted to the Region IV offices of EPA for review. After MDEQ obtained EPA's approval of the projected four-year workplan and the MSDH received EPA approval of its Intended Use Plan for the Drinking Water State Revolving Fund (DWSRF), MDEQ was able to acquire funding from the DWSRF to pursue development of the State SWAP.

7.1.2 Program Implementation Timeline

The SDWA allows states 2 years to complete SWAP implementation once EPA approves their program plans. Since Congress intended for states to complete implementation of their SWAPs by the 2001 deadline, the State anticipated the need to began addressing elements of program implementation before a comprehensive program strategy was completely devised. This effort began in earnest in early 1998 when MDEQ staff began the process of verifying aquifer confinement for all of the public water system (PWS) wells in Mississippi and developing a SWAP Geographic Information System (GIS). Throughout 1998, other elements related to SWAP implementation were addressed as well, such as the design and adoption of various program forms and researching the availability and usability of data. A comprehensive timeline illustrating the proposed

approach for completing the development and implementation of the State SWAP was included in the projected 4-year workplan and is included Appendix N.

7.1.3 Timeline Extension Request

The SDWA requires State SWAPs to be fully implemented by 2001. However, the legislation allows states to request an eighteen-month extension for completion of SWAP implementation if circumstances warrant the additional time. Although every effort will be made to achieve full implementation of SWAP in Mississippi by the November 7, 2001 deadline, the State is cognizant of the immense task this program poses and the limited amount of time that has been prescribed. Therefore, it appears prudent for the State to formally request the allowed eighteen-month extension with its SWAP plan submittal to EPA. The extension of the program's completion date to May 7, 2003 will allow for maximum coordination of the SWAP approach with the Mississippi Basinwide Approach to Water Quality Management and will ensure the integrity of the program.

7.2 FUNDING RESOURCES

Various funding sources will be tapped to offset the costs of SWAP development and implementation. Among the available funding sources that may be used during SWAP activities are the following:

(1) the Drinking Water State Revolving Fund;
(2) the 106 Ground Water Program grant;
(3) various 319 Program grants; and
(4) miscellaneous Federal grants when available.

7.2.1 Budgets

The annual workplans submitted to EPA list planned SWAP funding sources and project expenditures of program-related activities. Funding sources and projected expenditures for State fiscal year 1998 (SFY-98) are provided in Table 7-1 and for State fiscal year 1999 (SFY-99) in Table 7-2.

Table 7-1 SWAP Funding for SFY-98

Element	SRF	106 GW	319 Grant	Total
Develop SWAP Strategy/Plan	$3,794 (0.015 FTE)	$37,954 (0.58 FTE)	N/A	$41,748 (0.595 FTE)
Aquifer Confinement Verification	$58,236 (0.65 FTE)	$29,383 (0.45 FTE)	N/A	$87,619 (1.125 FTE)

Table 7-1 SWAP Funding for SFY-98				
Element	**SRF**	**106 GW**	**319 Grant**	**Total**
Develop GIS	$1,618 (0.019 FTE)	$3,061 (0.05 FTE)	$67,806 (0.96 FTE)	$72,485 (1.029 FTE)
Contaminant Source Inventory	$1,294 (0.015 FTE)	$10,406 (0.16 FTE)	N/A	$11,700 (0.175 FTE)
Data Management	$2,265 (0.026 FTE)	$20,569 (0.31 FTE)	N/A	$22,834 (0.336 FTE)
TOTAL	$67,207 (0.75 FTE)	$101,373 (1.55 FTE)	$67,806 (0.96 FTE)	$236,386 (3.26 FTE)

FTE = Full-Time Equivalent (Person Years)

Table 7-2. Proposed SWAP Funding for SFY-99					
Element	**SRF**	**106 GW**	**USGS**	**Misc. EPA Grant**	**Total**
Project Administration	$15,435 (0.15 FTE)	$13,535 (0.1125 FTE)	-$0-	-$0-	$28,970 (0.2625 FTE)
Develop SWAP Strategy/Plan	$16,575 (0.1875 FTE)	$52,023 (0.5625 FTE)	-$0-	-$0-	$68,598 (0.75 FTE)
Verify Aquifer Confinement	$75,084 (1.0 FTE)	$9,614 (0.1125 FTE)	-$0-	-$0-	$84,698 (1.1125 FTE)
Develop/ Administer GIS	$41,708 (0.4980 FTE)	$7,790 (0.09 FTE)	-$0-	-$0-	$49,498 (0.5880 FTE)
PCS Inventory	$15,000 (contract)	$8,330 (0.1050 FTE)	$15,000 (contract)	-$0-	$38,330 (0.1050 FTE)
Data Management	$40,180 (1.0820 FTE)	$25,899 (0.5175 FTE)	-$0-	-$0-	$66,079 (1.5995 FTE)
Public Participation	$1,910 (0.02 FTE)	$6,301 (0.075 FTE)	-$0-	$3,000 (contract)	$11,211 (0.095 FTE)
TOTAL	$205,892 (2.9375 FTE)	$123,492 (1.575 FTE)	$15,000 (contract)	$3,000 (contract)	$347,384 (4.5125 FTE)

7.2.2 Future Funding

The State will continue to pursue all available funding sources in an attempt to adequately fund SWAP-related activities while using the available DWSRF set-aside funding. By using the 106 Ground Water Program allocation while pursuing supplemental funding

from 319 Program grants and other miscellaneous Federal grants, the costs of implementing the State SWAP will be shared among several sources. The State intends to correlate some of the SWAP inventory and assessment activities with those associated with MDEQ's basinwide management approach. This arrangement will financially benefit both approaches. Funding appears adequate for the implementation of SWAP during its initial sequence, but real concern remains as to how susceptibility updates will be funded after 2003.

7.3 DELEGATION OF EFFORTS

The MSDH/Division of Water Supply delegated development of the SWAP to MDEQ/Office of Pollution Control. This arrangement exists in the form of a contract between MDEQ and the Local Governments and Rural Water Systems Improvement Board. The Ground Water Planning Branch of MDEQ/OPC is responsible for developing and implementing all of the SWAP elements that were identified in the projected four-year program workplan. Because of the tremendous level of effort that will be required to meet the SWAP-imposed deadlines, some of the related activities may be delegated to third parties beginning in SFY-01.

7.3.1 SWAP Implementation by MDEQ

The staff at MDEQ will lead the implementation effort for the State SWAP to ensure the completion of the program within the prescribed timeframe and to maintain quality assurance/quality control. Initially, all SWAP-related activities and components will be performed directly by MDEQ personnel. The following duties and responsibilities are scheduled to be handled by MDEQ personnel:

(1) Verify the aquifer confinement for all of the public water system (PWS) wells in the state.

(2) Delineate all Source Water Protection Areas (SWPAs) in the state for both public ground water and public surface water systems.

(3) Compile a preliminary inventory of potential contaminant sources (PCSs) within SWPAs prior to field investigations and inventories.

(4) Conduct all field investigations (inventories); complete PCS inventory forms and locate sites/facilities using global positioning system (GPS) equipment.

(5) Enter all program-related data (e.g., aquifer confinement, PCS inventory, etc.) into the SWAP Geographic Information System (GIS).

(6) Perform susceptibility analyses on all PWS wells and surface water intakes.

(7) Prepare susceptibility assessment packets for distribution to PWSs and provide access to the information for public viewing.

(8) Conduct annual meetings of the SWAP Advisory Committee and meet with the Local Governments and Rural Water Systems Improvements Board as needed to provide updates on program implementation.

(9) Coordinate SWAP-related activities with the Mississippi Basinwide Management Approach.

7.3.2 Third Party Involvement

As regular assessments are made to determine the progress being made during SWAP implementation, MDEQ may decide that its limited staff is inadequate to meet the imposed program deadlines. This determination may necessitate subcontracting with private entities or involving other MDEQ programs and divisions to perform some SWAP-related activities. The staff of MDEQ will provide direct oversight over this effort if third parties become involved, and EPA will be notified of the delegation of SWAP activities. Among the duties MDEQ may need to delegate to third parties are the following:

A. PCS Inventory

The staff of the Ground Water Planning Branch may not of sufficient size to perform all of the field inspections, a required element of the State SWAP. Possible alternatives available to remedy this situation include the following:

(1) Utilization of MDEQ personnel from other programs or branches. Advantages to this option are that the field staff at MDEQ is already trained in performing certain types of field investigations and could be easily trained to assist in SWAP inventories. However, financial considerations and conflicting work schedules may prohibit this option.

(2) Outsourcing with a private firm or another governmental entity. Some states have contracted with other firms or groups to obtain assistance in performing the inventory portion of SWAP. For instance, the State of Arizona contracted with a private environmental/engineering firm to perform the PCS inventory within all of the delineated SWPAs in the state. The State of Alabama has contracted with the Tennessee Valley Authority (TVA) for assistance in delineating SWPAs and performing certain inventory components along the

Tennessee River. Although MDEQ has had preliminary discussions with TVA regarding a possible contract, this option remains viable.

B. Making Susceptibility Assessment Reports Available to the Public

Once the susceptibility assessments have been completed for a particular county, all of the PWSs in that county will receive a notice that the State has completed an assessment of the susceptibility of their wells or intakes to contamination. An accompanying packet with the notice will contain the Source Water Assessment Report(s) with all of the appropriate information and maps generated during the SWAP implementation phase. After receiving the assessment packets, it will be the responsibility of the PWSs to notify their customers regarding the availability of the SWAP information for public viewing. Since the MSDH has primacy over the Public Water Supply Supervision Program, it will be necessary to obtain that agency's assistance in ensuring the timely dissemination of the susceptibility assessment notices to PWS customers.

7.4 COORDINATION

7.4.1 Introduction

Implementation of SWAP presents a unique opportunity to address ground water and surface water issues using a comprehensive approach. If the State is to be successful in developing and implementing measures that will culminate in the protection of source water, better communication and coordination of efforts among the various State and Federal programs and agencies involved in water-related issues, public-interest groups, and the citizens of Mississippi are needed. The State intends to continue holding meetings of the SWAP Advisory Committee so that the various stakeholders who represent both technical and citizens' perspectives can have the opportunity to provide input into program implementation. These meetings will allow the State to update the committee on SWAP implementation and will afford the opportunity to reemphasize the importance of maintaining the members' cooperation and involvement with source water assessment and protection activities.

7.4.2 State Involvement

To achieve as much coordination of SWAP-related activities as possible, the State sought input from other groups, programs, and agencies in addition to the Advisory Committee. Among these representatives were other State regulatory and non-regulatory agencies and programs that routinely deal with ground water and surface water quality issues. Many of these programs and divisions operate within MDEQ/Office of Pollution Control such as the Permitting Division, the Compliance and Enforcement Division, the Hazardous Waste

Division, the Non-Hazardous Waste Branch, the Underground Storage Tank Branch, and the Underground Injection Control Program. Other MDEQ divisions that were included in the development process were the Office of Geology's Mining and Reclamation Division and the Office of Land and Water Resources' Permitting Division and Water Resources Division.

7.4.3 Federal Agencies

The direct involvement of the Corps of Engineers in the operation of various surface water bodies in Mississippi necessitates its involvement in SWAP if the program implementation is to be successful. Since the Corps owns the property adjacent to many of the water reservoirs in the state and operates non-community water systems, it will be directly involved in associated inventories and SWAP implementation. The National Park Service also operates non-community water systems in the state and will be involved in SWAP-related activities as well.

Many of the other Federal agencies involved in water-related programs and activities either serve on the SWAP Advisory Committee, the Basinwide Management Approach Team, or both. This involvement ensures that they will be kept abreast of SWAP implementation. Some of these agencies with representation include the Natural Resource Conservation Service, the U.S. Geological Survey, U.S. Forest Service, U.S. Fish and Wildlife Service.

7.4.4 Tribes

The Choctaw Tribe of Mississippi acts as a private entity in Mississippi and does not fall under the regulatory and statutory authority of the State of Mississippi. Nonetheless, the tribe was invited to participate on the SWAP Advisory Committee. As an invited member of the advisory committee, the tribe will continue to receive updates on SWAP development and implementation efforts in the state. EPA has held preliminary discussions with the tribe and has suggested that the State assist in the delineation of the protection areas around the PWS wells on the reservations.

7.4.5 Other States

The State has an amiable working relationship with its bordering states regarding environmental concerns. Because the Tennessee River meanders into Mississippi after exiting the State of Alabama, it is important to work out some type of understanding regarding the operation of the stream that will be mutually beneficial to both states while

enhancing the source water protection efforts. Any such agreement will require the facilitation and assistance the U.S. Army Corps of Engineers and Tennessee Valley Authority.

The State has held previous discussions with the State of Tennessee and officials from the City of Memphis, Tennessee, regarding the protection of the Memphis Sand aquifer which extends into northern Mississippi. It will be important for these discussions to continue if the water quality of this invaluable resource is to be protected and over draft prevention is to be prevented.

The protection of the Southern Hills Regional Aquifer System, a sole source aquifer that includes counties in southwest and west-central Mississippi and parishes in east-central Louisiana, remains a consideration as well. However, the natural protection afforded this aquifer because of overlying beds of confinement and its discontinuous sands will not necessitate the State denoting extra protective measures in the designated area. Some of the proposed construction project plans in the area are reviewed by EPA Region IV to ensure the protection of local ground water resources.

Besides those instances detailed above, there does not appear to be any other ground water or surface water-related issues facing Mississippi and its neighboring states that requires addressing at this time. Preliminary discussions with representatives from Louisiana have not identified any SWAP-related issues of note. The hydrogeologic setting of Mississippi is such that the ground water contribution between Mississippi and the neighboring states of Alabama and Arkansas should not be a factor in the implementation of SWAP. If source water concerns are raised in regards to shared water resources in the future, every effort will be made to mediate a amiable solution.

7.4.6 Local Stakeholders

An important consideration in implementing an effective SWAP will be the inclusion of local stakeholders. The PWS purveyors in the state will be crucial component of this effort. Not only will they be directly involved in the distribution of SWAP information to their customers, but they may be asked to assist in performing the PCS inventories around PWS wells and intakes. Making the SWAP information available to the public (Chapter VI) hopefully will spur the interest and involvement of local stakeholders in future source water protection activities.

Various regions of the state have formed recognized water management districts that have been delegated certain water-related responsibilities. Ensuring the involvement of these quasi-public agencies in the implementation of SWAP and future updates will be paramount if the program is to be successful.

7.4.7 Databases

An important consideration in ensuring coordination of effort among different programs and agencies is the development of databases so that information can be shared and used effectively to enhance source water protection. The implementation of SWAP is dependent upon the accessibility of reliable data from available databases. As the program begins to generate GIS coverages of delineated SWPAs and corresponding PCSs, the information will be made available to all MDEQ programs and divisions and will be furnished to the Mississippi Automated Resource Information System (MARIS), the official state GIS repository and EPA.

7.4.8 Basinwide Management Approach

The inclusion of SWAP-related components was emphasized throughout development of MDEQ's emerging Mississippi Basinwide Management Approach. This representation will continue, thus ensuring the successful coordination of SWAP-related activities with the basinwide approach. The feasibility of adopting the susceptibility assessment updates to the 5-year basinwide cycle is being explored as well.

7.5 REPORTING

When the susceptibility assessments for public ground water and public surface water systems become available, the information will be made available on a county-wide basis to the PWSs and EPA Region IV. As implementation progresses, various SWAP-related updates and reports will be prepared by MDEQ for release to the public and submitted to EPA. The State will continue to prepare annual budget reports and SWAP workplans which will be submitted to EPA and the Local Governments and Rural Water Systems Improvements Board for review and approval. After the delineation and inventory elements of Wellhead Protection Program are modified to reflect the new methodologies adopted with the SWAP approach, the Biennial Wellhead Protection reports MDEQ submits to EPA will provide useful information on the progress both programs are experiencing. The ground water portion of the 305(b) reports MDEQ submits to EPA also can be written to provide relevant information on SWAP progress.

7.6 FUTURE ASSESSMENTS

The compressed timeframe imposed on states to complete development and implementation of their SWAPs requires states to use the best available data that is easily accessible. Because some of the spatial data associated with existing databases in the State is of questionable accuracy, the susceptibility assessments will not be as detailed and informative as they possibly could be if additional time were allowed for improvement of spatial data from other programs. However, this

initial effort is significant and will provide the PWS purveyors and the public with valuable information regarding the relative susceptibility of PWSs.

7.6.1 Database Improvements

The intent of Congress and EPA is for states to continue their SWAP-related activities after the deadlines for program implementation. Hopefully, additional Federal funding will be made available to allow the continuation of the program. As efforts progress during the initial implementation phase of SWAP, problem areas will be noted so that they can be addressed and/or corrected. Probably the biggest factor the State faces if it is to dramatically improve the SWAP process and truly enhance source water protection in Mississippi during the next iteration of SWAP is to address existing database deficiencies. Plans are being developed to pursue improvements to various databases, especially in regards to the accuracy and accessability of data related to regulated facilities and sites in the state. These anticipated improvements should allow for dramatic improvements in content and quality for the subsequent phase of SWAP development and implementation.

7.6.2 Updates

The experience gained by the State in administering the Wellhead Protection Program indicates that activities related to PCS facilities and sites and water usage associated with PWSs are subject to change rapidly. These factors bolster the State's desire to revisit and update all of the susceptibility assessments periodically. One possible method to accomplish such an effort could be to coordinate the SWAP updates with the Basinwide Management Approach, so that all of the PWSs in a particular basin will be updated every 5 years. However, the absence of additional funding could severely limit the ability of the State to address SWAP updates after the available DWSRF set-aside funding is depleted. States will depend on EPA to assist in identifying additional funding mechanisms for SWAP updates and to facilitate the coordination and education of other EPA programs with SWAP objectives.

7.6.3 New Public Water Systems

The MDEQ will coordinate with the MSDH to develop a methodology that will address the completion of required SWAP elements for new PWSs wells and surface water intakes. A notification system will be developed between the agencies so that MDEQ can be apprised of new PWS projects that require SWAP-related attention. Because of the importance placed on SWAP implementation, a goal is to have the completion of all required program elements tied to the issuance of ground water withdrawal and surface water diversion permits by MDEQ's Office of Land and Water Resources.

CHAPTER VIII

SOURCE WATER PROTECTION

8.0 INTRODUCTION

The development and implementation of the State Source Water Assessment Program (SWAP) represent only the initial phase in reaching Congress' intended goal to protect the water resources used for public water supply in the United States. Identifying significant potential contaminant sources that may contribute to the degradation of source waters and educating the public regarding the susceptibility of their public water supplies to contamination are important first steps in reaching the protection goals. However, to complete the protection process and truly realize the intended benefits of SWAP, potential contaminant sources (PCSs) of concern around public water system (PWS) wells and surface water intakes must be properly addressed through the development of local management plans, the adoption of best management practices, and the implementation of other protective measures. All of these efforts will culminate in what is referred to as the Source Water Protection Program (SWPP) which includes aspects of the State Wellhead Protection Program (WHPP).

8.1 WELLHEAD PROTECTION PROGRAM

Amendments to the Safe Drinking Water Act in 1986 mandated that states develop and implement Wellhead Protection Programs to enhance the protection of PWSs. Since gaining approval of its WHPP in September of 1993, the MDEQ has continued to address the protection of vulnerable PWS wells in the state. As initially conceived, the voluntary program was designed as a shared approach between local water systems and MDEQ (Table 8-1).

Table 8-1 Required WHPP Elements & Responsible Parties

Required Elements	Responsible Party
Form local advisory committees	PWSs & MDEQ
Delineate Wellhead Protection Areas	MDEQ
Inventory for PCSs	PWSs with MDEQ guidance
Develop local management plans	PWSs with MDEQ guidance
Develop local contingency plans	PWSs with MDEQ guidance

MDEQ intends to continue maintaining an active role in all of the wellhead protection activities related to program implementation. The delineation of all WHPAs in the state and the coordination and facilitation of PCS inventories will still be handled by MDEQ. The agency intends to remain involved to some degree with the other required program elements in more of a support role in the future. The involvement of the Mississippi State Department of Health (MSDH) in dealing with the adoption of management and contingency plans is essential to the success of WHPP.

Efforts to implement WHPP in Mississippi have met with limited success due to the general lack of local public support. Although some shallow wells used for public water supply have been addressed and local management plans have been adopted to enhance their protection, the number of PWSs participating in the voluntary program has been disappointing. The poor participation in the program can be attributed to two important factors: (1) the low number of contamination events associated with PWSs in the state; and (2) the voluntary nature of the State WHPP. Both of these factors most likely will continue to limit the success of program implementation. Another challenge facing the program is the identification of alternative methods to effectively manage PCSs other than the imposition of controversial land-use restrictions.

8.1.1 Program Modification

From the list of required program elements, it is apparent that the basic approach Congress and EPA adopted for SWAP was derived from the WHPP. However, certain elements of the voluntary State WHPP, as originally envisioned, do not lend themselves to the rigorous program deadlines mandated by SWAP. In pursuing new methodologies to address the inventory of PCSs and the delineation of protection areas, MDEQ devised new strategies and concepts for SWAP that will improve the effectiveness and efficiency of the WHPP. To ensure the consistency of these two elements between both programs, the State WHPP will be modified to include the delineation and inventory methodologies adopted for SWAP. A formal request to EPA for modification of the WHPP will be made prior to the State receiving approval of its SWAP plan.

8.1.2 Mississippi Rural Water Association

For the past several years, a ground water technician with the Mississippi Rural Water Association (MRWA) has been assisting MDEQ in the development of local wellhead protection management plans in the state. Funding for the technician is provided through a grant agreement between the National Rural Water Association and EPA.

The agreement specifies that the technician complete a certain number of wellhead protection projects each year. This effort specifically has included inventorying within

delineated WHPAs and developing local plans which address the management of identified PCSs.

With the limited staff available to address all of the required elements for both SWAP and WHPP, the responsibilities of the two programs may need to be delegated to some extent in the future. For now, MDEQ personnel will continue to delineate the protection areas around all PWS wells and to provide preliminary PCS inventory data. The proposed modification of the WHPP, so that it will coincide with SWAP, will greatly simplify completing the delineation and inventory components. The MRWA will be encouraged to concentrate its efforts exclusively on the development and completion of local wellhead protection management plans for PWSs in the state. MDEQ will focus its efforts on the completion of all remaining SWAP-related activities within the prescribed timeframe and will attempt to improve its coordination with MRWA in hopes of realizing the management objective of the WHPP. This delegation of responsibility and effort will allow progress to continue on implementing both SWAP and WHPP.

8.2 SOURCE WATER PROTECTION PROGRAM

The SWPP elements include the development and implementation of management plans that address PCSs identified within the delineated protection areas around PWS wells and surface water intakes as well as the development of contingency plans which address the handling of emergency situations that may arise. The work that will be performed by the MRWA in the development and implementation of local Wellhead Protection management plans by the MRWA is an important element in addressing the SWPP requirements. However, because the agreement with EPA does not require MRWA to develop contingency plans, the MRWA-selected PWSs will need to be revisited at some point to address this remaining program element. Management and contingency plans for the public surface water systems in the state will be handled by MDEQ after their susceptibility assessments are completed during SWAP.

8.2.1 Local Involvement and Education

During implementation of the voluntary WHPP, one of the few avenues that has been available to address the management of PCSs is public education. It is anticipated that the release of the SWAP susceptibility assessments not only will educate the public regarding source water but also will spur interest in addressing any identified potential problems and concerns at a local level. During the implementation phase of SWAP, the State will make a concerted effort to develop or purchase additional educational materials and techniques that will enhance the overall knowledge of Mississippians regarding the protection of their source waters. It will be important to coordinate these undertakings with the drinking water-related programs in the state (e.g., MSDH, MRWA, Mississippi Water Pollution

Control Operators Association, etc.) so that duplication of effort can be avoided and the information can be efficiently distributed.

The experience gained during development and implementation of the State WHPP clearly shows the importance of getting local participants involved in water resources protection and the need for public education. Because of it voluntary nature, grassroots involvement and public education are key elements that will remain critical components if effective management practices are to be adopted which address potential problems.

8.2.2 MDEQ Databases

When SWAP implementation actually begins, a large volume of valuable information related to source water protection will become available to the water-quality programs administered by MDEQ and other State and Federal programs. The potential exists for these water-quality programs to have an important role in SWAP. For instance, when the delineated protection areas and the susceptibility of PWS wells and surface water intakes in the state are made available to the various regulatory programs at MDEQ, the information should prove useful in making various permitting and compliance decisions and should lessen the possibility of source water degradation in vulnerable areas. As MDEQ continues to develop new databases and GIS applications and improves the accuracy of spatial components in existing databases, a comprehensive approach to address source water protection in the state should result.

8.2.3 Considerations

There are a number of important SWPP-related issues that remain unresolved at the time of SWAP plan submittal. Among the biggest unresolved issues is exactly what role the MSDH (with primacy over the Public Water Supply Supervision Program) will eventually play in the implementing source water protection elements for the PWSs in the state. Unlike the primacy agency, MDEQ has no regulatory or statutory authority over PWSs that could be used to spur development and implementation of management and contingency plans. This situation means that MDEQ may be relegated to a support and/or facilitator role during SWPP implementation.

Another major consideration is the unavailability of necessary funding to accomplish SWPP goals. Until funding for SWPP implementation is addressed at the Federal level, the State will not have the necessary resources to actively pursue the program objectives.

APPENDIX A

ESSENTIAL PROGRAM ELEMENT INDEX: STATE SWAP REVIEW PROTOCOLS (Final Version - June 3, 1998)

Use of these Protocols/Essential Program Element Index

The use of these protocols, developed by EPA, as an essential program element index should assist EPA during its review of the State's Source Water Assessment and Protection Program submittal. The protocols outline information from the statutory language of SDWA 1996, EPA's August 1997 Final Guidance for State Source Water Assessment and Protection Programs (SWAPs), and a few review items derived from information and exchanges with States and others encountered after EPA issued its Guidance. These are the elements of a SWAP that EPA deems essential for a complete and adequate State SWAP submittal.

How to Read These Protocols/Essential Program Element Index

The accompanying protocols are arranged under "Essential Program Elements" (Column 1) of a State SWAP submittal. These include Public Participation, State Approach, Making the Assessments Available to the Public, and Program Implementation. These four elements track those found in Chapter 2 of EPA's Guidance which addressed SWAPs. An additional fifth element is included for evaluating State Source Water Protection Programs. Nearly all review items found under the first four elements reflect the requirements laid out in EPA's 1997 Guidance. The exception is five additional review items which are italicized within the protocols. The location within the document of the State's response to each essential program element is referenced by section and page in the columns to the right.

How to Interpret the Protocols

"Essential Program Elements" (Column 1) include a detailed list of program descriptions which EPA will be looking for in the State SWAP submittal to ensure that it is complete and adequately meets the goals and purpose of a SWAP, i.e., for the protection and benefit of Public Water Supply Systems. Under Column 2, examples or explanations are given for specific items EPA reviewers will be looking for as they review these program descriptions. Items under both headings were developed from both the explicit statutory language of SDWA 1996 as amended (**"must do's", indicated in bold type**), and from additional elements deemed essential under EPA's August 1997 Guidance for the development of Source Water Assessment and Protection Programs (e.g., "needs to's", indicated in plain type). Post-Guidance "needs to's" (e.g., those developed after August 1997) are denoted by *italicized type*. While both the

"must do's" and "needs to's" are mandatory for EPA approval, in the case of the "needs to's", a State has the option of pursuing an alternative approach if the selected approach meets the same functional objective as the stated element.

Essential Program Elements	How EPA Will Evaluate Element	Location In Document	
		Section/ Appendix	Page
A. Public Participation	**The Reviewer will be looking for:**		
1) Describe the procedures established and used by the State (including but not limited to convening citizen's and technical advisory committees and notice of public hearings) to encourage public participation to the maximum extent possible in the development of the State's SWAP program. (SDWA 1428 (b))	- A record of meetings by the Advisory Committee(s)	Sec. 2.1 Tbl. 2-2 App. B	2-1 2-4 B-4
	- If the State is relying on previous advisory committee efforts, at least one meeting of each advisory committee that specifically recommends previous committee work is adequate needs to occur (See Appendix)	N/A	N/A
2) Describe how the State provided adequate opportunity for diverse interest groups to participate on the advisory committee(s)	- Whether the types of groups outlined in EPA's Guidance were given adequate opportunity to participate on the committees.	Tbl. 2-1 App. B	2-1 B-1
	- If only one committee is used, assurances that both citizen and technical points of view were adequately represented.	Sec. 2.1.1, 2.2	2-3, 2-5
3) Describe the key issues raised by the advisory committee(s) and their advice to the State.	The extent to which key issues, such as those raised in EPA's Guidance (Chapter 2), were addressed by the committee(s).	Tbl. 2-2 App. C	2-4 C-1
	If the State is relying on previous advisory committee efforts (e.g., WHP Program development), indications that previous efforts addressed these same issues.	N/A	N/A
	- A general idea that the committee was convened in an open forum and that their issues were adequately addressed, either in detail or by examples from the submittal that reflect the State's decision on each issue.	App. C	C-1
4) Describe how the State encouraged wide public participation to the maximum extent possible.	- Prior to dissemination of invitations and basic information for outreach efforts (See Section D; Program Implementation).	Sec. 2.3 App. E	2-5 E-1
5) Include a responsiveness summary showing public comments and how they were addressed in the submittal.	- Meaningful and substantial opportunities for all interested parties to be informed of the program and provide detailed comments.	App. D	D-1

Essential Program Elements	How EPA Will Evaluate Element	Location In Document	
		Section/ Appendix	Page
B. State Approach	**The Reviewer will be looking for:**		
1) Describe an overall approach and philosophy for conducting source water assessments (EPA Guidance 2-8 Section (b) paragraph (2) that explains how the State assessments will ultimately provide for "the protection and benefit of the public water system" (SDWA 1453 (a)(1)).			
a) Describe the State's definition of susceptibility; how it will be determined, and used in protection efforts.	- How feasible/credible is State's approach for assessments in providing for the protection and benefit of PWSs?	Sec. 5.0	5-1, 5-2
	- Does the State's susceptibility determination provide a synthesis of the information that is understandable to citizens and useful to decision makers?	Sec. 5.0, 5.2, 6.1	5-1, 5-2, 6-1
b) Describe what level of exactness and detail that assessments will achieve;	- Does the level of detail provide for such susceptibility determinations?	Sec. 5.3, 5.4	5-3, 5-8
c) Describe how the assessments will be linked to ongoing or future assessment and protection efforts;	- Will the assessments be linked with existing or future assessments and protection programs such as WHP?	Sec. 7.6, 8.1	7-9, 8-1
d) If the State is using a differential assessment approach (See Guidance for definition & examples), describe a rationale for it and how it will be applied [EPA Guidance 2-8, Section B, paragraph (2)];	- How types, sizes, current monitoring or hydrogeologic sensitivity data support the State's differential approach?	Sec. 5.3, 5.5 Tbl 5-3	5-3, 5-11 5-12
e) Whether area-wide assessments will be used and how the State plans to conduct them [EPA Guidance 2-12, Section (3), paragraph (1)];	- Any area-wide approach is based on broad, overriding, uniform conditions or situations that allow for fairly simple susceptibility determinations (See Appendix).	Sec. 3.1.4	3-2
	Is the approach likely to generate assessments that will provide for the protection and benefit of PWSs?	Sec. 4.1 Ch. V, VIII	4-1 5-1, 8-1
2. Describe the State's initial review of information and programs already available that could support the State's approach.	- The completeness of the State's review and if the available programs and information support the State's approach.	Sec. 4.1.1, 4.1.2	4-3 4-4

Essential Program Elements	How EPA Will Evaluate Element	Location In Document	
		Section/ Appendix	Page
B. State Approach (Continued)	**The Reviewer will be looking for:**		
3. Describe the delineation approach to be used for all types of public water supplies (SDWA 1453(a)(2)(A); EPA Guidance 2-13 Section (3)(a)), including:	- Separate descriptions as necessary for GW systems (confined, unconfined, CWS, NTCWS, TNCWS) and surface water systems (Great Lakes intakes, large rivers and lakes, inland lakes, etc.).	Sec. 3.1, 3.2 App. C	3-1, 3-9 C-1
a) Describe how the delineation approach for ground water systems compares with EPA's approved WHP delineation approach. (SDWA 1453(a)(2)(A); EPA Guidance 2-13 Section (3)(a).	- A delineation method already in use in an EPA-approved State WHP program , or, for States without an EPA-approved WHPP, a functionally-equivalent method that satisfies EPA 1987 WHPP delineation Guidance requirements; or an approach to delineation that is at least as protective as the EPA-approved WHPP approach for GW delineations.	Sec. 3.1 App. F	3-1 F-1
- Describe how recharge areas not adjacent to or surrounding the well will be delineated (EPA Guidance 2-13 Section (a) paragraph 2).	- Delineations of non-adjacent recharge areas that would have otherwise been included in a WHPA's TOT (or equivalent) delineation (See Appendix).	Sec 3.1.2	3-1
	- Rationale for decision as to where remote recharge areas will be included/excluded. If included, describe the method and rationale.	Sec. 3.1.2	3-1
- Describe how the State will perform assessments for PWSs which use source waters originating from outside the State and how the State exerted or will exert practical efforts to facilitate coordination among adjoining States, Tribes, etc. [EPA Guidance 2-20, Section (4)(a) para (2)].	- The extent to which assessments will be coordinated with neighboring States or Tribes and how the State plans to do this (e.g., written agreements, meetings, etc.)	Sec. 7.4.4 Sec. 7.4.5	7-7 7-7
b) Describe how the delineation of source water areas for surface water systems will be done.	- The delineations for a surface water system to include the entire watershed upstream of the intake/ diversion (up to a State's border; e.g., EPA can help facilitate needed cross-border discussions)	Sec. 3.2	3-9
c) Describe how the State will determine where conjunctive delineations are necessary and how these conjunctive delineations will be established.	- A plausible approach to how the State will determine hydraulic connection to a well	Sec. 3.1.3 Sec. 3.1.4.C	3-2 3-8

Essential Program Elements	How EPA Will Evaluate Element	Location In Document	
		Section/ Appendix	Page
B. State Approach (Continued)	**The Reviewer will be looking for:**		
3.c (Continued)	- A plausible approach to when a State will include or exclude watersheds for any waters that are known or suspected of being hydraulically connected to a well (including wells under the direct influence of surface water). The decision to exclude hydraulically connected surface waters must include a justification based on historical significance to water quality and the likelihood that surface water would be a source of contamination.	Sec. 3.1.3 Sec. 3.1.4.C	3-2 3-8
	- Where hydraulic connection of SW to a well is significant, the watershed for that surface water should be included in the SWPA delineation for the well. Watershed segmenting for inventory and assessment is allowed as it is for all SW watersheds.	N/A	N/A
4) Describe what will constitute a contaminant source identification and how this will be done [SDWA 1453(a)(2)(b)], including:	The extent the source inventory will identify sources, contaminants, general vs. exact locations, prioritization schemes, and methods such as database searches, GIS maps, etc.	Ch. IV	4-1
- The contaminant(s) of concern; - What constitutes a significant potential source.	- Whether sources of all regulated contaminants are considered [EPA Guidance, 2-15 (b), paragraph (3)].	Sec. 4.1 App. H, I	4-3 H-1, I-1
	- Whether sources of State-identified contaminants are considered [EPA Guidance, 2-15 (b) paragraph (3)].	Sec. 4.1.2, 4.1.3 App. I	4-4 4-4 I-1
	- A credible approach for determining significant sources.	Sec. 4.1.3	4-4
	- How well the inventory approach adequately addresses all of the State's "significant" sources.	Sec. 4.1	4-3
- If a State segments SWPAs based on surface water, describe the rationale used and how significant sources will be defined in each segment based on this rationale [EPA Guidance 2-16, last paragraph].	- A credible scientific and programmatic basis to any planned water-segmenting policy for the differential identification and assessment of significant sources.	Sec. 4.1.4	4-8

Essential Program Elements	How EPA Will Evaluate Element	Location In Document	
		Section/ Appendix	Page
B. State Approach (Continued)	**The Reviewer will be looking for:**		
5) Describe what will constitute a susceptibility determination [SDWA 1453(a)(2)(B)], including:	- How consistent the State's definition is with EPA's definition and if it supports any planned protection efforts by the State?	Sec. 5.0.1	5-1
a) the State's definition of a susceptibility determination [EPA Guidance 2-18, Section (c)].	How well the components of a susceptibility determination meet the requirements of EPA's Guidance (e.g., is it a synthesis of the factors described in the Guidance?)?	Sec. 5.3.1 Sec. 5.4.1	5-4 5-8
	Will there be a ranking, rating, or "narrowing down" of potential sources of contamination? (See Appendix)?	Sec. 4.1.3.A	4-5
b) the criteria the State will use to make a susceptibility determination in each SWPA relative to significant potential sources of contamination.	- Consideration of physical, biological, chemical, hydrologic and hydrogeologic characteristics and nature of the GW/SW interaction of the setting.	Sec. 5.3 Sec. 5.4 Sec. 5.5 Tbl. 5-1, 5-2	5-3 5-8 5-11 5-4, 5-8
	- Consideration of the location, amount, likelihood of release, and effectiveness of mitigation measures for significant potential sources of contamination.	Same as above	Same as above
	- Consideration of well/intake integrity.	Sec. 5.3, 5.4	5-3, 5-8
C. Making the Assessment Available to the Public			
1) Describe how and when the results of the assessments will be made available to the public [SDWA 1453(a)(7)].			
- Describe what steps will be taken to assure how each assessment will be made understandable to the public [EPA Guidance 2-21 Section (1) paragraph 1].	- Consideration of audiences and any special multilingual, visual, and audio presentation needs.	Sec. 6.1.2	6-1

Essential Program Elements	How EPA Will Evaluate Element	Location In Document	
		Section/ Appendix	Page
C. Making the Assessment Available to the Public (Continued)	**The Reviewer will be looking for:**		
- Describe how the State will use an effective array of means to assure that the results of the assessments will be made widely available to the public [EPA Guidance 2-22 Section (2) paragraph 1].	- An active schedule (specific or generic) and feasible formats and vehicles (e.g., newspapers; meetings, TV; etc.) that will cause the expeditious dissemination of the results of the assessments within the 2 or 3.5 year time frame for completion of all assessments.	Sec. 6.2	6-2
	- Public availability of maps that show the delineated areas and descriptions of sources inventoried, and susceptibility determinations.	Sec. 6.3	6-3
- Describe who will be responsible for getting the information out to the public and within what time frame [EPA Guidance 2-21 Section C paragraph 1].	- A feasible plan that describes the persons, agency, or organization charged with this task.	Sec. 6.2, 6.3	6-2, 6-3
2) Describe how and when all pertinent supporting information from the assessments (in addition to the final result) will be made available to the public when requested [EPA Guidance 2-21 Section C, paragraph 1].	- A sufficient approach for informing the public of the existence and availability of ancillary information from the assessments, and for providing that information when requested by the public.	Sec. 6.1.4	6-2
D. Program Implementation			
1) Describe the timeline the State proposes for completing the SWAP within the prescribed 2-year period (or, if the State requests and is granted an extension; 3 ½ years) after EPA approves the State's program [SDWA 1453 (a)(3)].	- A sequential approach for the completion of appropriate steps in the SWAP (e.g., delineation of SWPAs, completion of source ID's and susceptibility determination, and release of the results to the public).	Sec. 1.2.6 Sec. 7.1 App. N	1-3 7-1 N-1
a) In the event a State requests an extension of the timeline for submission of a SWAP beyond the prescribed 2-year period, give rationale for the request [SDWA 1453 (a)(4)].	- Justification for the request based on individual State needs or constraints in completing the SWAP (resources, etc.).	7.1.3	7-2
2) Describe resources the State plans to allocate to the SWAP, including from the DWSRF, CWSRF, other Federal funds, State resources, and any other resources.	- The resources being allocated to the State's SWAP effort are sufficient to meet objectives and deadlines.	Sec. 7-2 App. N	7-2 N-1

Essential Program Elements	How EPA Will Evaluate Element	Location In Document	
		Section/ Appendix	Page
D. Program Implementation (continued)	**The Reviewer will be looking for:**		
3) Describe the extent to which any portion of the SWAP will be delegated, including how; to whom; what aspects of the SWAP are to be delegated; financial and resource capacity of the delegated entities, and the feasibility of completion of the delegated portions of the SWAP by the designated entities.	- A feasible rationale for those portions of the SWAP delegated.	Sec. 7-3	7-4
a) If susceptibility determinations are delegated to another entity, describe how the State will ensure that the determinations will be made using the State's criteria for conducting susceptibility determinations by the final deadline for SWAP implementation [EPA Guidance 2-8 Section (b); 2-16].	- State approach for monitoring progress of delegated entities and process for identifying and resolving delegation problems.	Sec. 7.3, 7.4	7-4, 7-6
4) Describe how the State will coordinate with other State environmental programs, tribes, local stakeholders, and federal agencies.	- Efficiency through working in partnerships with these stakeholders.	Sec. 7.4	7-6
5) Describe how the State will periodically report progress in SWAP development and implementation to EPA [EPA Guidance 2-27 Section (5)].	- Do the priorities and timetables make sense and lead to completion of all PWS assessments by the SDWA deadline?	Sec. 7.5	7-9
- Describe the State's priorities and time frames for completion of assessments by (for example) size or type (e.g., community vs. non-community) systems or systems or types of source waters (e.g., ground vs. surface waters).	- Does the State plan to report on the measures described in EPA's Guidance and will the reports be capable of showing emerging problems as well as progress?	Sec. 7.5	7-9
	- Does State indicate reporting mechanisms such as the WHP Biennial Report, SDWIS, or other reporting vehicles?	Sec. 7.5	7-9
6) Describe if, how, and when the State will update its assessments to better align with emerging regulatory flexibilities.	- Reasonable efforts by the State to keep assessment efforts aligned with emerging regulatory flexibilities.	Sec. 7.6	7-9
	- How EPA can assist the State with their proposed updating approach	Sec. 7.6.2	7-10

Essential Program Elements	How EPA Will Evaluate Element	Location In Document	
		Section/ Appendix	Page
E. Source Water Protection Programs Given the significant number of States that currently support and actively intend to pursue SWP Programs either in phase with assessments or as a follow-up to the assessment process, EPA reviewers will be looking for a description of the linkages between completed assessments and future SWP efforts as an essential element of the program submittal. At a minimum, the reviewer will be looking for a commitment on the State's part to use the assessments in active protection programs [SDWA 1453(1)].	- Needed changes to timelines or implementation phases in a State's WHPP or Watershed Protection Program. (Or in the case of States without EPA-approved WHPPs, indications that a formal WHPP is planned as an integral part of the State's Source Water Protection Program).	Sec. 8.1	8-1

APPENDIX B

MISSISSIPPI SWAP ADVISORY COMMITTEE & DELINEATION WORKGROUPS

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SWAP ADVISORY COMMITTEE

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Participants	**5/5/98**	**6/11/98**	**8/13/98**	**9/30/98**	**12/3/98**	**1/21/99**
Bill Wall David Mitchell (MSDH)	X X	X X	X X	X X	X X	X X
Katetra Newman Donnie Garris Pete Boone (MRWA)	X		X	X X	X	 X X
Ken Griffin	X	X				
Jim Maher	X					
Lon Strong Homer Wilkes (NRCS)	X X	X		X	X	
Rusty Crowe	X	X	X	X	X	X
Jimmy Bonner	X	X	X		X	X
Todd Freeman	X					
Jerry Hill	X					
Jake Scott	X					X
Paul Tchounwou	X	X	X	X	X	
Chip Morgan	X					
Gala Goldsmith	X			X		
Joel Yelverton			X	X		
Mark Leggett		X				
Linda Golladay		X	X	X	X	X
Guynell Duncan			X	X		
Lincoln Warren		X	X	X		
Deborah Dawkins			X			
Mark Gilbert			X			

Role of Attendees (continued)						
Participants	**5/5/98**	**6/11/98**	**8/13/98**	**9/30/98**	**12/3/98**	**1/21/99**
Mary Currier Bruce Brackin Bob Hotchkiss (MSDH)		X	X		X X	
Lydia Strayer			X			
Lisa Ivshin		X	X	X	X	
Jeanie Smith			X			
Jerry Wilkinson		X	X	X		
Donna Yowell				X		
Deidre McGowan						
Eugene Bryant						
Charles Matthews						
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APPENDIX C

REQUIRED ISSUES FOR SWAP ADVISORY COMMITTEE

I. PUBLIC PARTICIPATION (TABLE 1)

EPA requires the SWAP Advisory Committee to address various prescribed issues that are contained within six tables in the SWAP guidance document. The important issue of public participation (pages 2-3 of the SWAP guidance document) was addressed during the June 11, 1998 SWAP Advisory Committee meeting. Following each question listed in the table is the state's initial approach to addressing it (presented as italicized), which is pursued by comments from the Advisory Committee members and then the ensuing State's response to those comments (presented as italicized).

1. Should the state do more to provide adequate opportunity for stakeholder groups to participate in development of the program? If so, how?

State's approach:

The State intends to follow EPA guidance in addressing the issue of public participation. EPA requires states to provide meaningful and substantial opportunities for all interested parties to comment on SWAP proposals. This includes the SWAP Advisory Committee, as well as future public hearings. The role of the Advisory Committee is to generate advice on the key issues contained in the six tables that are a part of the SWAP guidance document. EPA guidance allows flexibility on the number of public hearings, locations, and formats; however, states are required to hold more than one hearing. The preparation of a responsive summary addressing the advice generated by the Advisory Committee and significant public comments and opinions generated through the public hearing process is required.

States must meet the Safe Drinking Water Act's requirement to encourage public participation "to the maximum extent possible" by making a good faith effort to provide meaningful and realistic opportunities for public input into SWAP development. A considerable effort was undertaken by the State to ensure that broad coverage of stakeholder groups were represented on the SWAP Advisory Committee. As part of the public access element of SWAP development, further effort will be undertaken to identify additional stakeholder groups that may be potentially impacted by the SWAP; this will ensure that their input can be included in program development as well. After draft copies of the SWAP plan are prepared with direct input from the SWAP Advisory

Committee, copies of the document will be distributed to representatives of those other stakeholder groups to seek written comments on the draft proposal. All written comments that are received will then be addressed by SWAP staff and the Advisory Committee during final document preparation.

The State has applied for grant funds to develop a SWAP website that will link to MDEQ's or MSDH's home page. It is anticipated that the website will be used to advertise future meetings, educational events, and hearings; address comments; and distribute draft copies of the SWAP plan and other information.

Advisory Committee comments/questions:

(1) A suggestion was made to include the results of the susceptibility assessments on the home pages of both the MDEQ and the MSDH/DWS.

State's response:

The results of the susceptibility assessments will be included as links on both the MDEQ and the MSDH/DWS home pages.

2. Should the state do more to receive recommendations from both technical and citizen's perspectives?

State's approach:

SWAP personnel have sought out experienced technical expertise to serve on two work groups that will address highly technical delineation issues for ground and surface water sources. The delineation work groups include personnel from the State agencies that address ground and surface water quantity resource issues (Office of Land & Water Resources) and surface and ground water quality issues (Office of Pollution Control). Other participants in the work groups included the federal agency that addresses water resources in the state (U.S. Geological Survey) and academia that specializes in hydrology and soil science (Mississippi State University and Alcorn State University). Recommendations from the SWPA work groups will be presented to the SWAP Advisory Committee.

In an effort to address both technical issues and citizens perspectives, participants on the SWAP Advisory Committee include stakeholders which represent both technical and citizens' perspectives. The State was careful to follow EPA guidance regarding recommended participants for the SWAP Advisory Committee. During the process of

assimilating the SWAP Advisory Committee, the state coordinated with EPA Region IV personnel in an effort to ensure that the SWAP Advisory Committee met EPA's approval.

The extra effort described by the State to seek out additional stakeholders for written comments on the SWAP draft document will include stakeholders representing both technical and citizens' perspectives. In addition, the State intends to follow EPA guidance that requires public hearings to be held in different areas of the State in an effort to broaden public access and input.

Advisory Committee comments/questions:

No comments were received.

3. What should the state do for ongoing public participation in implementing assessments once the State's SWAP is approved?

State's approach:

It is the intent of the state to continue the public participation process by continuing its relationship with the SWAP Advisory Committee after receiving program approval. However, it will be necessary to change the committee's role to one of implementation oversight of the program at that time. This role will probably occur as annual meetings when the Advisory Committee will review program status and general performance to ensure that program goals and time line requirements are being met.

It is anticipated that when the SWAP website is developed, it can be used to distribute SWPA delineations, water quality analytical data from PWS wells, PCS inventory information, and results of the susceptibility analyses. In addition, the state will continue to address public participation through SWAP educational presentations throughout the state using a variety of forums to reach as broad an audience as possible.

Advisory Committee comments/questions:

(1) Will all of the SWAP funding come from EPA/will there be any local or State funding?

State's response:

All SWAP funding will be obtained from EPA through the 10% set-aside of FY-97 for the Drinking Water State Revolving Fund, as well as from the 106 Ground Water Program

and 319 Non-point Source Program. It is not anticipated that there will be any local or State funding made available for SWAP-related activities.

II. STATE'S STRATEGIC APPROACH (TABLE 2)

The State's strategic approach (pages 2-7 of the SWAP guidance document) was addressed during the May 5, 1998 SWAP Advisory Committee meeting.

1. Has the state done an initial review of all data sources available and determined the scope of the need for additional information?

State's approach:

A large amount of data currently exists within a number of various State and Federal agencies and programs. In keeping with SWAP guidance, the State will focus on using the best available data for SWAP elements. Criteria for determining which data is the best available focuses on accuracy and capacity for integration with ArcInfo, the GIS software used by the SWAP. Because of time constraints created by the existing SWAP milestone requirements, the State will take a cautious approach to the development of new data.

The State has performed a detailed review of all known useable data sources available for each element of the SWAP. In the cases when existing qualitative data are used, the State will use the analytical data developed by various regulatory programs that is used to make regulatory compliance determinations (and based on EPA standards). Qualitative data that is used by the State during SWAP development will be the best available data, based upon the best professional judgement of SWAP technical personnel. In the case of spatial data, the State will locate sites and facilities by using highly accurate global positioning system (GPS) technology where possible. However, a significant amount of existing regulatory program spatial data was not acquired using GPS technology. The integration of that data with the newly-developed GPS data will present a challenge to the program.

The data and sources that the State plans to use for the individual SWAP elements are listed in Appendix K of this document. The State has determined that those data sources are more than adequate to meet SWAP goals and requirements.

Advisory Committee comments/questions:

(1) A suggestion was made to send out a brief form letter to the large water purveyors in the state requesting available hydrogeological data that they may have and informing them of the data that the State is developing for the SWAP.

(2) A suggestion was made to coordinate with other ground water and surface water programs in the state in an effort to minimize duplication of efforts (e.g., nutrient analyses, surface water measurements).

State's response:

Since the Mississippi State Department of Health/Division of Water Supply (MSDH) analyzes all water samples for the state public water systems (PWSs) and serves as the official repository for the analytical data, it would appear best that requests for the information be forwarded to MSDH. SWAP already has obtained this data. An exception might be surface water data that Pearl River Valley Water Supply District and Tennessee/Tombigbee Waterway Authority might possess. Since those organizations will be included in the development of SWAPs, the State will request all available hydrogeological data that those organizations might possess at the appropriate time. In an effort to minimize duplication of efforts during SWAP data development, coordination with other ground water and surface water programs in the State will be stressed.

2. What level of exactness/detail should be achieved by each assessment to be considered "complete?"

State's approach:

In response to the issue of what constitutes a complete assessment in its post-guidance document "Questions and Answers To Clarify Certain Aspects of the Final Guidance for State Source Water Assessment and Protection Programs," EPA states: "A state's SWAP is complete when the state has accomplished the steps of delineation, source inventory, and susceptibility determination for every PWS in the state and released the results of the assessments to the public. A local assessment is complete when the source water protection area (encompassing one or more PWSs) delineation, source inventory, and susceptibility determination has been accomplished. Releasing the results of an assessment is a State responsibility, unless delegated, and therefore is not technically a part of any local assessment itself."

The State intends to follow EPA guidelines in developing the SWAP. This includes the issue of completeness, as clarified in the above paragraph. The level of exactness (or

accuracy, as the state infers the term) and detail that the State intends to achieve during SWAP development will be of the highest order practical using the best data available.

Since environmental assessments within other ground and surface water quality programs typically focus initially on the protection of withdrawal points for public water supplies, the State will increase the interaction and effectiveness of those programs by focusing the SWAP delineation process on the generation of data needed by those other related programs as well as SWAP data needs. Because of this strategy, the new databases under development should emphasize accuracy and useability of data.

An example of the level of detail and comprehensive approach that the State intends to achieve during the SWAP delineation process can be found in the data that will be generated for the Source Water Assessment Form (Appendix J). Well completion data and aquifer confinement data, two essential elements typically needed in most environmental assessments, are essential data needed for SWAP also. The exactness of the data will vary depending on the accuracy of the original source data used. For example, the accuracy of well locations as indicated on well driller's logs are highly variable, while the location accuracy associated with electrical logs for water wells is generally very dependable. However, as discussed earlier, only the best available data will be used.

The level of detail the State intends to achieve during the potential contaminant source (PCS) inventory process will be driven largely by the amount of time and funding available to perform the PCS inventories, as well as the accuracy of the best available data existing at the time this SWAP element is performed. Because GPS technology will be utilized during field inspections, the accuracy of the PCS data generally will be at a high level for the new data generated by SWAP. However, the accuracy of the existing spatial data that will be used from other regulatory programs for PCS inventory purposes is quite variable. Both time and funding constraints preclude improvement of spatial data quality for existing data related to other regulatory programs.

Data detail and accuracy will be maintained at the highest level practical for the susceptibility analysis which will combine data from both the delineation and PCS inventory processes. Also, generally high quality analytical data used to determine compliance issues by ground and surface water quality regulatory programs will be used as part of the susceptibility analysis.

The State will release the results of the source water assessments and all supporting data to the public, as federally mandated. As other SWAP elements are clarified, the release of this information in the form of Consumer Confidence Reports (CCR) will be addressed by SWAP personnel and the SWAP Advisory Committee.

Advisory Committee comments/questions:

(1) Does the State plan to interact with the private sector in an effort to achieve a higher level of data quality from the private sector?

(2) A suggestion was made to develop recommendations for the collection of data which could be used by the private sector and State agencies and programs.

(3) In response to this suggestion, a comment was made that the level of accuracy was evolving on its own due to advancing computer hardware and database developments, and that the level of data accuracy will continue to evolve due to these factors.

(4) Another comment that was made concerned whether the SWAP should work with the existing data first to determine its usefulness before attempting to develop data quality recommendations.

State's response:

The issue of data quality improvement is a very significant issue that is already being addressed at the national and state levels. This effort will include standards developed for data generated by the State as well as data submitted to the State by the private sector. The SWAP has representation on the state committee that is addressing this issue within Mississippi. The driving factor in this issue is the development of new computer hardware and software that can link and interact with multiple data sources. The State's approach will complement the effort that is currently under way.

3. Should the level of assessment provide for the protection and/or benefit of the PWSs?

State's approach:

The primary focus of the State SWAP is to provide both direct and indirect benefits to PWSs. Direct benefits include accurate quantitative, qualitative, and spatial information addressing the hydrogeology of source aquifers, identification and location of significant PCSs which could adversely impact PWS wells, an assessment of the relative susceptibility threat posed by those identified sources, and educational information concerning ground water and surface water quality issues. All of this information will be supplied to the certified PWS operators. It is anticipated that the use of this information at the local level will result in the establishment of protective measures from a grass-roots approach.

Indirect benefits include a more comprehensive approach to protecting ground and surface water sources of PWSs through the development of multiple GIS coverages which can be used by all ground and surface water quality regulatory and nonregulatory programs.

EPA SWAP guidance repeatedly emphasizes the intent of the enabling SWAP legislation (1996 SDWA Amendments) to lead to a protection program for all PWS sources. Because of this emphasis, the state's focus on SWAP development is to assimilate and develop useful data which will be the basis for developing a Source Water Protection Program in the future. An example of this approach is manifested in the design of the inventory process where the emphasis of the inventories performed at PCS sites will be not only on what is found, but how the materials are used and stored. Such information will provide the foundation for easy recognition of PCS sites where best management practices are needed as well as other educational applications.

Advisory Committee comments/questions:

General statements of support were made for the State's approach.

4. **What should be the basis for differential levels of assessments to be completed for different public water supplies or categories of PWSs? System type or size? Preliminary information about the existence of threats? Others?**

State's approach:

The initial element of Mississippi's SWAP development, and a primary element of the SWPA delineation process, is the verification of aquifer confinement for PWSs using ground water sources. During the aquifer confinement verification process, no distinction is being made regarding PWS categories or system size. By addressing SWAP development in this manner, the most vulnerable aquifers (unconfined) will be determined in the initial phase of SWAP development, regardless of PWS categories, sizes, or preliminary knowledge of threats. All surface water sources are considered to be vulnerable to contamination. SWAP personnel are currently assessing the desirability of establishing differential levels of assessments for transient and non-community PWS systems.

Subsequent SWAP development, in terms of performing the inventories of significant PCSs and the susceptibility analyses, will be more prescriptive for the more vulnerable PWS systems. After determining the programmatic issue of which categories of PCSs will be considered significant for PWSs using unconfined aquifers and surface water intakes,

all significant PCS sites will be inventoried and assessed for susceptibility in the delineated SWPAs.

Confining layer(s) of clay provide a level of natural protection for the deeper PWS wells in the state that withdraw ground water from confined aquifers. Because of these natural barriers, only those existing wells that penetrate the confining layer of a source aquifer and are located within a delineated SWPA will be inventoried and assessed for susceptibility. The SWPA comprises the larger land area located outside of a 500 foot radius of the PWS well of interest. Within the Priority Protection Area (inside a 500 foot radius from a PWS well), all significant PCS sites will be inventoried and assessed for susceptibility.

One element of the susceptibility analysis includes a review of the water quality analytical data that the MSDH continues to develop for PWS wells and intakes in the state as part of its regulatory compliance program. Such a review will point out PWS wells and surface water intakes that have experienced occurrences of contaminant detects from the source waters used by those PWS systems. Even small levels might indicate the existence of a nearby contaminant source.

Advisory Committee comments/questions:

(1) Will the level of susceptibility be based (at least in some part) on land use?

(2) Will there be an up-slope consideration? Are screened intervals a consideration?

(3) What elements affect vulnerability?

(4) Will the susceptibility assessment go beyond aquifer confinement?

(5) A statement was made regarding this issue that warned not to get into a 303(d) report situation when addressing susceptibility.

(6) A suggestion was made that the State should make sure that all counties and regions are covered.

(7) A statement was made that two very important considerations of the assessments should be that (a) the susceptibility is based on hydrogeology and (b) the priority level is based on the potential for contamination.

State's response:

The Advisory Committee will play a big role in determining the elements of susceptibility assessments. Certain types of land use activities will be considered during the process of determining the susceptibility of surface water sources. Additionally, up-gradient considerations will be a part of the susceptibility determination for both surface water and ground water systems, being a significant factor during the SWPA delineation and PCS inventory processes. For wells, the determination of susceptibility will go beyond aquifer confinement (which naturally includes consideration of screened intervals). The SWAP will consider information contained in the 303(d) report, but will not duplicate its process or findings. Detailed explanations of the elements that will be a part of the determination of susceptibility can be found in the appropriate chapters of this SWAP document.

All of the PWSs in the state will be assessed. Fundamental considerations to the State'SWAP approach are that the susceptibility determinations be based on the hydrogeology and that the priority levels be based on the overall potential for contamination.

5. **How will the state SWAP be coordinated among various environmental and other state programs (e.g., PWS, water quality, water resources, agriculture, land use, information management, geologic)?**

State's approach:

Development of the SWAP presents a unique opportunity to address ground and surface water issues through a comprehensive approach. Through direct participation and access, the state intends to coordinate with both the SWAP Advisory Committee and the two SWPA delineation work groups throughout the development of the SWAP. This step will ensure that every effort is made to maximize the potential of the program to address source water protection in a comprehensive manner. Participants on the SWPA delineation work groups include personnel from the MDEQ Office of Land & Water Resources, MDEQ/OPC Surface Water Quality Division, MDEQ/Ground Water Quality Division, MSDH/Division of Water Supply, U.S. Geological Survey, Mississippi State University, and Alcorn State University. Participants on the SWAP Advisory Committee include representatives from the MSDH/Division of Water Supply, MSDH/Division of Sanitation, MSDH/Division of Community Health Services, MDAC/Bureau of Plant Industry, MS State Oil & Gas Board, MS Cooperative Extension Service, MS Emergency Management Agency, MS Rural Water Association, Mississippi Water & Pollution Control Operator's Association, MS Soil & Water Conservation Commission, Natural Resources Conservation Service, and the United States Forest Service.

To achieve as much coordination as possible, other stakeholders not participating on the Advisory Committee from which the state will seek input include other Federal and State regulatory and nonregulatory agencies and programs that routinely deal with ground and surface water quality issues, such as the MDEQ/OPC Permitting Division, MDEQ/OPC Compliance & Enforcement Division, MDEQ/OPC Hazardous Waste Division, MDEQ/OPC Nonhazardous Waste Division, MDEQ/OPC Underground Storage Tank Branch, MDEQ/OPC Underground Injection Control Program, MDEQ/OG Mining & Reclamation Division, and water supply districts throughout the state.

As GIS coverages are developed and assimilated they will become an integral part of MDEQ's comprehensive database which will allow other programs direct access. The data will be furnished to MSDH/Division of Water Supply and the Mississippi Automated Resource Information System (MARIS), the official state repository of GIS data, and other agencies or programs that address ground and surface water quality issues.

Advisory Committee comments/questions:

No comments were offered after presentation of the State's approach to this issue. However, prior to addressing this issue, the following comments were made that relate to this issue:

(1) A statement was made that "commonality" should exist from state-to-state.

(2) An additional statement was made regarding the lack of state flexibility contained in the 1996 SDWA Amendments.

State's response:

The emphasis on state flexibility contained within the enabling SDWA legislation allows each state to develop and implement a SWAP that is tailored to address individual state needs and circumstances. The State fully appreciates this concept. The purpose of EPA's guidance document is to establish a broad guideline for SWAP development for the states to ensure that every state addresses all required SWAP elements. Obviously, not all states will follow the same approach; however, all of the required program elements will be addressed. Additionally, one of EPA's roles is to facilitate cooperation among adjacent states. The State is coordinating with both Alabama and Tennessee during SWAP development and will continue during SWAP implementation, especially when addressing common surface water situations. Preliminary discussions with SWAP personnel from Louisiana have not identified any areas yet where coordination of effort between the two states would be beneficial to address source waters. Likewise, there are no known ground water or surface water issues between the Mississippi and the State of Arkansas.

6. How would the state's assessment program lead to state watershed approaches and link to wellhead and other protection programs?

State's approach:

There are only four public surface water systems operating in the state. Because of this small number, the foundation of the SWAP will be built around the existing State Wellhead Protection Program (WHPP). Some modifications of the WHPP are being developed due to stringent milestone requirements contained in the SWAP. Those modifications include using the delineation methodology and PCS inventory approach developed for the SWAP.

Delineations of surface water sources will use the watershed/basinwide management approach being developed by the Surface Water Division of the MDEQ. Linkage with other surface water and ground water programs is a fundamental building block of the SWAP.

Advisory Committee comments/questions:

(1) A suggestion was made that the SWAP should tie-in and coordinate with the TMDL program.

(2) An additional statement was made that non-point sources of pollution were difficult to control.

(3) Ken Griffin, General Manager of the Pearl River Valley Water Supply District (PRVWSD) informed SWAP personnel that the District desired to work with the SWAP during the development of the surface water component of the program.

(4) In a letter dated December 11, 1998, Dr. Griffin wrote "The District controls relatively little of large watershed tributary to the Ross Barnett Reservoir, approximately 33 square miles out of 3,300 square miles. Accordingly I believe that it is most important that a basin plan be carefully prepared and implemented for the Ross Barnett Reservoir basin. I also believe that an approach that focuses on the roles that existing state and local agencies can and do play, would be most effective. I hope that the Source Water Assessment Program can be a positive force in starting, completing, and implementing a basin plan for the Ross Barnett Reservoir."

State's response:

SWAP personnel are involved with deveoping the State's "basin approach" which incorporates the TMDL issue. Future coordination is ensured because of the high priority assigned the drinking water issue by the basin team. The basin approach also addresses the issue of non-point sources of pollution within each basin.

As a member of the SWAP Advisory Committee, the Pearl River Valley Water Supply District is involved in the development of the surface water component of the program. Additionally, the State will work closely with the PRVWSD during implementation of the assessment for the District. Dr. Griffin's December 11 letter was circulated to several program managers within the Surface Water Division of the MDEQ along with a request for comments.

III. DELINEATION, SOURCE INVENTORY, AND SUSCEPTIBILITY (TABLE 3)

The following issue, delineation, source inventory, and susceptibility (pages 2-13 of the SWAP guidance document), was addressed during the September 30, 1998 SWAP Advisory Committee meeting.

1. What delineation method and criteria will be used for systems using ground waters? Where shall recharge areas not be included and why?

State's approach:

Due to the stringent milestone requirements and funding constraints of the SWAP, modifications to the existing delineation methodology used by the Wellhead Protection Program (WHPP) are being made to ensure that the state will be able to meet those requirements. After an exhaustive study of published aquifer information and review of the effectiveness of the existing WHPP delineation methodology, the state has proposed to modify its existing WHPP delineation methodology that uses a one-mile fixed radius for PWS wells screened in confined aquifers and a ten-year time-of-travel capture zone using the WHPA Model for unconfined and semi-confined aquifers.

Delineation criteria for eight distinct scenarios, based on differing transmissivities, hydraulic gradients, pumping rates, and other criteria, have been developed that vary in size and offset distance to the PWS well for which the delineation is performed. The key element is pumping rate of the well of interest. Probably the most significant result of this proposed modification is the elimination of the large down gradient portion of each Wellhead Protection Area, which has been outside of the capture zone of the well for which the delineation was performed. The elimination of this noncontributing area

reduces unnecessary inventory efforts. Because this modification considers a number of hydrologic parameters common to both confined and unconfined aquifers, the proposed delineation forms were developed to address both aquifer types.

Another modification of delineation methodology deals with reducing the number of protection zones within a Wellhead Protection Area. This modification was necessary in order to fit within GIS capabilities, as well as to meet future zoning definition requirements. A great deal of study and review were devoted to these modifications in order to assure that they were based on good science, had practicality in application, and were justifiable.

Remote recharge within semi-confined conditions (situations where PWS wells screened in confined or semi-confined aquifers are located near their outcrop or recharge area) will be addressed primarily through the inventory process. In those cases, all designated significant potential contaminant source types will be inventoried.

Advisory Committee comments/questions:

The State should, at some date, address the issue of delineating and protecting recharge areas.

State's response:

The State recognizes the importance of protecting aquifer recharge areas. Although this issue has not yet been formally addressed by the State, hopefully in the future it will be. Complicating factors in addressing the recharge areas include the detail of site-specific studies needed due to the complexity of the hydrogeology, the large areas that would be affected due to the existence of the fourteen major aquifer systems in the state, and the impact that such an effort could have on other ground water quality programs . This is also a vital issue in some existing federal programs, such as the CRP, which places an emphasis in the determination of funding eligibility upon whether a portion of land exists in a recharge area.

2. What contaminants that are not currently regulated by EPA should be part of the State's SWAP program?

State's approach:

Only SDWA and Surface Water Treatment Rule (SWTR)-regulated contaminants and Cryptosporidium will be designated by the State for SWAP applications. However, because the ultimate use of the source water assessments will address protection

measures at designated PCS types within delineated protection areas, a range of contaminants (including unregulated contaminants) might be involved. The State feels that addressing material storage and operating concerns evidenced at inventoried PCS sites is a more useful approach for the ultimate application of establishing protection measures.

Many of the PCS types that are considered significant for SWAP PCS inventory purposes are regulated sites or facilities that already have existing regulatory oversight and reporting requirements. However, the PCS inventory within delineated SWPAs will focus on unregulated sites. These PCS types include above ground storage tanks, drum and container storage, automotive/equipment maintenance shops, Class V wells, water wells, and oil and gas production facilities. The SWAP Potential Contaminant Source Inventory Form (Appendix H) lists the significant PCS types that will be addressed through the SWAP inventory process.

Advisory Committee comments/questions:

No comments were received.

3. **Should the State segment source water protection areas for more focused source inventories? What should be the basis for such segmentation?**

State's approach:

Only three PWSs in the state divert surface water for potable use. The City of Jackson operates an intake on the Ross Barnett Reservoir and another one below the reservoir dam in the Pearl River. In northeast Mississippi, the City of Tupelo withdraws water from a watershed supplemented with supply from the Tennessee-Tombigbee Waterway system and the Short-Coleman Water Association withdraws surface water from Pickwick Lake. The State intends to segment basins as part of its effort to address SWPAs. The basis for segmentation of those SWPAs is currently under development.

Advisory Committee comments/questions:

The State should consider segmenting watersheds due to the large areas that would have to be assessed if this methodology were not undertaken.

4. **How should the State define and identify significant PCSs and how should the state undertake their inventory within source water protection areas?**

State's approach:

As a basis for the development of the PCS inventory process, the State is focusing on lessons learned during the implementation of the WHPP. Certain distinctive unregulated PCS types were found to routinely appear throughout the state that present significant potential threats to source water quality. It is those significant PCS types that will be addressed during the PCS inventory process.

A fundamental consideration to be addressed by Mississippi in its approach to developing useful PCS inventories are the issues of source water protection and management. Elements of these considerations are:

a. *Identification of greatest unregulated threats to public water supplies - To aid in the development of an effective future protection and management program, six significant potential PCS types have been identified for field inspection activities (i.e., ASTs, Class V wells, automotive/equipment maintenance shops, container/drum storage, improperly abandoned water wells, and oil & gas production facilities). These PCSs were the documented types found most often during implementation of the WHPP and generally represent the greatest unregulated threats to public water supplies in the state.*

b. *Evidence of material storage concerns and operating concerns (poor management practices) to be used to target future protection and management efforts - The PCS Inventory Form facilitates an assessment of material storage and operating practices observed during the field inspection process. This inventory form will provide for the "flagging" of PCS sites where material storage and/or operating concerns were observed so that those sites can be readily identified as targets for future protection and management efforts. In addition, the susceptibility analysis element of the GIS application under development will assign a "higher sensitivity" ranking to those sites where evidence of material storage and/or operating concerns have been found.*

c. *Contamination mitigation - A system is being planned that will notify the appropriate regulatory programs when contaminants detected in raw water samples from PWS wells are correlated with related materials found at PCS sites. Such a notification process has the potential to facilitate additional assessment and mitigation activities which could reduce the human health risk to users of the public water supply.*

d. *Distance of PCS site to PWS well/surface water intake - The State will site all of the field inspected PCSs using GPS technology to ensure the acquisition of accurate locations. As a benefit of this effort, the GIS application under development for use with the susceptibility analysis element will routinely calculate accurate distances of PCS sites from previously GPS'd public water supply wells and surface water intakes and will assign those PCS sites located within 500 feet of a well screened in an unconfined aquifer a "higher susceptibility" ranking.*

e. *Contaminant(s) present - The PCS Inventory Form provides for a listing of materials or contaminant(s) present at an inventoried site.*

f. *Volume of contaminants - The PCS Inventory Form also provides for an estimate of the amounts/volumes of contaminants observed during the inventory process at each site.*

g. *Development of accurate inventory and spatial information - PCS inventory information and spatial information developed through the field inspection process will be of the highest quality possible. This attention to detail will ensure the integrity of the newly-developed information.*

h. *Recognition of deficiencies in existing spatial locations in regulatory program databases - Because limitations in spatial location accuracy exist within regulatory databases of other programs, the data for those identified facilities will exist in separate GIS coverages and will not be field inventoried. This decision is due to the existing regulatory oversight already in place and the limited resources available to field inspect those facilities/sites. The sites will only be GPS'd when an obvious error is found to exist in their reported location during the PCS inventory process.*

Advisory Committee comments/questions:

No comments were received.

5. How will the results of the susceptibility analysis be characterized?

State's approach:

When addressing the issue of susceptibility, or "the lack of ability to resist some extraneous agent, such as a pathogen" (Webster's), the primary focus of the state will be consistent with the SDWA and EPA requirement to "determine the susceptibility of the

public water supply systems in the delineated area to the identified contaminants inventoried." In keeping with this specific language of the enabling legislation and guidance, the susceptibility analysis methodology developed by the state will not focus on an arbitrary ranking of individual PCSs. Rather, the analysis will focus on the individual elements that individually or collectively will determine the ability of a PWS to resist becoming contaminated by the inventoried PCSs. A decision tree has been developed that assigns a higher, moderate, or lower susceptibility ranking while taking into account the following factors:

1. *Contaminant detect concentrations in raw water analyses*
2. *Aquifer confinement/surface water intake*
3. *Minimum design criteria for wells*
4. *PCSs withing 500' of well or within surface water buffer zone*
5. *PCSs located within SWPA*
6. *Material storage and/or operating concerns at inventoried PCS sites.*

The state's approach to susceptibility is consistent with the stated goal of EPA and Congress for the susceptibility analysis to "be the means for a state to make the inventory useful for decisions regarding source water protection programs and other possible uses." By determining the most susceptible PWSs, the State can focus initially on the information developed through the PCS inventory process for those systems which eventually should lead to the implementation of effective management measures. The analysis will also assist the state in determining which PCSs are "significant."

Advisory Committee comments/questions:

(1) The report format should be easy for the operators to understand and explain to their consumers.

(2) Operators will face considerable questioning when the reports are released and may not be able to fully communicate the report content with the general public. Training needs to be given to the operators to help explain the analysis.

(3) A qualitative approach is preferred over a quantitative approach because it is easier to understand.

(4) The decision tree approach developed by the State is easy to understand and is helpful in determining why a PWS has received its ranking.

State's response:

A report narrative will be developed to explain in simple terms the significance of the information contained in the susceptibility report. In addition, the State will coordinate with MSDH, Mississippi Rural Water Association, and Mississippi Water & Pollution Control Operators Association to schedule training sessions focused on understanding the results of the assessments.

SYNOPSIS OF COMMENTS
DELINEATION WORK GROUP FOR GROUND WATER SOURCES

May 27, 1998

Attendees:

Dr. Darryl Schmitz, Ph.D. (Mississippi State University)
Eric Strom (USGS)
Kerry Arthur (USGS)
Jim Hoffman (OLWR/MDEQ)
Jamie Crawford (OPC/MDEQ)
Richard Ingram, SWAP/OPC/MDEQ)
John Andrews, SWAP/OPC/MDEQ)

Format:

1. Work group members were mailed copies of proposed delineation methodology for review prior to meeting.

2. Proposed delineation methodology was presented to work group members attending meeting. Discussion was facilitated and various methodology-related topics were discussed.

3. Comments were drafted at conclusion of meeting.

Comments:

Regarding delineation methodology:

1. Delineation methodology is acceptable, considering the established SWAP funding and milestone requirements.

2. The proposed methodology addresses delineations in a conservative manner which is the desirable approach to take.

3. For each scenario established in delineation methodology, provide examples of upper and lower limits.

4. The proposed delineation methodology represents the continuing evolution of more thorough drinking water protection efforts and hopefully will continue to evolve in future programs.

5. Data is currently available to develop and perform a more detailed and scientifically accurate delineation methodology; however, the limited amount of time and resource constraints will not allow development and use of such a methodology.

Regarding delineation methodology process:

6. Limit unnecessary data on the *Source Water Protection Area Delineation Form.*

7. Consider other data for future use in the development of the database.

8. All future PWS wells should be required by the MSDH/DWS to use the following evaluation and siting criteria:

   a. E-logs and gamma-ray logs that are run from the surface to total depth; and

   b. Establish accurate locations of wells using GPS technology.

IV. BOUNDARY WATERS, MULTI-STATE RIVERS, AND THE GREAT LAKES (TABLE 4)

The issues of boundary waters, multi-state reivers, and the Great Lakes (pages 2-19 of the SWAP guidance document) were addressed during the September 30, 1998 SWAP Advisory Committee meeting.

1. What agreement should the state maintain or initiate with other states, tribes, or nations to gain more complete and consistent source water assessments?

State's approach:

Jurisdictional issues that may arise in the future between neighboring states, as well as the Choctaw Tribe of Mississippi, are currently unknown. Because of this uncertainty, the State has no plans at this time to negotiate agreements with neighboring states regarding SWPA jurisdictional issues. Upon notification from other states of overlapping SWPAs for PWSsi, the State will attempt to negotiate an acceptable agreement. Following the delineation phase of SWAP implementation, the State will request assistance from EPA Region IV to facilitate agreements with neighboring state(s) if needed. A PWS representative of the PWS owned by the Choctaw Tribe of Mississippi is actively participating on the SWAP Advisory Committee which will ensure that the SWAP takes into account the jurisdictional issues that may arise from overlapping SWPAs of the State and Choctaw Tribe.

The State recognizes that overlapping SWPAs will probably occur with the EPA Region IV states of Tennessee and Alabama, as well as the EPA Region VI state of Louisiana. The three most significant overlapping SWPA delineations likely to occur will include the following: (1) the City of Memphis, Tennessee metropolitan area due to the large volume of water being pumped from the Memphis Sand aquifer; (2) the extreme northeast corner of the state due to the existence of the surface water intake for Short-Coleman Water Association that is located adjacent to the Tennessee - Tombigbee Waterway; and (3) for Louisiana PWSs with surface water intakes in the Mississippi River.

Advisory Committee comments/questions:

(1) Will other States be asking us for contaminant sources?

(2) This issue could result in some interesting jurisdictional situations.

State's response:

MDEQ will be happy to supply other States who request inventory information with available data. However, the State will not be performing any field inventories of potential contaminant

sources for them. Because this is an assessment program and not a management program, jurisdictional issues should not be a problem. However, once Source Water Protection becomes the focus, jurisdictional issues will need to be addressed. This is a good area for EPA to assist the States.

2. What contingency plans should be pursued?

State's approach:

In an effort to effectively address the emergency contingency plan element contained in the Wellhead Protection Program, during 1996 participants from the Planning Division of the Mississippi Emergency Management Agency (MEMA), the Mississippi State Department of Health/Division of Water Supply (MSDH/DWS), and the Wellhead Protection Program established a work group designed to develop a standardized Emergency Contingency Plan format for state-wide application. The resulting document format from that effort has been accepted by every public water supply system that has developed a local Wellhead Protection Program. It is recommended that this standardized Emergency Contingency Plan format be formally adopted by the MSDH/DWS and MEMA and implemented by both agencies as a requirement for all public water supply systems to develop locally, maintain as currently as feasible, and file with other appropriate state agencies. Such an effort would provide immediate and long-term benefits in the event of widespread ice storms, tornados, or other natural disasters which periodically occur in the state that in the past have created significant disruptions in public water supplies.

Advisory Committee comments/questions:

Items discussed regarding this issue included the following:

(1) MSDH has historically relied on MEMA for assistance in addressing emergencies and County Emergency Plans are supposed to address drinking water emergencies, however many county plans are inadequate or incomplete in this area.

(2) It is estimated that up to half of rural water systems do not have adequate emergency contingency plans for power outages and emergencies, nor do they have their own generators.

(3) Comments/suggestions that were made addressing the issue of availability of generators during power outages.

   (a) A list of agencies with power generators should be developed with the name of a contact person and telephone number.

(b) Within each local emergency contingency plan, the size of the power generator needed should be listed.

(c) Other issues related to emergency power needs, such as gasoline/diesel availability during prolonged outages, need to be addressed.

(d) An electronic method, such as a web site (many operators have Internet capabilities, but not all), could be used to track available power generators, since they are often moved around by the agencies that possess them. However, limitations exist when power losses occur due to the lack of electricity and/or telephone lines.

(e) Municipal and county governments often do not know what options exist, so they need to be tied-in informationally.

(4) All of the local emergency contingency plans developed should have a required updating mechanism to keep them useful.

(5) The issue of power restoration was addressed. An opinion was expressed that the elderly and handicapped living at home are not a high priority status during power outages while some government facilities carry a higher priority but do not have health risks among their personnel.

(6) Both the Mississippi Water & Pollution Control Operators Association and the Governor's Task Force on Water Quality may be able to assist/facilitate an effort in the area of power restoration.

(7) Vendors can assist operators in determining the size of generator needed to sustain pumping in emergency situations.

(8) Seminars can be held on this issue to better educate operators on how to prepare and respond to emergencies (MWPCOA already does this every other year).

State's response:

From the discussion, it is evident that the Advisory Committee considers this to be a significant unresolved issue. Recent emergencies created by widespread ice storms have demonstrated that current emergency contingency planning is inadequate. A work group will be established in the future consisting of representatives from the Mississippi Department of Health/Division of Water Supply, Mississippi Emergency Management Agency, Mississippi Water & Pollution Control Operators Association, Governor's Task Force on Water Quality, and others to address this issue.

3. What coordination/facilitation activities should the state request of EPA?

State's approach:

A significant element contained within the 1986 SDWA as it addressed SWAP requirements was the focus on state flexibility. As a result of this element, a Mississippi-focused SWAP is being developed which reflects the state's circumstances and needs, as well as fulfills the federal program requirements. During the development of the state's SWAP document, the state has coordinated with the EPA Region IV SWAP Coordinator and the EPA Region IV State 106 Ground Water Contact on a continuing basis as individual SWAP elements have been developed, to ensure that the state is developing an approvable SWAP.

The state recognizes the benefits that the EPA Region IV coordinators can provide, especially in coordinating and facilitating boundary situations with neighboring states (as specified in the State's response to issue question 1) and in dealing with other federal programs. The state will continue to use those assets that EPA has offered during SWAP development and implementation.

Advisory Committee comments:

EPA already has the role of oversight of the program.

4. Are compatible and complimentary assessments being done in watersheds shared with other states and counties?

State's approach:

Surface water intakes for the two PWSs in the northeast corner of the state appear to be located in watersheds that may also include portions of Alabama and Tennessee. The State intends to work with SWAP personnel/contractors in those states to ensure that compatible and complementary approaches exist between the states. In the event that boundary situations develop in the future in other areas or with other states, Mississippi will work likewise with the affected boundary state to ensure that all elements of its SWAP are coordinated.

Advisory Committee comments:

Surface water bodies should be looked at on a basin basis, rather than a watershed basis.

V. MAKING THE RESULTS OF ASSESSMENTS AVAILABLE TO THE PUBLIC (TABLE 5)

The issue of making the results of assessments available to the public (pages 2-21 of the SWAP guidance document), was addressed during the August 13, 1998 SWAP Advisory Committee meeting.

1. What should be included in the results of the assessments, what should be the format of an understandable report on results, and when should the results be made available?

State's approach:

It is the desire of the State to supply as much useful information to PWS systems as practical. The format currently being developed for the Susceptibility Analysis Report provides for a comprehensive report that provides useable information related to the major elements considered during the determination of public water supply well/surface water intake susceptibility, including well and surface water intake information, hydrogeological data, potential contaminant source inventory information, raw water quality analytical data, and other pertinent information. The report will include a map element to identify spatially the locations of SWPAs, PWS wells and intakes, PCS sites, and also a list of susceptibility concerns. The PWS systems should find this information useful for planning and emergency response purposes.

The State anticipates that completed source water assessments will be sent to each PWS operator upon completion on a county-by-county basis. Coordination with the MSDH will be necessary to distribute the completed assessments. A concern that the State has is the issue of whether the more technical elements developed during the SWAP are understandable to the general public and might lead to misinterpretations. The State is will be developing generic explanations about the meaning and useability of the information contained in the susceptibility analysis in an effort to offset such a situation.

Advisory Committee comments/questions:

(1) Why use "higher" and "lower" rather than "high" and "low" for rankings?

(2) Because of the complexity of much of the assessment material, a general easy-to-understand report to be prepared for system operators and consumers and the other more technical material could be place in file drawers for those who desired it.

(3) There isn't any public apathy regarding drinking water issues; the release of the susceptibility assessment reports will create questions for water system operators.

(4) An addendum should be added to the report to put in perspective what the report means -- this is very important.

State's response:

Because of the relative and arbitrary nature of the proposed ranking system, specific thresholds are not established separating the rankings. "Higher" simply means that a public water supply well or surface water intake has a higher susceptibility to becoming contaminated from the inventoried potential contaminant sources than those with a moderate or lower ranking. The State feels that if "high" and "low" are used that it will be forced to develop arbitrary thresholds that may lack technical merit. In an effort to improve understanding of the susceptibility reports by operators, as well as the general public, generic explanations of the significance and meaning of the rankings will be developed and included with the reports.

2. How and when should the State make available all the information collected during each assessment when someone requests it?

State's approach:

One method that will be used will be to have the information available on the Internet for easy access for those with Internet capabilities. Otherwise requests can be made to MDEQ ffor hard copies of the assessment information. MDEQ has designated personnel who reply to information requests from the public on an ongoing basis. In addition, the State will supply hard copies of the SWAP-related information to the public libraries in counties with completed assessments. This will be facilitated through the State library system in Jackson. The information will be supplied to each county as susceptibility assessments are completed for the entire county.

The State will require that distribution of notices of the release of the assessments be included with the next monthly water bill to all PWS customers to whom the assessment has been released. The PWS will then be responsible for providing copies of the assessments to the requesting parties.

Advisory Committee comments/questions:

(1) Susceptibility results distributed to public libraries will become a source of curiosity for non-system viewers.

(2) Susceptibility reports should be placed in water offices first, before distributing copies to area libraries.

(3) The Mississippi Water and Pollution Control Operators Association has a web site which will provide a link for the reports.

(4) The Public Service Commission has good map coverage of certificated areas for public water systems. Susceptibility reports could be released on this basis rather than county-by-county.

State's response:

Public release of the susceptibility reports is intended to educate both the water system operators and general public, as well as facilitate "grass-roots" interest in the protection of drinking water sources. Because the initial focus of the susceptibility report deals with public water system operators and their consumers, the reports will first be distributed to systems prior to distribution to libraries. The State will attempt to coordinate with MWPCOA to establish a link with its web page. The State is aware of the Public Service Commission map coverage and has evaluated its potential role in establishing sewered versus non-sewered areas (in which septic systems are probably widely used). The State will assess the potential for incorporating this map coverage into its proposed report release strategy.

3. What type of maps should be developed to display the results of the assessments?

State's approach:

Arc/Info is the platform which is being used to assimilate and manage the abundant data that will be generated by the SWAP. Numerous types of queries and reselects are being developed in order to provide the information in a format useful to as many programs/persons as possible. The generated data will have queries/reselects developed on a PWS system basis, county basis, multi-county basis, aquifer basis, radial search basis, and state-wide basis. Auto-scale maps with attributes related to information that the SWAP has assimilated or developed will be spatially displayed. Included on these maps are delineated SWPAs with protection zones, inventoried PCS sites, and other base data.

Advisory Committee comments/questions:

No comments were received.

4. How and when should the State make public all information collected during each assessment for a PWS(s)? (See State's approach to question No. 2, p. C-28)

5. How should the State or delegated entities provide wide notification of the availability of the results and other information collected?

State's approach:

The MDEQ will use it's public affairs office to issue press releases on a state-wide, county, and local basis addressing the availability of the results and information developed during the assessments. Notification will also be provided on the websites maintained by MDEQ and MSDH.

Advisory Committee comments:

No comments were received.

VI. STATE PROGRAM IMPLEMENTATION (TABLE 6)

The issue of state program implementation (pages 2-24 of the SWAP guidance document) was addressed during the June 11, 1998 SWAP Advisory Committee meeting.

1. What should be the timetable for SWAP program implementation?

State's approach:

The timetable for SWAP implementation was submitted to EPA Region IV as part of the State's work plan, which has been approved. The release of available funding for SWAP-related activitties was dependent upon obtaining work plan approval. Appendix N contains the projected four-year work plan.

Advisory Committee comments/questions:

(1) Do you have a plan for training inventory personnel? Perhaps the Mississippi Water & Pollution Control Operators Association (MWPCOA) can help.

(2) Are you ready for the public fallout from releasing the results of the assessments?

(3) Do you have to send all of the information out?

(4) Public education efforts should start now to minimize the risk of a potentially adversial reception by the public.

(5) The MSDH and MDEQ should work together and hold joint meetings around the state to explain the results and issues of the released reports.

(6) You should expect problems from newspapers which will pick up the public water systems "higher susceptibility" ranking results.

(7) Before releasing "higher susceptibility" ranking results, you should involve local newspapers in those areas in order to mitigate an adverse article being written. In Jackson, Bruce Reid will provide a fair and objective article.

(8) The major public concern will be "is my water safe to drink?," not necessarily the ranking results.

State's response:

The State recognizes as one of its fundamental responsibilities the function of training personnel that will be responsible for each SWAP element. As part of the negotiations with a third party candidate for performing the potential contaminant source (PCS) inventory, the issue of training of inventory personnel will naturally be an issue that will be addressed.. During SWAP development, a document was developed that describes the procedure and process for completing PCS inventory forms. It is anticipated that this document, in addition to the chapter addressing the PCS inventory contained within the SWAP document, will provide a good basis for training.

A legislative and EPA requirement for SWAP is the release of all information used in its development. The State understands the rationale for this requirement and recognizes its potential public impact. Public education efforts will be conceptually developed and planned as part of the State's initial SWAP activities. These efforts will involve a cooperative approach by both MDEQ and MSDH. The State will incorporate the Advisory Committee concerns related to adverse public reactions to the release of "higher susceptibility" ranking results in developing its approach to how the rankings should be made available to the public. A document explaining the significance of the results will be included with each release of ranking results.

2. How much should the State spend on SWAP program development and implementation, and should the resources come from the DWSRF and/or other resources?

State's approach:

Funding for the SWAP program for FY-98 will come from the Drinking Water State Revolving Fund, the Ground Water 106 program, and the 319 program which are all Federally funded programs administered by the state. The state's annual work plans for FY-98 and FY-99 list planned SWAP funding sources and amounts.

Advisory Committee comments/questions:

(1) Only one comment was received which was a statement that the State should not spend any of its money (general fund) for this program.

State's response:

Available funding should be adequate to accomplish SWAP activities.

3. Should the State delegate aspects of the assessment? If so, to whom? Should funding be provided to delegated entities?

State's approach:

MSDH delegated SWAP development to the MDEQ. The Ground Water Planning Branch of MDEQ/OPC will be responsible for developing and performing all elements of the SWAP, as designated in its approved work plan. However, much of the PCS inventory field work may be delegated to MDEQ's Underground Storage Tank (UST) program. The UST program has proven expertise and experience in ground water protection efforts and has existing infrastructure in both personnel and equipment that would otherwise have to be duplicated at significantly higher costs.

In the event that additional help is required to complete implementation of the SWAP within the prescribed timeframe, the State will consider outsourcing some program elements.

Advisory Committee comments/questions:

(1) If abandoned wells are the only real threat to public water supply wells screened in confined aquifers, why would the State inventory for other potential contaminant sources located within a 500 foot radius of each public water supply well? This issue is especially pertinent when you consider the large effort that the inventorying would involve and the State's limited resources and time available.

State response:

After considering the issues related to this comment, the State has decided to focus only on abandoned wells located within SWAPs for wells screened in confined aquifers .

State update:

Since considering a contractual arrangement with the UST program, the State has discovered that Arizona has successfully implemented its potential contaminant source inventory through a third

party contract with a consulting firm. Although slightly larger than Mississippi in terms of the numbers of public water systems and wells, Arizona was able to implement a more detailed inventory than what Mississippi has planned at a lower cost than what Mississippi has projected. As a result of this information, the State will probably consider a similar third party arrangement.

4. How should State agencies coordinate with each other and with other state, federal, and local stakeholders when implementing SWAPs?

State's approach:

Implementation of the SWAP presents a unique opportunity to address ground and surface water issues through a comprehensive approach. It is the intent of the State to continue the public participation process after program development by continuing its relationship with the SWAP Advisory Committee. This will necessitate changing the committee's role to one of oversight during program implementation and execution. This oversight will probably occur as annual meetings when the Advisory Committee will review program status and general performance to ensure that program goals and time line requirements are being met. Participants on the SWAP Advisory Committee include stakeholders which represent both technical and citizens' perspectives.

To achieve as much coordination of SWAP activities as possible, the State will seek input from other stakeholders not on the advisory committee such as other Federal and State regulatory and non-regulatory agencies and programs that routinely deal with ground and surface water quality issues. Some of these groups/agencies would include MDEQ/OPC Permitting Division, MDEQ/OPC Compliance & Enforcement Division, MDEQ/OPC Hazardous Waste Division, MDEQ/OPC Nonhazardous Waste Division, MDEQ/OPC Underground Storage Tank Branch, MDEQ/OPC Underground Injection Control Branch, MDEQ/OG Mining & Reclamation Division, and water supply districts throughout the state. GIS coverages developed and assimilated and developed will be furnished to all programs requesting the data as well as the MS Automated Resource Information System (MARIS), the official State GIS repository.

Advisory Committee comments/questions:

(1) The SWAP should also coordinate with the Department of Transportation as it develops and implements its program.

State's response:

During SWAP development and implementation, coordination with the Department of Transportation will be included.

5. How and when should the State report to EPA regarding SWAP implementation?

State's approach:

Upon completion of the SWAP, the State will deliver to Region IV offices a copy of the completed assessments for all PWS systems in the state. In addition, the State will prepare a brief report of significant SWAP-related issues discovered during the development and implementation of the SWAP.

Advisory Committee comments/questions:

No comments were received.

6. When and how should the State update assessments?

State's approach:

The issue of updating source water assessments is essentially a funding issue. Without adequate funding, the State will be unable to consider this important issue. It is important to note that a Federal mandate does not exist to perform the exercise.

In the event that funding was made available and SWAP updates became a Federal requirement, a great deal of flexibility would be required for the states. Updates would prove difficult because of the amount of time it would entail to address all of the required elements of SWAP. New SWPAs would need to be delineated for new PWS wells and surface water intakes. Also, the PCS inventory, the most time-consuming SWAP element, would need to readdressed. Likewise, the susceptibility analysis would need to redone using the new PCS data. SWAP updates for surface water-based PWS could follow a plan under development at MDEQ/OPC designed to address TMDL requirements on a watershed-by-watershed basis.

Advisory Committee comments/questions:

(1) A suggestion was made to see what situations exist as revealed by the completion of the assessment program before addressing the issue of updates.

(2) In addition, a recommendation was made to wait until federal money is provided before addressing updating the assessments.

State's response:

The State has conceptually developed the SWAP so that the information can be easily updated in the future when additional funding will allow such an effort.

APPENDIX D

SUMMARY OF SWAP PUBLIC HEARINGS AND OTHER STAKEHOLDER COMMENTS

PUBLIC HEARING NUMBER 1
Hattiesburg, Mississippi
January 4, 1999

Attendees:

Chris LaGarde (Congressman Gene Taylor's office); Chuck Henderson (Hattiesburg Water Office); Donnie Garris (MRWA); Jamie Crawford (SWAP/MDEQ); Richard Ingram (SWAP/MDEQ); Rosie Scott (Court Reporter)

Public Comments/Questions:

#1 How will the State deal with continued [public water system] growth?

State's response:

EPA requires that States address this issue in their Source Water Assessment Program plan; Mississippi has already included it in the plan. The State has developed a strategy to tie-in future updates with the 5-year basin rotation schedule currently being developed by the Surface Water Division of the Office of Pollution Control (MDEQ). However, additional funding will be necessary to implement future updating activities.

No further comments or questions were received.

PUBLIC HEARING NUMBER 2
Jackson, Mississippi
January 5, 1999

Attendees:

Pete Boone (MRWA); William Weems (Jackson, MS); C.E. Williams (Jackson, MS); E.C. Barnwell (Jackson, MS); Bill Barnett (Ground Water Division/MDEQ); Jamie Crawford (SWAP/MDEQ); Richard Ingram (SWAP/MDEQ); Cheryl Smith (Court Reporter)

Public Comments/Questions:

#1 Is the spraying of timber land considered to be a potential contaminant?

State's response:

Run-off from pesticide applications is always a concern. However, the main issue in silvaculture is sediment transport into surface water bodies.

#2 What do you mean by "regulated"?

State's response:

"Regulated'" refers to those facilities and sites for which regulatory oversight exists in the form of permitting and/or compliance requirements. Typically in such circumstances, MDEQ engineers or scientists are assigned oversight responsibility for those facilities and sites to ensure that permitting and/or compliance requirements are met.

#3 What happens if problems are found during the assessment? What is the responsibility of MDEQ in the event a problem is found?

State's response:

We expect to find problems during the inventory process. The relative susceptibility ranking methodology will account for many of the problems that we expect to find. It is the responsibility of MDEQ to release the results of the assessments to public water supply system operators and the general public. It is anticipated that public scrutiny of this information may facilitate local efforts

to address the problems that are found. In cases where serious violations are found to exist, MDEQ is required to address those situations.

#4 You've got a big job ahead of you. How many people are working on it?

State's response:

The task is daunting, especially when considering the timeline requirements and available funding. However, the State believes that it has developed a program that can be beneficial to public water supply operators and consumers while meeting Federal legislative and EPA requirements. During the past year, three scientists have been hard at work developing the program and its GIS application conceptually, preparing forms and processes, and performing aquifer confinement verifications. The SWAP plan discusses program implementation in Chapter VII.

No further comments or questions were received.

PUBLIC HEARING NUMBER 3
Oxford, Mississippi
January 7, 1999

Attendees:

Mike Morrison (East W/A); Joseph Murphey (Oxford, MS); John Lewis (Water Valley, MS); Gordon Tollison (Oxford, MS); Edith Hayles (Oxford, MS); Jeff Howell (UM Biology lab); M.J.M. Romkens (UM Sedimentation lab); Jim Pratt (Oxford Eagle); Bill Canty (Senator Lott's office); Daryall Whittington (North Regional Office/MDEQ); Jamie Crawford (SWAP/MDEQ); Richard Ingram (SWAP/MDEQ); Karen Reid (Court Reporter)

Public Comments/Questions:

#1 Most of your assumptions about contamination are based on proper sealing of the well casing above the intake screens. ...If the well is not properly sealed or if the casing has deteriorated, you've got a lost cause. ...If the well casing is not sealed properly, it's an open container. ...Are you doing anything to ascertain the integrity of the seals on the wells that are providing public water supplies? Are you running electric logs and can you tell from an old electric log or a new one whether or not the well was properly sealed to begin with? ...Cement seals are only good as long as the soil around it stays moist. If it drys out, you get a shrinkage crack around the side of the well and then if you don't have a bentonite seal below that or around it, the water is going to percolate right down the side of the casing and will eventually get into your well screens. ...If you've got an unsealed casement, it goes from one right down to the next.

State's response:

The issue of well integrity has been analyzed and discussed in depth by SWAP staff and the Delineation Work Group for Ground Water Sources throughout the development of the proposed SWAP plan. Regulations do not require PWSs to run expensive cement bond logs or to perform mechanical integrity tests on wells to evaluate the integrity of casings. Because this information is not available, a decision was made to base this issue on whether or not PWS wells have met MSDH completion requirements prior to being placed into service. Additionally, the existence of MSDH raw water data may serve as a potential indicator of a possible well integrity problem. This approach follows the EPA requirement to use the best data available for SWAP implementation.

#2 You say that most of the public water supplies (90 to 95%) are in confined aquifers, and yet, your approach only looks at contaminant sources which are located within the same surface watershed as the wellhead. This is not assuming any possibility of contamination down the well casing from a hundred-year flood or anything like that. Its just that you are assuming that any contaminant is going to come within that watershed. By the very fact that you have artesian systems, your water is coming from 15, 20, 50 miles up slope. Any agricultural or private well, unregulated well, or any contaminant source in that whole area can work its way into any water system.

State's response:

The basis for determining the boundaries of delineations for Source Water Protection Areas (SWPAs) is time-of-travel calculations. The closer the location of a PCS is to a PWS well or surface water intake, the higher the threat to that system because a contamination event could occur with inadequate time to mitigate its impact. The boundaries of SWPAs were based on five-year time-of-travel computer model studies. For the majority of aquifers in Mississippi, an average five-year time-of-travel radius from a well will roughly correlate to a distance of between 0.5 and 1.5 miles, depending primarily on aquifer transmissivity and gradient. Priority Protection Areas established within SWPAs for unconfined aquifers roughly correlate with 90 day time-of-travel studies. The rationale for developing a more detailed inventory process within these areas is due to the limited amount of response time in the event of a contamination event.

A review of ambient chemical concentrations of ground water in Mississippi immediately reveals the transport of some chemicals at very low concentrations. The sources for the detected chemicals are to a large degree unknown. Certainly, some of those chemicals may have crossed watershed boundaries. The primary focus of the PCS inventory for PWS wells screened in confined aquifers is to attempt to locate abandoned and improperly plugged wells of all types because of the direct threat that they represent not only to the aquifer in which they are screened.

#3 We had reports in Oxford (7 or 8 years ago) about some kind of contaminant in the northeast quadrant supply wells that was tentatively identified as something like embalming fluid. Whether it was caused from medical school disposals in the National Forest back before any regulations. . . or wherever it came. . . it got shut up real quick. I don't know whether any of you are aware of it or not, but we've got about fifty times the national average of a very rare type of brain tumor in this area. The national average is supposed to be only about 0.5 people per 100,000 with this condition. We've already got a couple of dozen in this area; people who have died from it within the last 20 years. Whether or not some type of contamination in the water caused the tumors or perhaps some other problem is responsible, we don't know.

State's response:

The State Department of Health (MSDH) might be helpful to you in providing accurate information about the situation you are referring.

#4 I can see one big problem with your sampling system -- the people who are in danger of being shut down are the ones who supply you with your water samples. The DEQ should go to wellheads randomly and take water samples. ...You don't have a budget to do that, probably.

State's response:

The MDEQ is not the primacy agency with drinking water oversight -- that responsibility belongs to the MSDH. They have a Federally-approved sampling program that meets EPA requirements. They also have regional engineers who are in the field much of the time addressing compliance and discussing other issues with the system operators. It is attribute to their competence that Mississippi enjoys one of the highest compliance rates for PWSs in the nation. Additionally, the Agricultural Chemical (AgChem) Ground Water Monitoring program at MDEQ has sampled a number of PWS wells but has not found any analytical results that contradict the MSDH's data.

#5 (In response to comment about natural protection provided by overlying confining layers) Well, that's partly due to the fact that we are lucky enough to have a lot of our wells in confined aquifers. ...However a confined aquifer is not totally safe. If you've got contaminants with low volatility, they will go right through the casing - or low enough viscosities.

State's response:

The safety net afforded by confined aquifers is directly related to the thickness of the overlying confining layer(s), the homogeneity of the confining material, and the occurrence of nearby wells that have breached the confining layer. In order for an aquifer to be classified as confined by SWAP, at least thirty feet of homogeneous confining material (usually clay in Mississippi) must be indicated by either a driller's log or electric log. In addition, occurrences of contaminant detects are reviewed for wells screened in these aquifers which could suggest either the lack of an homogeneous confining layer or a problem with the integrity of the well casing. The focus of the PCS inventory in confined aquifers is the existence of wells that have breached the confining layer of the PWS well.

One incident did occur in Mississippi where two PWS wells screened in a confined aquifer became contaminated with the solvent, trichloroethylene (TCE). Although site assessments could not determine the source of contamination, subsequent anonymous reports have alleged that the solvent was unlawfully disposed of down a nearby abandoned well casing.

#6 What about agricultural wells, where people are using chemigation for irrigation? They are applying their fertilizer and pesticides through the well water. And if you don't have a properly sealed flap gate on the casing, anything that is left in the supply tank goes back down the casing into the aquifer without any delay of having to percolate.

State's response:

The issue of backflow contamination through irrigation wells as a result of chemigation is a serious ground water quality issue that is recognized by the SWAP. Currently, regulations do not exist that require backflow eliminators (check valves) on irrigation wells. In the absence of regulation, public education efforts addressing this issue need to be included as an element of source water protection.

#7 Most of the irrigation wells in the Delta tap into a basement gravel deposit at the bottom of the Pleistocene fill in the alluvial cover, and there's less than a twenty-four hour response time as much as fifty or sixty miles away from the Mississippi River whenever a high flood stage goes past the Mississippi so there is, obviously, interflow coming from the Mississippi all the way back under all of those wells. And there's no telling what kind of contaminants we've got coming in the Mississippi.

State's response:

The AgChem program has sampled over 700 wells throughout the state, most of which are located in the Delta region, but has not found a serious problem yet in the shallow Mississippi River Alluvial Aquifer. This is probably due to the existence of an overlying clay deposit which naturally restricts infiltration and attenuates certain chemicals. Two PWSs in the state have wells that are screened in this aquifer but are routinely sampled for water quality. To date, the MSDH has not determined that those wells are under the direct influence of surface water.

#8 If you are looking at deep wells as potential contaminant sources for public water supplies, the irrigation wells usually bottom out at 130 to 250 feet so they are not that much of a concern. I think most of the Delta water supplies are in the Sparta Aquifer.

State's response:

Most of the PWS wells located in the Delta region are screened in the confined Sparta or Meridian/upper Wilcox aquifers.

#9 If you've got an oil and gas well going in, does the DEQ attempt to do any regulation on whether or not there is disposal of production fluids or reinjection? ...who is going to sit on the wellhead the whole time and watch what they [drilling and completion contractors] are doing?

State's response:

The State Oil & Gas Board is the primacy agency that regulates oil & gas drilling and production activities in the state. This includes disposal and/or reinjection of production fluids.

#10 How many people is it going to take to do all this survey [assessment] work?

State's response:

The best projection can be found in Appendix N of the SWAP plan which includes the projected 4-year work plan for SWAP development and implementation. The biggest remaining question is completion of the PCS inventory. Contractors may be required to assist in completing this element.

#11 Can you identify source areas for aquifer recharge by the geochemical signatures?

State's response:

Certainly, that is a hydrologic investigative procedure that is used for a variety of applications. However, such an application generally goes beyond the scope of SWAP in that the assessments are focused on a limited defined area surrounding PWS wells or surface water intakes. SWAP does address recharge areas that are located within or adjacent to delineated SWPAs.

#12 Do your MCLs relate to chemical contaminants? Are sediments excluded?

State's response:

The MCLs addressed by SWAP can be found in Appendix L of the SWAP plan. Included in the list of MCLs are chemical constituents, viruses, bacteria, and other micro-organisms. The only mention of sediments is the potential relationship between turbidity for surface water sources and pathogens.

#13 Is this program designed [only] for public water supplies? What about the private sector?

State's response:

As is the case for the Wellhead Protection Program, SWAP addresses only regulated PWSs. Domestic, irrigation, and industrial wells are not addressed unless they are also used to supply drinking water to at least 25 people.

#14 Are privately-owned water systems regulated?

State's response:

Privately-owned water systems that serve 25 or more people are defined as PWSs. As a result, they are subject to SDWA regulations as administered by the MSDH. Domestic water wells are not regulated.

#15 How often are PWSs required to sample their incoming and outgoing water purities, and how much notification time are they given to let their consumers know that they've got a problem? ...How does notification occur?

Response (by Mr. Gordon Tollison, President of ABE, a privately-owned company that operates 13 PWSs in the Oxford area):

Bacteriological testing is required monthly with the number of samples taken based on population. MSDH analyzes the samples and reports the results back within several days. Resampling is required if a detection is found. If any detects are found in the resamples, the system is classified as non-compliant and public notification is required. Each PWS must have an approved sampling plan as well as an approved public notification plan which lists all the specific media outlets which must be used. Raw and finished water sampling for numerous other potential contaminants is also routinely performed in accordance with EPA requirements. These include volatile organics, synthetic organics in some cases, inorganic, nitrates, radionuclides, and others. The MSDH has a good historic databases of the analytical results.

#16 You said MDEQ is basically just a support agency, and that the Health Department is supposed to be running this. Is there anybody here from the Health Department?

State's response:

MDEQ is not a support agency, but has a supporting role in the development of the State SWAP. The Mississippi State Department of Health (MSDH) has been deeply involved with the development of all SWAP elements. In addition to routine interaction Bill Wall, Associate Director of MSDH's Division of Water Supply and MSDH SWAP Contact, other members of the SWAP Advisory Committee include Lydia Strayer, Director of MSDH's Division of Sanitation, and Dr. Mary Currier, State Epidemiologist. David Mitchell, Director of MSDH's Division of Water Supply, and Dr. Robert Hotchkiss, Director of MSDH's Community Health Division have also played vital roles and attended multiple Advisory Committee meetings.

#17 Are you on schedule with your implementation timeline?

State's response:

The implementation timeline addresses the four major elements of SWAP development. The Strategic Planning and Data Management/GIS elements are on schedule. In fact, with submittal of the SWAP document to EPA Region IV, the major issues contained in those two elements will have been completed. The Aquifer Confinement Verification process is on schedule and with the completion of the GIS element, the delineation processes are ready for implementation. Since the development of the implementation timeline, the State has discovered new options for performing the PCS Inventory element which could significantly reduce the time needed to perform all of the inventories. Because of these options, the State is currently focusing its efforts on determining aquifer confinement which determines what areas need to be inventoried. In regard to the status of the susceptibility analysis element, the State has plans to automate this element which will dramatically reduce the time needed for its completion. States have the option to request an 18 month extension for completion of all SWAP activities. It is anticipated that most states will request the extension. As a safeguard, Mississippi also will request a program extension.

#18 Is this a continually-evolving program? What happens after two years of implementation?

State's response:

From the standpoint of performing assessments on existing PWS wells and intakes during the its implementation period, the program is fixed. However, the State is required to address the issues of updating the assessments and source water protection, both of which are open-ended. The current absence of funding clouds a definitive response; however, the State desires to coordinate the assessment updates with the 5-year basin rotation cycle that is a part of the Basin Approach under development by the Surface Water Division of MDEQ. In addition, the structure of SWAP has been developed so that it will provide the basis for future implementation of a protection program.

#19 Which GIS platforms are you using? Why are you not using State plotting coordinates?

State's response:

The SWAP GIS uses ArcInfo software -- the industry standard for GIS applications. Coverages developed for the SWAP application use the Mississippi Transverse Mercator coordinate system -- the State designated coordinate system.

#20 When you start the on-site assessment, do you plan on involving the water well owners or water supply officials or operators or people that are involved? Are they going to have to participate or

are they going to have an opportunity to participate? ...I think if you don't let the water supply officials or operators, in particular, get involved in it, you may overlook some contaminant sources like unlocated abandoned wells or other things like that.

State's response:

The ultimate success of the program lies with local water system operators "buying into" and participating in the implementation of the program. During implementation, probably the greatest area for operator participation is during the PCS inventory, when local knowledge of the locations of PCSs could greatly improve the quality and accuracy of each inventory. In addition, operators will be required to play key roles during the notification and education processes when the results of the assessments are made available to them, their consumers, and the general public.

#21 Once deficiencies or problems that might cause you to be ranked in a high risk area are determined, who is going to have to pay for correcting those, or what is going to be some kind of a program available for people to address them? ...The only concern I have is that this might lead into another program where we might help locate the problems, and then the EPA gives us 6 months to fix the problems at our expense or they put us in jail and I don't want it to turn out to be that kind of a deal.

State's response:

The implementation of the Wellhead Protection Program has revealed that a large majority of PCS sites were found to contain material storage and/or operating concerns that could easily and inexpensively have those concerns corrected. Additionally, it is believed that an effective public education program could have mitigated the number of occurrences and degree of impact found at the sites. It is anticipated that many owners and/or operators of PCS sites where material storage and/or operating concerns are found to exist will be motivated to correct those concerns in order to improve the susceptibility ranking of the PWSs. Statutory and regulatory authority already exist to address serious violations and to protect human health and the environment.

A significant issue addressed throughout the SWAP plan is source water protection. From both the original SDWA legislation and EPA guidance, it is clear that the intent was for States to develop SWAP plans with the ultimate goal of having the developed data used for future source water protection and management applications. However, currently there is no mandate for the development of a Source Water Protection Program, although the protection of our drinking water supplies should be everyone's concern.

(From the MDEQ North Regional Office administrator) *One analogy could be the 303(d) surface water assessment program -- the State has been assessing the threats or stresses that the streams in our state are under and then developing an action plan to reduce those threats or stresses.*

#22 (In response to the previous response correlating the implementation process with that of the 303(d) program) Are you looking at the surface water that is currently moving? Are you sampling the sediments from the bottom of the water bodies to analyze for contamination?

State's response:

The 303(d) list covers only surface waters and does not include sediment load information. It also looks at indicator organisms and takes a holistic approach to a watershed, not using just a single assessment point. Initially, a short assessment is performed and then later a more-detailed assessment. The program is only in its second or third year of implementation.

#23 On your risk areas, are you making any attempt to see if there is any fresh water infiltration across drainage divides into a catchment area so that you've got a compound and pollution source area that is not reflected from the surface department? ...You've got it in practically every watershed, the surface drainage divides do not totally reflect the contributing areas. ...You have that same trouble with underground aquifers, too, where you get leakage from one aquifer to another, even in confined aquifers, so you have that same problem. There are places where that occurs naturally, but there are also manmade interconnections.

State's response:

The interaction of surface water and ground water is a fundamental issue in hydrology. Certainly, the occurrence of such interaction exists throughout the surficial aquifers of the state. However, from the standpoint of establishing a program that can clearly define its objectives and reach its goals, a system approach is necessary. From the standpoint of surface water sources of drinking water, the systems being identified are individual watersheds. The boundaries of SWPAs are based on time-of-travel rates. In addition, buffer and/or protection zones have been established using a conservative approach to err on the side of protection, should actual situations differ from the conceptual plan.

No further comments or questions were received.

APPENDIX E

ADDITIONAL STAKEHOLDERS SOLICITED FOR COMMENTS

Identified by the State:

Mississippi Forestry Association
620 North State Street, Suite 201
Jackson, MS 39202-3398

U.S. Oil & Gas Association
210 East Capital Street
Jackson, MS 39205

Mississippi Loggers Association
1128 Flowood Drive
Flowood, MS 39208

Pearl River Basin Development District
2304 Riverside Drive
Jackson, MS 39296-5332

Tombigbee River Valley Water Mang. Dist.
P.O. Box 616
Tupelo, MS 38802

Tenn-Tom Waterway Develop. Authority
P.O. Drawer 671
Columbus, MS 39703

Mississippi Poultry Association
720 North President Street
Jackson, MS 39202

Mississippi Rural Health Association
31 Woodgreen Place
Madison, MS 39110

Associated General Contractors of Mississippi
P.O. Box 12367
Jackson, MS 39236-2367

Mississippi Nurses Association
31 Woodgreen Place
Madison, MS 39110

Mississippi Lumber Manufacturers Association
P.O. Box 5241
Jackson, MS 39296

Mississippi Trucking Association
767 North President Street
Jackson, MS 39202

Mississippi Restaurant Association
P.O. Box 16395
Jackson, MS 39236

Magnolia Veterans Association
P.O. Box 31336
Jackson, MS 39286-1336

Mississippi Pest Control Association
P.O. Box 12741
Jackson, MS 39236

Note: No comments were received from any of these solicited parties prior to submittal of this document to EPA on February 5, 1999.

Public Requests for Draft SWAP Plans:

Mr. Rick Zerkus
Picayune, MS

Mr. Jim Pratt
Oxford Eagle
Oxford, MS

Mr. Jim Kidd
Faulkner, MS

Ms. Celina Johnson
Williford, Gearheart & Knight
Hazlehurst, MS

Mr. Dee Layman
Jackson, MS

Mr. Frank Taylor
McGowan Operating Company
Jackson, MS

Ms. Christine White
Abbeyville, MS

Mr. Craig Ryals
IMS Engineers
Jackson, MS

Ms. Gloria Walker
Jackson, MS

Mr. Ken Ruckstuhl
Malcolm-Pirnie
Jackson, MS

Mr. Robert Wilson
Puckett, MS

Mr. C.E. Williams
Jackson, MS

Comments Received:

Mr. James V. Kidd:

Well drillers should be made to do the job right ...men and women who work for DEQ should do their job truthfully and honestly, and not undermine and cover up for one another ... Federal and State money for the programs should be fair for all of the people in Mississippi ...I am concerned about the water problem ... put me on your mailing list.

State Response:

The Missions and Values Statement adopted by MDEQ stresses doing the job right, truthfully and honestly, fairly and equitably. These values are honored by all SWAP personnel.

Mr. Ken Ruckstuhl:

I would suggest that all reports, including public drafts, be posted on MDEQ's website within 30 days of when hard copies are made available.

State's Response:

The State will post all results on MDEQ's website as quickly as possible after the release of the assessment reports.

APPENDIX F

DELINEATION OF SOURCE WATER PROTECTION AREAS FOR PUBLIC WATER SYSTEMS

1.0 INTRODUCTION

Mandates associated with the Source Water Assessment Program (SWAP) impose deadlines on states to address and complete all components of the new program by 2003. Mississippi's approved Wellhead Protection Program (WHPP) set forth a methodology that can be used to address certain required elements of SWAP (i.e., delineation of protection areas and inventory of potential contaminant sources). However, the WHPP requires the establishment of wellhead protection areas with a fixed 1-mile radius around all public water supplies (PWSs) using confined aquifers as a source of potable water. After reassessing the WHPP, it has become apparent that attempting to inventory such large protection areas (3.14 square miles) within the prescribed time frame dictated by SWAP is a daunting task and probably cannot be realized using the limited resources available to this task.

Another problem to the completion of SWAP objectives identified during program reassessment was the considerable amount of time demanded of the MDEQ staff to complete the detailed hydrogeologic assessments required for the delineation of wellhead protection areas associated with unconfined aquifers. It became obvious that the imposed time constraints of the SWAP would not allow staff to spend the necessary months performing such detailed hydrogeologic assessments for such a small number of public water supply (PWS) wells. Realization of this obstacle influenced the opinion of MDEQ to pursue a new delineation methodology that will adequately address protection of PWS wells using unconfined aquifers.

It is widely accepted by states that geographic information system (GIS) technology must play a major role in SWAP development if program objectives are to be met within the imposed guidelines. MDEQ set out to devise a new approach for delineation of protection zones that is logical yet straightforward and that will allow full use of GIS capabilities. This new approach not only will be assimilated into the new SWAP but also into the revised State WHPP. Paramount to the development and adoption of this new strategy are the requirements that PWSs be adequately protected and that the methodology be defendable.

2.0 PROPOSED DELINEATION METHODOLOGY

2.1 Wellhead Protection Areas

The existing WHPP stipulates delineation of the following three zones of protection for PWS wells based on aquifer confinement:

(1) Zone 1 -- All wellheads must be secured within a locked fence or building;
(2) Zone 2 -- A 250-foot radius is required around all wells using confined aquifers. The larger areal extent of either a 90-day time-of-travel or a 500-foot radius must encompass all wells using semi-confined or confined aquifers.
(3) Zone 3 -- A 1-mile fixed radius imposed around public water supply (PWS) wells using confined aquifers and a 10-year time-of-travel is delineated for PWSs using semi-confined or unconfined aquifers.

2.2 Zone 1

The proposed new delineation methodology for SWAP and WHPP still maintains the requirement that all wellheads are to be surrounded by a fence with a locked gate and/or a building with a locked door, however, these areas will not be designated as a formal protection zone. It is proposed that only two zones of protection (i.e., Zones 1 and 2) be incorporated into the SWAP and revised WHPP. Zone 1 will encompass a 250-foot fixed radius around all PWS wells screened in confined aquifers and a 500-foot fixed radius around all PWS wells screened in unconfined aquifers.

The WHPP plan made reference to "semi-confined" conditions for aquifers. The new approach will only recognize aquifers as either confined or unconfined. If there is any uncertainty as to the confinement of an aquifer, it will be considered unconfined and the effected PWSs will be obligated to meet the appropriate requirements of Mississippi's SWAP.

2.3 Zone 2

It was apparent early on in the development process that MDEQ's GIS could be designed to accommodate a calculated fixed-radius (circular) approach for Zone 2 delineations without overly taxing the limited staff. However, it was noticed that using a fixed-radius approach in the traditional manner requires inventorying for potential contaminant sources (PCSs) in large areas extending down gradient past the null points or stagnation points of capture zones for wells. In reality, any sources identified in those down-gradient areas should not adversely impact the capture zones of wells. Eventually, staff decided to modify the calculated fixed-radius approach to make it more indicative of actual ground

water flow patterns. Because the WHPA code is an EPA-approved delineation tool which yields results typically skewed in the up-gradient direction from which ground water is naturally moving, attempts were made to adapt the results generated from the model to a new calculated fixed-radius approach. Since the WHPA code was designed so that it does not actually distinguish between unconfined and confined aquifers, the MDEQ proposes using the new delineation technique for both types of aquifers in most cases.*

* An exception to this proposal will be discussed as Scenario 9 in Section 2.3.3.

2.3.1 Zone 2 Delineation

Eight basic scenarios are proposed for the delineation of Zone 2 source water protection areas (SWPAs) in conjunction with aquifers that exhibit flows of ground water in a discernable direction. Although this approach requires using eight different calculated fixed radii, all of the scenarios were developed using the same fundamental delineation approach:

- The WHPA code model (MWCAP) was run using established input parameters. Available data from the U.S. Geological Survey (USGS) and the MDEQ's Office of Land and Water Resources and the Office of Geology were used to identify representative examples and characteristic patterns and trends associated with Mississippi's aquifers and PWS wells. The data were incorporated into the various computer runs and pumping scenarios that were attempted.

- The overall length of capture zones from the WHPA-generated plots were determined. Next, the lengths were divided in half to establish the fixed radii (distance) for the delineations (Figure 3-1, Chapter III).

- Circles were drawn from the center point of the capture zone plots using the established fixed radii; the circles correspond to the delineated SWPAs (Figure 3-2, Chapter III). The resulting delineations are circles that closely resemble the plots generated using the WHPA code which have most of their encompassed area projected up gradient from the wells and have more realistic (smaller) areas projected down gradient past the wells.

Another noticeable difference between the two types of delineation is that the fixed-radius approach typically includes somewhat larger protection areas along the periphery than the plots generated using the WHPA code.

Note: With actual SWPAs, the center points of the circular delineations will not correspond with the established (GPS determined) locations of PWS wells. Instead, the delineations will be shifted or offset a prescribed distance directly up gradient from the

actual wellheads depending upon the scenario. These distances will be determined by subtracting the fixed radii of the SWPAs from the calculated null points of each scenario (Figure 3-3, Chapter III).

- The many model runs generated during this evaluation process were compared to the results obtained from solving basic ground water equations (e.g., Theis equation, uniform flow equation, and volumetric flow equations). Comparing the results obtained from solving the equations with various proposed calculated fixed-radii allowed for some necessary "tweaking" of the proposed SWPAs to ensure good fits for various pumping scenarios.

  Once the methodology is approved, MDEQ's GIS will be programmed to handle the delineation of SWPAs rather easily. The GIS will be programed to delineate the six fixed radii based on pumping rates and will automatically calculate the required well offsets so that the delineated areas are moved the correct distance up gradient to conform with the methodology.

2.3.2 Input Parameters

Because the proposed delineation methodology is fundamentally based upon running the WHPA code, it is important that the input parameters selected for specific scenarios are explained. The following parameters are required for input into the WHPA code:

- **Discharge or Pumping Rate (Q)**

  The rate of pumping associated with PWS wells in Mississippi is quite variable depending upon the size of the well, how the well was completed, and various aquifer characteristics. Discharges range from less than 25 gpm for some of the smaller PWS wells to more than 2,000 gpm for large PWS wells in productive aquifers. Using information included in the U.S. Geological Survey's Open File Report 92-82 entitled *Records of Public-Supply Wells in Mississippi, 1991*, the average reported discharge rate of 2,290 PWS wells in the state is 351 gpm. In reality, the discharge rates for most of the wells are almost certainly less than those found in the report, since most of the reported values are based upon initial well completion data. It is commonly accepted that the productivity of water wells gradually decreases as their efficiency declines over time.

  Based upon information included in the USGS report, the decision was made to place the various discharge rates for the PWS wells into particular ranges, thus including them into one of the following eight pumping categories:

(1) 100 gpm for 242 wells with discharges ≤ 100 gpm;
(2) 250 gpm for 936 wells with discharges between 101 and 250 gpm;
(3) 500 gpm for 699 wells with discharges between 251 and 500 gpm;
(4) 750 gpm for 198 wells with discharges between 501 and 750 gpm;
(5) 1,000 gpm for 121 wells with discharges between 751 and 1,000 gpm;
(6) 1,500 gpm for 76 wells with discharges between 1,001 and 1,500 gpm;
(7) 2,000 gpm for 13 wells with discharges between 1,501 and 2,000 gpm; and
(8) 2,300 gpm for 3 wells with discharges ≥ 2,000 gpm.

❒ **Thickness (b)**

Without examining geophysical logs and/or well drillers logs for every PWS well in the state, there is no means of determining the available thickness of aquifers. Because information on the screened interval in water wells is readily available from well drillers logs, the decision was made to substitute screen length used during well completion for aquifer thickness. This decision was reached although it is common knowledge that most PWS wells are completed without screening the entire thickness of an available aquifer. Since the size of the protection area generated using the WHPA code is inversely proportional to the thickness of the aquifer, a conservative approach for delineation of protection zones is ensured by using the smaller screened intervals. Based upon information contained in the USGS Open-File Report 92-82, the screens used to complete PWS in Mississippi range in length from less than 15 feet to more than 100 feet; the average screen length for 2,284 PWS wells in the state is 52.22 feet. Calculated average screen lengths for PWS wells falling within the 6 pumping categories mentioned above include the following:

(1) 36 feet for wells with discharges ≤ 100 gpm;
(2) 47 feet for wells with discharges between 101 - 250 gpm;
(3) 55 feet for wells with discharges between 251 - 500 gpm;
(4) 64 feet for wells with discharges between 501 - 750 gpm;
(5) 62 feet for wells with discharges between 751 - 1,000 gpm;
(6) 72 feet for wells with discharges between 1,001 - 1,500 gpm;
(7) 83 feet for wells with discharges between 1,501 - 2,000 gpm; and
(8) 80 feet for wells with discharges ≥ 2,000 pgm.

❒ **Transmissivity (T)**

Summary of Aquifer Tests in Mississippi, June 1942 Through May 1988 (USGS Water-Resources Investigations Report 90-4155) reports transmissivity values ranging from < 1,000 to > 25,000 ft^2/d for aquifers in the state; the average transmissivity of the reported 574 tests is 7,110 ft^2/d. These results were evaluated and incorporated into numerous

computer runs using the WHPA code to develop the basic delineation methodology concept. Primarily based upon the staff's best professional judgement, transmissivity values ranging between 5,000 and 15,000 ft^2/d will be representative of the aquifers in Mississippi. These values when incorporated into the proposed pumping scenarios should provide a conservative approach to the delineation of SWPAs.

- **Porosity (n)**

With the exception of the fractured Paleozoic-aged aquifer used in northeast Mississippi for potable water supply, the aquifers of the state consist of unconsolidated sands and gravels. Although the reported porosity values for unconsolidated sand and gravel aquifers are quite variable, textbooks typically give ranges from 25% to 50%. Since lower aquifer porosities correspond to larger SWPAs, a conservative value of 30% was used for all proposed pumping scenarios. Using a 30% value should reflect the secondary porosity associated with the Paleozoic aquifer as well.

- **Time (t)**

The methodology prescribed in the WHPP plan stipulates a Zone 3 delineation based on a 10-year time-of-travel for PWS wells screened in unconfined aquifers. While reviewing this approach, it was noted that most ground water equations and computer models, such as the WHPA code, do not take into account any recharge of the aquifer occurring during the duration of pumping. Since recharge of the aquifers is naturally occurring throughout the withdrawal time, it is only logical to compensate for this phenomenon. Another consideration was that most PWSs spread out their pumping so that their wells are actually pumped less than 50% of the time. Even those systems with only one well available rarely pump the well more than 66% of the time. Because of these considerations, the MDEQ proposes using a 5-year time-of-travel for the pumping duration. This approach will allow some recharge of the aquifer to be considered and will provide more realistic pumping scenarios.

- **Gradient (I)**

No input parameter proved as troublesome to establish for the pumping scenarios as the hydraulic gradient. Although it is not unusual to find strata dipping up to 35 to 40 feet per mile in some areas of Mississippi, the potentiometric surfaces associated with the aquifers in the state generally reflect much lower hydraulic gradients. Potentiometric maps examined for the major aquifers in the state typically indicate gradients of approximately 10 feet per mile. In some areas of large ground water withdrawals, localized cones of depression reflect hydraulic gradients of up to 20 feet per mile or more.

After running the WHPA code while using various input parameters and following the proposed delineation methodology (described previously in Section 2.3.1), the hydraulic gradients of only those portions of the SWAPs extending up dip from the well locations were calculated using the Theis equation. Then the calculated gradients were compared to the gradients that had been input into the WHPA code during the computer runs. Adjustments in the hydraulic gradients were made (when necessary) to eventually establish comparable gradients that would agree with the results obtained from the other ground water equations. This portion of the scenario development process consisted of primarily "trial and error." Countless runs were made before selecting variable hydraulic gradients for the pumping scenarios which range between 8.5 and 20 feet per mile.

2.3.3 Pumping Scenarios

After performing various statistical analyses using the best available data, comparing the results of numerous model runs with results obtained from solving basic ground water equations, and relying on best professional judgement, seven pumping scenarios are proposed. Scenarios 1 - 6 represent average conditions that can be expected in most situations in Mississippi and are generally skewed to yield a conservative approach. Obviously, not all of the PWS wells in the state will fit perfectly into one of these scenarios. However, the new methodology takes full advantage of the natural protection afforded most (>90%) of the PWSs in the state which obtain their potable water supply from deep confined aquifers.

Because of the conservative approach applied in developing the proposed methodology and selecting the input parameters used in the various pumping scenarios, the results obtained vary only slightly whether delineating SWPAs and/or WHPAs for unconfined versus confined aquifers. Therefore, it is proposed that this delineation methodology be applied for all PWS wells screened in confined aquifers and for most of the PWS wells screened in unconfined aquifers. The exception is for those wells using unconfined aquifers that do not have an established hydraulic gradient.

- **SCENARIO 1** -- 242 PWS wells with discharges rated at ≤ 100 gpm

Records of Public-Water Supply Wells in Mississippi, 1991 indicates 242 wells with pump rates less than or equal to 100 gpm. Many of these PWSs either supply a small number of connections or operate wells in aquifers which are incapable of yielding large volumes of water.

- The WHPA model was run using the following input parameters:

Q	=	100 gpm
T	=	5,000 ft^2/d
n	=	30%
b	=	36 ft
t	=	5 yrs
I	=	0.001610 (8.5 ft/mi)

When scaled off, the resulting model-generated capture zone is 2,435 feet long and 1,670 feet wide. However, the null point for the capture zone only extends 370 feet down gradient which is an insufficient distance to allow for the Zone 1 required radius of 500 feet for PWS wells using unconfined aquifers. To offset this dilemma, an additional 135 feet were added to the length of the protection area which results in a null point of 505 feet and an overall length of 2,570 feet. (Note: An extra 5 feet were added to the difference of 130 feet (i.e., 500 ft - 370 ft = 130 ft) to make the overall length of the null point divisible by five).

- A fixed radius of 1,285 feet was determined by dividing 2,570 feet in half. Subtracting the null point length of 505 feet from the fixed radius of 1,285 feet results in an offset distance of 780 feet. This value means that the center point of the intended SWPA is shifted 780 feet up gradient away from the actual well location to conform to the methodology. The circular SWPA when delineated with a radius of 1,285 feet encompasses an area of 0.18 square miles.

- The uniform flow equation yielded a null point of 380 feet and a lateral boundary or total width of 2,394 feet. Both of these figures are relatively close to the Scenario 1 delineation results. The Theis equation was used to establish a hydraulic gradient for the generated plot of approximately 8.2 ft/mi in both confined and unconfined conditions.

❒ **SCENARIO 2** -- 936 PWS wells pumping between 101 and 250 gpm

- The WHPA model was run using the following input parameters:

Q	=	250 gpm
T	=	7,500 ft^2/d
n	=	30%
b	=	47 ft
t	=	5 yrs
I	=	0.001989 (10.5 ft/mi)

The model-generated capture zone is 3,400 feet long and 2,300 feet wide. The null point for this proposed scenario is 507 feet. (Note: A larger value of 514 feet was applied in establishing the proposed scenario.)

- A fixed radius of 1,700 feet was established for the scenario by dividing in half the model-generated capture zone length of 3,400 feet. An offset distance of 1,186 feet was established by subtracting the null point of 514 feet from the fixed radius of 1,700 feet. This calculation results in the center point of the circular delineation being moved 1,186 feet up gradient from the actual well location. The corresponding SWPA includes an area of 0.33 square miles.

- According to the uniform flow equation, the null point for the scenario is 514 feet and the total width of the SWPA is 3,228 feet. Both of these values are comparable to those generated by the WHPA code (i.e., 307 feet and 3,400 feet respectively). Adjustments were made to the hydraulic gradient used in scenario using the Theis equation until a best fit 10.5 feet per mile was established for the scenario.

❒ **SCENARIO 3** -- 700 PWS wells with discharges rated between 251 and 500 gpm

- The WHPA model was run using the following parameters:

Q	=	500 gpm
T	=	7,500 ft^2/d
n	=	30%
b	=	55 ft
t	=	5 yrs
I	=	0.003127 (16.5 ft/mi)

The scaled-off length of the WHPA-generated capture zone is 4,500 feet with a width of 2,967 feet and a null point of 650 feet. (Note: A larger null point of 654 feet was used in the proposed scenario.)

- Using a fixed radius of 2,250 feet results in a circular SWPA that includes a 0.57 square mile area. Subtracting 654 feet from 2,250 feet results in the center point of the delineated circle being offset 1,596 feet up gradient from the actual location of the PWS well.

- The null point of 654 feet and total width of 4,107 feet that were calculated using the uniform flow equation are comparable with the values estimated from the WHPA-generated SWPA. The hydraulic gradient used for the proposed WHPA

run (16.5 feet per mile) is similar to the values calculated for confined aquifers (16.5 feet per mile) and unconfined aquifers (17.0 feet per mile) using the Theis equation. The WHPA code does not take into account the high storage coefficients and corresponding lower drawdowns associated with unconfined aquifers, so the decision was made to use the lower 16.5 feet per mile gradient for this scenario.

- **SCENARIO 4** -- 199 PWS wells pumping between 501 and 750 gpm

  - The WHPA model was run using the following parameters:

Q	=	750 gpm
T	=	10,000 ft^2/d
n	=	30%
b	=	64 ft
t	=	5 yrs
I	=	0.003220 (17 ft/mi)

    The overall length of the WHPA-generated delineation is 5,180 feet; the estimated total width of the capture zone is 3,312 feet and the null point is 700 feet. (Note: A larger value of 714 feet was used for the null point in developing the scenario.)

  - With a fixed radius of 2,590 feet, the delineated SWPA encompasses an area of 0.76 square miles. The prescribed offset requires the center point of the circular protection area to be shifted up gradient 1,876 feet.

  - The null point (714 feet) that was calculated using the uniform flow equation matched up well with the scaled-off estimate from the WHPA computer run. But the calculated total width of 4,488 feet for the capture zone using the appropriate flow equation is much smaller than the SWPA diameter of 5,180 feet. (Note: An attempt was made to tweak the length of the width to compensate for this discrepancy; however, since it resulted in unfavorable changes to the other parameters and a less conservative overall approach, the decision was made to leave the proposed scenario in this configuration.) A comparison of the 17 feet per mile hydraulic gradient used in the WHPA run with various estimates calculated with the Theis equation yielded a good match.

❒ **SCENARIO 5** -- 121 PWS wells withdrawing between 751 and 1000 gpm

- The WHPA model was run using the following parameters:

Q	=	1,000 gpm
T	=	12,500 ft^2/d
n	=	30%
b	=	62 ft
t	=	5 yrs
I	=	0.002936 (15.5 ft/mi)

The scaled off length of the WHPA-generated capture zone is 6,080 feet, the width is 3,040 feet, and the null point is 825 feet. (Note: A larger value of 836 feet was used for the null point.)

- A circular SWPA with a fixed radius of 3,040 feet covers an area of 1.04 square miles. Subtracting 836 feet from 3,040 feet yields an offset of 2,204 feet from the center point of the SWPA.

- As determined by the uniform flow equation, the total width of the capture zone is 5,250 feet and the null point is 836 feet. When compared to the diameter of the proposed circular SWAP (6,080 feet), this calculation does not agree as closely as some of the other scenarios. However, as in Scenario 4, this approach ensures a conservative approach. Both the calculated hydraulic gradients for confined and unconfined aquifer conditions agree with the proposed gradient of 15.5 feet per mile.

❒ **SCENARIO 6** -- 76 PWS wells with discharge rates between 1,001 and 1,500 gpm

- The WHPA model was run using the following input parameters:

Q	=	1,500 gpm
T	=	15,000 ft^2/d
n	=	30%
b	=	72 ft
t	=	5 yrs
I	=	0.003125 (16.5 ft/mi)

The overall length of the WHPA-generated capture zone is approximately 6,830 feet, while the total width is estimated at 4,467 feet and the null point is 967 feet. (Note: A larger value of 981 feet was used for the null point.)

- Dividing the capture zone length in half yielded a fixed radius of 3,415 feet. Subtracting the null point from the fixed radius produced an offset distance of 2,434 feet for the center point of the SWPA. The calculated area of the SWPA is 1.32 square miles.

- Calculations derived from using the uniform flow equation predicted the null point of the capture zone to be 981 feet and the total width to be 6,166 feet. These represent good matches with other calculations of the null point and width. Estimates of the hydraulic gradient using the Theis equation matched up well with the gradient of 16.5 feet used in the scenario.

❒ **SCENARIO 7** -- 13 PWS wells pumping between 1,501 and 2,000 gpm

- The WHPA model was run using the following parameters:

Q	=	2,000 gpm
T	=	16,600 ft^2/d
n	=	30%
b	=	83 ft
t	=	5 yrs
I	=	0.003504 (18.5 ft/mi)

The overall length of the model-generated capture zone is 7,370 feet and the width is 4,800 feet.

- When the null point of 1,054 feet is subtracted from the fixed radius of 3,685 feet, the resulting offset distance of the center point for the SWPA is 2,631 feet. The calculated area of the SWPA is 1.53 square miles.

- The set parameters for the scenario matched up well with other calculations (e.g., Theis equation, uniform flow equation, etc.) that were used for comparison sake.

❒ **SCENARIO 8** -- 3 PWS wells with pumping rates in access of 2,001 gpm

- The WHPA model was run using the following input parameters:

Q	=	2,300 gpm (the largest pumping rate in Mississippi)
T	=	16,600 ft^2/d
n	=	30%
b	=	80 ft

t = 5 yrs
I = 0.003788 (20 ft/mi)

When scaled off, the WHPA-generated capture zone is 8,080 feet in length and 5,167 feet in width.

- Subtracting the null point of 1,122 feet from the established fixed radius of 4,040 feet yields an offset of 2,918 feet for the capture zone's center point. The calculated area of the SWAP is 1.84 square miles.

- The set parameters for the scenario matched up well with the calculations derived from the equations and methods used throughout the various delineation exercises.

❒ **SCENARIO 9** -- Special cases involving PWS wells screened in unconfined aquifers

In certain circumstances it is impossible to establish a single hydraulic gradient direction for unconfined aquifers that can be used in accordance with the WHPA code. Such cases may exist if the ground water flow direction either cannot be determined or is highly variable depending upon local factors and conditions. Examples of situations where this type of hydraulic gradient can be expected are those PWS wells located on the crests of topographic hills and ridges or those wells under direct influence of surface water (e.g., City of Vicksburg). Since the promoted delineation methodology for Scenarios 1 - 8 only relates to aquifers with reasonably stable hydraulic gradients with discernable directions of ground water flow, Scenario 9 is proposed to cover the unique cases that do not meet these gradient criteria. To compensate for these situations, the MDEQ proposes to utilize a standard calculated fixed-radius approach for the delineation of Zone 2 protection areas in such identified cases. This approach will incorporate aquifer-specific and well-specific data into the calculations while maintaining the 5-year time-of-travel used throughout the other delineation scenarios. An example exhibiting this delineation methodology is provided in Figure 3-4 (Chapter III).

APPENDIX G

AQUIFER CONFINEMENT VERIFICATION FORM

■ WELL IDENTIFICATION DATA

Public Water Supply _____ PWS ID Number _____

PWS Well Number _____ OLWR Permit Number _____ USGS ID Number _____

■ WELL COMPLETION and AQUIFER DATA

Top of Aquifer: DD _____ft MSL _____ft S/T ___ / ___ Aquifer Code: _____ S/T ___ / ___

Base of Aquifer: DD _____ft MSL _____ft Pumping Rate (gpm): _____ S/T ___ / ___

Top of Screen: DD _____ft MSL _____ft S/T ___ / ___ Surface Elevation: _____ft S/T ___ / ___

Base of Screen: DD _____ft MSL _____ft GW Flow Direction: _____° S/T ___ / ___

Static Water Level: DD _____ft MSL _____ft S/T ___ / ___ Is Aquifer Fully Saturated ? (y/n) _____

Completion Date: _____

DD: Drilled Depth

MSL: Reference Datum is Mean Sea Level

Data Source (S): A - OLWR
B - OG
C - USGS
D - MSDH
E - OPC

Data Type (T): 1 - Drillers Log
2 - Electric Log
3 - Program Files
4 - Well Schedule
5 - Permit Application / Notice of Claim Form
6 - Potentiometric Map

■ CONFINING LAYERS OVERLYING THE SOURCE AQUIFER*

Confining Layer #1:

Top: DD _____ft MSL _____ft Lithology _____ S/T ___ / ___

Base: DD _____ft MSL _____ft Thickness _____ft

Confining Layer #2:

Top: DD _____ft MSL _____ft Lithology _____ S/T ___ / ___

Base: DD _____ft MSL _____ft Thickness _____ft

Confining Layer #3:

Top: DD _____ft MSL _____ft Lithology _____ S/T ___ / ___

Base: DD _____ft MSL _____ft Thickness _____ft

Total Thickness of Confining Layer(s): _____ft

* If more than 3 confining layers exist, list the 3 thickest confining layer intervals above the source aquifer.

■ AQUIFER CONFINEMENT CLASSIFICATION

Aquifer Confinement Classification: _____ **1 - confined** **2 - unconfined** **3 - unknown**

Basis of Classification (from criteria listed below): _____

To be classified as a confined aquifer, one of the following criteria must be met (listed in order of priority):

a. **Minimum total thickness of 30 feet of overlying confining layer(s);**
b. **Minimum head difference of 10 feet between the source aquifer and an overlying aquifer above the confining layer; or**
c. **A significant difference in water chemistry between the source aquifer and an overlying aquifer above the confining layer.**

Aquifers that do not meet one of the above-listed criteria will be considered to be unconfined. In the event that insufficient or conflicting data exist that prevent assigning a definitive aquifer confinement classification, then the aquifer confinement for the well will be determined to be "unknown."

■ SOURCE WATER PROTECTION AREA (SWPA) DELINEATION SCENARIO

The following eight SWPA delineation scenarios have been developed for SWAP purposes. The primary basis for determination of the delineation scenario assigned to a well is its pumping rate. A ninth delineation scenario (not listed below) is reserved for special cases where wells exhibit variable hydrologic gradients.

Scenario	Pumping Rate	Transmissivity	Radius	Thickness	Gradient	Null Point	Offset	Area
#1	0 - 100 gpm	5,000 ft^2/d	1,285 ft	36 ft	8.5 ft/mi	505 ft	775 ft	0.19 mi^2
#2	101 - 250 gpm	7,500 ft^2/d	1,700 ft	47 ft	10.5 ft/mi	514 ft	1,186 ft	0.33 mi^2
#3	251 - 500 gpm	7,500 ft^2/d	2,250 ft	55 ft	16.5 ft/mi	654 ft	1,596 ft	0.57 mi^2
#4	501 - 750 gpm	10,000 ft^2/d	2,590 ft	64 ft	17.0 ft/mi	714 ft	1,876 ft	0.76 mi^2
#5	751 - 1,000 gpm	12,500 ft^2/d	3,040 ft	62 ft	15.5 ft/mi	836 ft	2,204 ft	1.04 mi^2
#6	1001 - 1500 gpm	15,000 ft^2/d	3,415 ft	72 ft	16.5 ft/mi	981 ft	2,434 ft	1.32 mi^2
#7	1501 - 2,000 gpm	16,600 ft^2/d	3,685 ft	83 ft	18.5 ft/mi	1,054 ft	2,631 ft	1.53 mi^2
#8	> 2,001 gpm	16,600 ft^2/d	4,040 ft	80 ft	20.0 ft/mi	1,122 ft	2,918 ft	1.84 mi^2

■ COMMENTS

_____

_____

_____

_____

_____

_____

Person Verifying Confinement: _____ **Date:** _____

APPENDIX H

PCS No.

SOURCE WATER ASSESSMENT INVENTORY FORM

■ FACILITY / SITE DATA

Owner / Business _____ County _____

Address _____ Latitude _____

City _____ State _____ Longitude _____

Zip _____ Telephone _____ Source ___ (1-GPS; 2-Cogo; 3- Topo)

■ SITE DESCRIPTION

_____

_____

_____

Status of Site: (circle applicable) Active Abandoned Unknown

■ OWNERSHIP

Type: (circle applicable) Federal State County Local Govt. Private

■ LAND CHARACTERIZATION

Type: (circle applicable) Residential Commercial Industrial Agricultural

Forested Unimproved

■ SIGNIFICANT POTENTIAL CONTAMINANT SOURCES

PCS Type: (circle all applicable) AST Water well Container / drum storage

Class V well Automotive / equipment maintenance shop

Oil & gas production facility

Description of Potential Contaminant (s) Found with Estimated Volume:

Do any material storage or operating concerns exist ? **(yes / no)** _____ **If yes, describe:** _____

■ OTHER COMMENTS

Inventory Performed by: _____ **Date:** _____

APPENDIX I

REGULATED CONTAMINANTS COMMONLY FOUND AT POTENTIAL CONTAMINANT SOURCES

To help states and water suppliers assess the quality of their source water, EPA has created an index which helps identify likely sources of contamination and the contaminants that may be associated with them. To incorporate this information into the potential contaminant source (PCS) inventory process of the State SWAP, the index was edited to make it more applicable to the approach adopted by Mississippi. The edited version lists the PCS types and some related types that the State has designated fro SWAP inventory applications and identifies those contaminants most likely to be used, generated by, disposed of, or stored at that source type. The list identifies PCS types for both ground water (confined and unconfined aquifers) and surface water sources.

This index will serve as a field guide for inventory personnel as well as others who may be interested in watershed protection. For example, water purveyors can use the index to identify a PCS type and find a list of the contaminants commonly associated with it. The list of sources and contaminants is comprehensive but may not be exhaustive. The resources used in developing the list include:

- The Cadmus Group, Inc. "Standard Industrial Code -- Contaminant Database." Prepared under contract for the U.S. EPA, Office of Ground Water and Drinking Water, Sept. 30, 1996.
- Conservation Technology Information Center. "Groundwater and Surface Water: Understanding the Interaction." West Lafayette, IN: Conservation Technology Information Center.
- Lewis, Richard J., Sr., 1992. *Sax's Dangerous Properties of Industrial Materials*, 8th edition (New York, NY: Van Nostrand Reinhold).
- Oregon Department of Environmental Quality. Table 3-2 in "Oregon Wellhead Protection Program Guidance Manual."
- Sittig, Marshall. 1985. *Handbook of Toxic and Hazardous Chemicals and Carcinogens*, 2nd edition (Park Ridge, NJ: Noyes Publication).
- U.S. EPA, Office of Research and Development, Office of Water, 1993. "Wellhead Protection: A Guide for Small Communities." EPA/625/R-93/002.
- U.S. EPA, Office of Water, 1990. "A Review of Sources of Groundwater Contamination from Light Industry." EPA/440/R-90/005.

- U.S. EPA, Office of Research and Development, Office of Water, 1994. "Ground Water and Wellhead Protection." EPA/625/R-94/001.

- U.S. EPA, Office of Water. "A Consumer's Guide to the Nation's Drinking Water." EPA/815-K-97-002.

- U.S. EPA, Region 5 and Agricultural and Biological Engineering, Purdue University. Via: http://www.epa.gov/grtlakes/seahome/groundwater/src/quality2.html. Version 1.0, updated May 8, 1998.

- U.S. EPA, 1993. IRIS (Integrated Risk Information System). Via: http://rtk,net/T866.

- Whitten, Jon and Scott Horsely. U.S. EPA and American Planning Association. "A Guide to Wellhead Protection." PAS Number 457/458.

Source	Contaminant*
GROUND WATER SOURCES - UNCONFINED AQUIFERS	
Automobile, Body Shops/Repair Shops	**Arsenic**, Ammonium Persulfate, **Barium**, **Benzene**, **Cadmium**, **Chlorobenzene**, **Copper**, Creosote, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, Ethylene Glycol, **Lead**, Flouride, **1,1,1-Trichloroethane or Methyl Chloroform**, **Dichloromethane or Methylene Chloride**, **Nickel**, Nitric Acid, Phosphoric Acid (Ortho-), Sulfuric Acid, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Trichloroethylene or TCE**, Tin, **Xylene (Mixed Isomers)**
Confined Animal Feeding Operations	**Coliform**, Cryptosporidium, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, ***Giardia Lambia***, **Nitrate**, Nitric Acid, **Nitrite**, Sulfate, **Vinyl Chloride**, Viruses
Fleet/Trucking/ Bus Terminals	Acetone, **Arsenic**, **Acrylamide**, **Barium**, **Benzene**, **Benzo(a)pyrene**, **Cadmium**, **Chlorobenzene**, Chloroform, Creosote, **Cyanide**, **Carbon Tetrachloride**, **2,4-D**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene**, **Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthlate**, **Epichlorohydrin**, Formaldehyde or K157, **Heptachlor (and Epoxide)**, Hydrochloric Acid or Muriatic Acid, **Lead**, Lindane, **Mercury**, Methanol, **Methoxychlor**, Naphthalene or K156, **Pentachlorophenol**, Phosphoric Acid Ortho-, Propylene Dichloride or **1,2-Dichloropropane**, **Selenium**, **Styrene**, Sulfuric Acid, Sodium Cyanide, **Toxaphene**, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Diisocyanate (Mixed Isomers), **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**
Gas Stations	**cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene**, **Dichloromethane or Methylene Chloride**, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE
Injection Wells	**Atrazine**, **Alachlor**, Benomyl, Bromine, Chlorpyrifos, Cyanuric Acid, Calcium Hypochlorate, Chlorine, **Carbofuran**, **Dalapon**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene**, **Dichloromethane or Methylene Chloride**, **Diquat**, Diazinon, **Endothall**, Flouride, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, Methanol, Nitrosamine, Oxamyl (Vydate), Peroxide, Phosphates, **Picloram**, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, Sulfate, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE, Tin

Junk/Scrap/Salvage Yards	**Barium**, Benomyl, **Benzene**, Boric Acid, Chlorpyrifos, Chromated Copper Arsenic, **Copper**, cis **Dalapon**, 1,2-Dichloroethylene, **Diquat**, Diazinon, Epoxy, Ethylene Glycol, **Glyphosate**, Isopropanol, **Lead**, **N** Manganese, **ickel**, Nitric Acid, Nitrosamine, **Polychlorinated Biphenyls**, Phosphates, Sulfate, **Simazine**, Trichloroethylene or TCE, 1,1,2,2 - Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Tin
Machine Shops	Acetone, **Arsenic**, Aluminum (Fume or Dust), Ammonia, Ammonium Persulfate, **Barium, Benzene**, Boric Acid, **Cadmium**, Chlorine, **Chlorobenzene**, Chloroform, **Copper**, Creosote, **Cyanide**, **Carbon Tetrachloride 2,4-D**, **1,4-Dichlorobenzene or P-Dichlorobenzene, 1,2-Dichloroethane or Ethylene Dichloride, 1,1-Dichloroethylene or Vinylidene Chloride, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride, Di(2-ethylhexyl) phthlate, Ethylbenzene**, Ethylene Glycol, Flouride, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, **Hexachlorobenzene**, Hydrochloric Acid or Muriatic Acid, Hydrogen Cyanide, Isopropyl Alcohol (Manufacturing, Strong-Acid Process), **Lead**, **Mercury**, Methanol, Naphthalene or K156, **Nickel**, Nitric Acid, **Polychlorinated Biphenyls**, **Pentachlorophenol**, Phosphoric Acid Ortho-, **Selenium**, Strychnine, **Styrene**, Sulfuric Acid, Sodium Cyanide, **Tetrachloroethylene or Perchlorethylene (Perk)**, Tetrachloroethane-1,1,2,2 , Tin, **Toluene**, Toluenediisocyanate (Mixed Isomers) **1,1,1-Trichloroethane or Methyl Chloroform**,1,1,2-Trichloroethane, Trichloroethylene or TCE, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)
Motor Pools	**cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, 1,1,2,2 Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE
Railroad Yards/Maintenance/Fueling Areas	**Atrazine**, Ammoniacal Copper Arsenate, **Barium, Benzene, Cadmium**, Chlorine, Chromated Copper Arsenic, Copper Quinolate, **Dalapon, 1,4-Dichlorobenzene or P-Dichlorobenzene, cis 1,2-Dichloroethylene, trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, Polyurethane, **Lead, Mercury**, Tetrachloroethane-1,1,2,2 , Trichloroethylene or TCE, **Tetrachloroethylene or Perchlorethylene (Perk)**
Underground Storage Tanks	**Arsenic, Barium, Benzene, Cadmium, 1,4-Dichlorobenzene or P-Dichlorobenzene, Lead**, Trichloroethylene or TCE
Drinking Water Treatment	**Atrazine, Benzene, Cadmium, Cyanide**, Flouride, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead, Polychlorinated Biphenyls**, Phosphoric Acid Ortho-, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk), Toluene, Total Trihalomethanes, 1,1,1-Trichloroethane or Methyl Chloroform**

Septic Systems	**Atrazine**, **Alachlor**, Benomyl, Bromine, Calcium Hypochlorate, **Carbofuran**, Chlorpyrifos, **Coliform**, Cryptosporidium, Cyanuric Acid, **Diquat**, **Dalapon**, Diazinon, ***Giardia Lambia***, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, Methane, **Nitrate**, **Nitrite**, Nitrosamine, **Oxamyl (Vydate)**, Peroxide, Phosphates, **Picloram**, Sulfate, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, **Vinyl Chloride**, Viruses
Transportation Corridors	**Dalapon**, **Picloram**, **Simazine**, Sodium, Sodium Chloride
Wastewater	**Cadmium**, Chloroform, **Coliform**, Cryptosporidium, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, Flouride, ***Giardia Lambia***, Isopropanol, **Lead**, **Mercury**, **Nitrate**, **Nitrite**, **Tetrachloroethylene or Perchlorethylene (Perk)** **Selenium**, Sulfate, Tin, 1,1,2,2-Tetrachloroethane, Trichloroethylene or TCE, **Vinyl Chloride**, Viruses
Wells	**Atrazine**, **Alachlor**, Benomyl, Bromine, Chlorpyrifos, Cyanuric Acid, Calcium Hypochlorate, **Carbofuran**, **Diquat**, **Dalapon**, Diazinon, Flouride, **Glyphosate**, Heptachlor Epoxide, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, **Dichloromethane or Methylene Chloride**, Nitrosamine, **Oxamyl (Vydate)**, Peroxide, Phosphates, **Picloram**, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, Sulfate, Tetrachloroethane-1,1,2,2 , **Tetrachloroethylene or Perchlorethylene (Perk)**, Tin, Trichloroethylene or TCE
SURFACE WATER SOURCES	
Auction Lots/Boarding Stables	**Coliform**, Cryptosporidium, ***Giardia Lambia***, **Nitrate**, **Nitrite**, Sulfate
Confined Animal Feeding Operations	**Coliform**, Cryptosporidium, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, ***Giardia Lambia***, **Nitrate**, Nitric Acid, **Nitrite**, Sulfate, **Vinyl Chloride**, Viruses
Crops - Irrigated + Nonirrigated	Acetone, Ammonia, **Benzene**, **2,4-D**, **Dalapon**, **Dinoseb**, **Diquat**, **Glyphosate**, Lindane, **Lead**, **Nitrate**, **Nitrite**, Phosphoric Acid Ortho-, **Picloram**, **Simazine**, Sulfuric Acid, Turbidity
Lagoons and Liquid Waste	**Atrazine**, **Alachlor**, **Coliform**, Cryptosporidium, **Carbofuran**, **Diquat**, **Dalapon**, ***Giardia Lambia***, **Glyphosate**, Methane, **Nitrate**, **Nitrite**, **Oxamyl (Vydate)**, **Picloram**, Sulfate, **Simazine**, **Vinyl Chloride**, Viruses

Managed Forests	**Atrazine**, **Diquat**, Benomyl, Chlorpyrifos, Diazinon, **Glyphosate**, Nitrosamine, Phosphates, **Picloram**, **Simazine**, Turbidity
Pesticide/Fertilizer/Petroleum Storage	**Atrazine**, **Alachlor**, Benomyl, Chlorpyrifos, **Carbofuran**, **Chlordane**, **2,4-D**, **Diquat**, **Dalapon**, Diazinon, **1,2-Dibromo-3-Chloropropane or DBCP**, **Glyphosate**, **Nitrate**, **Nitrite**, Nitrosamine, **Oxamyl (Vydate)**, Phosphates, Phosphorus, **Picloram**, Strychnine, **Simazine**, 2,4-TP (Silvex)
Transportation Corridors	**Dalapon**, **Picloram**, **Simazine**, Sodium, Sodium Chloride

***Bold** - Denotes that contaminant is a National Primary Drinking Water Contaminant

APPENDIX J

SUSCEPTIBILITY ASSESSMENT REPORT
(Public Ground Water Systems)

■ WELL IDENTIFICATION DATA

Public Water Supply _____ PWS ID Number _____

PWS Well Number _____ OLWR Permit Number _____ USGS ID Number _____

■ WELL COMPLETION and AQUIFER DATA

Top of Aquifer: DD _____ft MSL _____ft S/T ___ / ___ Aquifer Code: _____ S/T ___ / ___

Base of Aquifer: DD _____ft MSL _____ft Pumping Rate (gpm): _____ S/T ___ / ___

Top of Screen: DD _____ft MSL _____ft S/T ___ / ___ Surface Elevation: _____ft S/T ___ / ___

Base of Screen: DD _____ ft MSL _____ft GW Flow Direction: _____° S/T ___ / ___

Static Water Level: DD _____ft MSL _____ftS/T ___ / ___ Is Aquifer Fully Saturated ? (y/n) _____

Completion Date: _____

DD: Drilled Depth

MSL: Reference Datum is Mean Sea Level

Data Source (S): A - OLWR
B - OG
C - USGS
D - MSDH
E - OPC

Data Type (T): 1 - Drillers Log
2 - Electric Log
3 - Program Files
4 - Well Schedule
5 - Permit Application / Notice of Claim Form
6 - Potentiometric Map

■ CONFINING LAYERS OVERLYING THE SOURCE AQUIFER*

Confining Layer #1:

Top: DD _____ft MSL _____ft Lithology _____ S/T ___ / ___

Base: DD _____ft MSL _____ft Thickness _____ft

Confining Layer #2:

Top: DD _____ft MSL _____ft Lithology _____ S/T ___ / ___

Base: DD _____ft MSL _____ft Thickness _____ft

Confining Layer #3:

Top: DD _____ft MSL _____ft Lithology _____ S/T ___ / ___

Base: DD _____ft MSL _____ft Thickness _____ft

Total Thickness of Confining Layer(s) _____ft

* If more than 3 confining layers exist, list the 3 thickest confining layer intervals above the source aquifer.

■ AQUIFER CONFINEMENT CLASSIFICATION

Aquifer Confinement Classification: _____ **1 - confined** **2 - unconfined** **3 - unknown**

Basis of Classification (from criteria listed below): _____

To be classified as a confined aquifer, one of the following criteria must be met (listed in order of priority):

a. **Minimum total thickness of 30 feet of overlying confining layer(s);**
b. **Minimum head difference of 10 feet between the source aquifer and an overlying aquifer above the confining layer; or**
c. **A significant difference in water chemistry between the source aquifer and an overlying aquifer above the confining layer.**

Aquifers that do not meet one of the above-listed criteria will be considered to be unconfined. In the event that insufficient or conflicting data exist that prevent assigning a definitive aquifer confinement classification, then the aquifer confinement for the well will be determined to be "unknown."

■ SOURCE WATER PROTECTION AREA (SWPA) DELINEATION SCENARIO

The following eight SWPA delineation scenarios have been developed for SWAP purposes. The primary basis for determination of the delineation scenario assigned to a well is its pumping rate. A ninth delineation scenario (not listed below) is reserved for special cases where wells exhibit variable hydrologic gradients.

Scenario	Pumping Rate	Transmissivity	Radius	Thickness	Gradient	Null Point	Offset	Area
#1	0 - 100 gpm	5,000 ft^2/d	1,285 ft	36 ft	8.5 ft/mi	505 ft	775 ft	0.19 mi^2
#2	101 - 250 gpm	7,500 ft^2/d	1,700 ft	47 ft	10.5 ft/mi	514 ft	1,186 ft	0.33 mi^2
#3	251 - 500 gpm	7,500 ft^2/d	2,250 ft	55 ft	16.5 ft/mi	654 ft	1,596 ft	0.57 mi^2
#4	501 - 750 gpm	10,000 ft^2/d	2,590 ft	64 ft	17.0 ft/mi	714 ft	1,876 ft	0.76 mi^2
#5	751 - 1,000 gpm	12,500 ft^2/d	3,040 ft	62 ft	15.5 ft/mi	836 ft	2,204 ft	1.04 mi^2
#6	1001 - 1500 gpm	15,000 ft^2/d	3,415 ft	72 ft	16.5 ft/mi	981 ft	2,434 ft	1.32 mi^2
#7	1501 - 2,000 gpm	16,600 ft^2/d	3,685 ft	83 ft	18.5 ft/mi	1,054 ft	2,631 ft	1.53 mi^2
#8	≥ 2,001 gpm	16,600 ft^2/d	4,040 ft	80 ft	20.0 ft/mi	1,122 ft	2,918 ft	1.84 mi^2

■ MSDH WATER QUALITY SAMPLING DATA

Sample Date	Detected Contaminant	Concentration (ppm)	MCL (ppm)

■ SIGNIFICANT POTENTIAL CONTAMINANT SOURCES WITHIN DELINEATED SWAP

Non-Regulated Sites (field inspected)			
PCS Number	**Facility / Site**	**PCS Type**	**Storage / Operation Concerns**

Regulated Facilities / Sites (not field inspected)		
Permit / Facility Number	**Facility / Site**	**Regulatory Oversight**

■ SUSCEPTIBILITY CONCERNS

■ SUSCEPTIBILITY RANKING

Susceptibility Ranking _____ **1 - Higher** **2 - Moderate** **3 - Lower**

Date Susceptibility Assessment Report Completed: _____

SUSCEPTIBILITY ASSESSMENT REPORT
(Public Surface Water Systems)

■ INTAKE IDENTIFICATION DATA

Public Water Supply _____

PWS ID Number _____

■ SURFACE WATER / INTAKE DATA

Surface Water Body _____

8-Digit HUC _____ **Pumping Rate (gpm)** _____

Surface Water Body Included On 303(d) List? (Yes / No) _____

■ TRANSPORTATION CORRIDOR

Is The Surface Water Body Used For Barge Trafficking? (Yes / No) _____

Are Major Highways, Pipelines, or Railroads Located Within The Delineated SWPA? (Yes / No) _____

■ MSDH WATER QUALITY SAMPLING DATA

Sample Date	Detected Contaminant	Concentration (ppm)	MCL (ppm)

■ SIGNIFICANT POTENTIAL CONTAMINANT SOURCES WITHIN DELINEATED SWAP

Non-Regulated Sites (field inspected)			
PCS Number	Facility / Site	PCS Type	**Storage / Operation Concerns**

Regulated Facilities / Sites (not field inspected)		
Permit / Facility Number	Facility / Site	**Regulatory Oversight**

Non-Point Sources of Pollution		
Facility / Site	**Land Use Activities**	**Location**

■ SUSCEPTIBILITY CONCERNS

■ SUSCEPTIBILITY RANKING

Susceptibility Ranking _____ **1 - Higher** **2 - Moderate** **3 - Lower**

Date Susceptibility Assessment Report Completed: _____

APPENDIX K

SWAP DATA SOURCES

DELINEATION ELEMENT:

Information	Sources
Well driller's logs	OLWR, USGS
Electric logs	OLWR, OG, USGS
Permit application/Notice of Claim forms	OLWR
Well schedules	USGS

PCS INVENTORY ELEMENT:

Information	Sources
GPS'd PWS well locations	MSDH/DWS
Water wells	USGS, OLWR
Various state-wide GIS coverages	MARIS
Oil & gas well locations (under development)	O&G Board
RCRA facilities	MDEQ
CERCLA/State uncontrolled sites	MDEQ
Underground storage tanks	MDEQ
NPDES discharge points	MDEQ
Surface water impoundments	MDEQ
Nonhazardous waste facilities	MDEQ
Air emission facilities	MDEQ
Surface mines	OG

SUSCEPTIBILITY ANALYSIS ELEMENT:

Information	Sources
Well driller's logs	OLWR, USGS
Electric logs	OLWR, OG, USGS
Permit application/Notice of Claim forms	OLWR
Well schedules	USGS
Vulnerability assessment	USGS
Water quality analyses	MSDH/DWS
PCS inventory	SWAP

CONSUMER CONFIDENCE ELEMENT:

Information	Sources
Water quality analyses	MSDH/DWS
PWS operator database	MSDH, MRWA
SWAP data	SWAP

APPENDIX L

EPA United States Environmental Protection Agency
Office of Water

Office of Ground Water and Drinking Water

Current Drinking Water Standards

National Primary and Secondary Drinking Water Regulations

National Primary Drinking Water Regulations (NPDWRs or primary standards) are legally enforceable standards that apply to public water systems. Primary standards protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health and are known or anticipated to occur in public water systems. Table 1 divides these contaminants into Inorganic Chemicals, Organic Chemicals, Radionuclides, and Microorganisms. See Setting Standards for Safe Drinking Water to learn about EPA's standard-setting process.

National Primary Drinking Water Regulations

Contaminants	MCLG[1] (mg/L)[4]	MCL[2] or TT[3] (mg/L)[4]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Inorganic Chemicals				
Antimony	0.006	0.006	Increase in blood cholesterol; decrease in blood glucose	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder
Arsenic	none[5]	0.05	Skin damage; circulatory system problems; increased risk of cancer	Discharge from semiconductor manufacturing; petroleum refining; wood preservatives; animal feed additives; herbicides; erosion of natural deposits
Asbestos (fiber >10 micrometers)	7 million fibers per Liter	7 MFL	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits
Barium	2	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Beryllium	0.004	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries
Cadmium	0.005	0.005	Kidney damage	Corrosion of

Cadmium	0.005	0.005	Kidney damage	galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints	
Chromium (total)	0.1	0.1	Some people who use water containing chromium well in excess of the MCL over many years could experience allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits	
Copper	1.3	Action Level=1.3; TT[6]	Short term exposure: Gastrointestinal distress. Long term exposure: Liver or kidney damage. Those with Wilson's Disease should consult their personal doctor if their water systems exceed the copper action level.		Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Cyanide (as free cyanide)	0.2	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories	
Fluoride	4.0	4.0	Bone disease (pain and tenderness of the bones); Children may get mottled teeth.	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories	
Lead	zero	Action Level=0.015; TT[6]	Infants and children: Delays in physical or mental development. Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits	
Inorganic Mercury	0.002	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and cropland	
Nitrate (measured as Nitrogen)	10	10	"Blue baby syndrome" in infants under six months - life threatening without immediate medical attention. Symptoms: Infant looks blue and has shortness of breath.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	
Nitrite (measured as	1	1	"Blue baby	Runoff from	

(Nitrogen)[1]		[1]	syndrome" in infants under six months - life threatening without immediate medical attention. Symptoms: Infant looks blue and has shortness of breath.	fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Selenium	0.05	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum refineries; erosion of natural deposits; discharge from mines
Thallium	0.0005	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and pharmaceutical companies
Organic Chemicals	**MCLG[1] (mg/L)[4]**	**MCL[2] or TT[3] (mg/L)[4]**	**Potential Health Effects from Ingestion of Water**	**Sources of Contaminant in Drinking Water**
Acrylamide	zero	TT[7]	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/wastewater treatment
Alachlor	zero	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops
Atrazine	0.003	0.003	Cardiovascular system problems; reproductive difficulties	Runoff from herbicide used on row crops
Benzene	zero	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills
Benzo(a)pyrene	zero	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines
Carbofuran	0.04	0.04	Problems with blood or nervous system; reproductive difficulties.	Leaching of soil fumigant used on rice and alfalfa
Carbon tetrachloride	zero	.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities
Chlordane	zero	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide
Chlorobenzene	0.1	0.1	Liver or kidney problems	Discharger from chemical and agricultural chemical factories
2,4-D	0.07	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops
Dalapon	0.2	0.2	Minor kidney changes	Runoff from herbicide used on rights of way

1,2-Dibromo-3-chloropropane (DBCP)	zero	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards
o-Dichlorobenzene	0.6	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories
p-Dichlorobenzene	0.075	0.075	Anemia; liver, kidney or spleen damage; changes in blood	Discharge from industrial chemical factories
1,2-Dichloroethane	zero	0.005	Increased risk of cancer	Discharge from industrial chemical factories
1-1-Dichloroethylene	0.007	0.007	Liver problems	Discharge from industrial chemical factories
cis-1, 2-Dichloroethylene	0.07	0.07	Liver problems	Discharge from industrial chemical factories
trans-1,2-Dichloroethylene	0.1	0.1	Liver problems	Discharge from industrial chemical factories
Dichloromethane	zero	0.005	Liver problems; increased risk of cancer	Discharge from pharmaceutical and chemical factories
1-2-Dichloropropane	zero	0.005	Increased risk of cancer	Discharge from industrial chemical factories
Di(2-ethylhexyl)adipate	0.4	0.4	General toxic effects or reproductive difficulties	Leaching from PVC plumbing systems; discharge from chemical factories
Di(2-ethylhexyl)phthalate	zero	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories
Dinoseb	0.007	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables
Dioxin (2,3,7,8-TCDD)	zero	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories
Diquat	0.02	0.02	Cataracts	Runoff from herbicide use
Endothall	0.1	0.1	Stomach and intestinal problems	Runoff from herbicide use
Endrin	0.002	0.002	Nervous system effects	Residue of banned insecticide
Epichlorohydrin	zero	TT[7]	Stomach problems; reproductive difficulties; increased risk of cancer	Discharge from industrial chemical factories; added to water during treatment process
Ethylbenzene	0.7	0.7	Liver or kidney problems	Discharge from petroleum refineries
Ethelyne dibromide	zero	0.00005	Stomach problems; reproductive difficulties; increased risk of cancer	Discharge from petroleum refineries
Glyphosate	0.7	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use
Heptachlor	zero	0.0004	Liver damage;	Residue of banned

Heptachlor	zero	0.0004	increased risk of cancer	termiticide
Heptachlor epoxide	zero	0.0002	Liver damage; increased risk of cancer	Breakdown of hepatachlor
Hexachlorobenzene	zero	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories
Hexachlorocyclopentadiene	0.05	0.05	Kidney or stomach problems	Discharge from chemical factories
Lindane	0.0002	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on catttle, lumber, gardens
Methoxychlor	0.04	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, livestock
Oxamyl (Vydate)	0.2	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes
Polychlorinated biphenyls (PCBs)	zero	0.0005	Skin changes; thymus gland problems; immune difficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfils; discharge of waste chemicals
Pentachlorophenol	zero	0.001	Liver or kidney problems; increased risk of cancer	Discharge from wood preserving factories
Picloram	0.5	0.5	Liver problems	Herbicide runoff
Simazine	0.004	0.004	Problems with blood	Herbicide runoff
Styrene	0.1	0.1	Liver, kidney, and circulatory problems	Discharge from rubber and plastic factories; leaching from landfills
Tetrachloroethylene	zero	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners
Toluene	1	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories
Total Trihalomethanes (TTHMs)	none[5]	0.10	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection
Toxaphene	zero	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle
2,4,5-TP (Silvex)	0.05	0.05	Liver problems	Residue of banned herbicide
1,2,4-Trichlorobenzene	0.07	0.07	Changes in adrenal glands	Discharge from textile finishing factories
1,1,1-Trichloroethane	0.20	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories
1,1,2-Trichloroethane	0.003	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories
Trichloroethylene	zero	0.005	Liver problems;	Discharge from

Trichloroethylene	zero	0.005	increased risk of cancer	petroleum refineries
Vinyl chloride	zero	0.002	increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories
Xylenes (total)	10	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories
Radionuclides	**MCLG[1] (mg/L)[4]**	**MCL[2] or TT[3] (mg/L)[4]**	**Potential Health Effects from Ingestion of Water**	**Sources of Contaminant in Drinking Water**
Beta particles and photon emitters	none[5]	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits
Gross alpha particle activity	none[5]	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits
Radium 226 and Radium 228 (combined)	none[5]	5 pCi/L	Increased risk of cancer	Erosion of natural deposits
Microorganisms	**MCLG[1] (mg/L)[4]**	**MCL[2] or TT[3] (mg/L)[4]**	**Potential Health Effects from Ingestion of Water**	**Sources of Contaminant in Drinking Water**
Giardia lamblia	zero	TT[8]	Giardiasis, a gastroenteric disease	Human and animal fecal waste
Heterotrophic plate count	N/A	TT[8]	HPC has no health effects, but can indicate how effective treatment is at controlling microorganisms.	n/a
Legionella	zero	TT[8]	Legionnaire's Disease, commonly known as pneumonia	Found naturally in water; multiplies in heating systems
Total Coliforms (including fecal coliform and *E. Coli*)	zero	5.0%[9]	Used as an indicator that other potentially harmful bacteria may be present[10]	Human and animal fecal waste
Turbidity	N/A	TT[8]	Turbidity has no health effects but can interfere with disinfection and provide a medium for microbial growth. It may indicate the presence of microbes.	Soil runoff
Viruses (enteric)	zero	TT[8]	Gastroenteric disease	Human and animal fecal waste

Table 1

National Secondary Drinking Water Regulations

National Secondary Drinking Water Regulations (NSDWRs or secondary standards) are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic

effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. However, states may choose to adopt them as enforceable standards. See Table 2.

Contaminant	Secondary Standard
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

Table 2

Notes

[1] Maximum Contaminant Level Goal (MCLG) - The maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health effect of persons would occur, and which allows for an adequate margin of safety. MCLGs are non-enforceable public health goals.

[2] Maximum Contaminant Level (MCL) - The maximum permissible level of a contaminant in water which is delivered to any user of a public water system. MCLs are enforceable standards. The margins of safety in MCLGs ensure that exceeding the MCL slightly does not pose significant risk to public health.

[3] Treatment Technique - An enforceable procedure or level of technical performance which public water systems must follow to ensure control of a contaminant.

[4] Units are in milligrams per Liter (mg/L) unless otherwise noted.

[5] MCLGs were not established before the 1986 Amendments to the Safe Drinking Water Act. Therefore, there is no MCLG for this contaminant.

[6] Lead and copper are regulated in a Treatment Technique which requires

systems to take tap water samples at sites with lead pipes or copper pipes that have lead solder and/or are served by lead service lines. The action level, which triggers water systems into taking treatment steps if exceeded in more than 10% of tap water samples, for copper is 1.3 mg/L, and for lead is 0.015mg/L.

[7] Each water system must certify, in writing, to the state (using third-party or manufacturer's certification) that when acrylamide and epichlorohydrin are used in drinking water systems, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows:

- **Acrylamide** = 0.05% dosed at 1 mg/L (or equivalent)
- **Epichlorohydrin** = 0.01% dosed at 20 mg/L (or equivalent)

[8] The Surface Water Treatment Rule requires systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water to meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

- ***Giardia lamblia***: 99.9% killed/inactivated
  Viruses: 99.99% killed/inactivated
- ***Legionella***: No limit, but EPA believes that if *Giardia* and viruses are inactivated, *Legionella* will also be controlled.
- **Turbidity**: At no time can turbidity (cloudiness of water) go above 5 nephelolometric turbidity units (NTU); systems that filter must ensure that the turbidity go no higher than 1 NTU (0.5 NTU for conventional or direct filtration) in at least 95% of the daily samples in any month.
- **HPC**: NO more than 500 bacterial colonies per milliliter.

[9] No more than 5.0% samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive). Every sample that has total coliforms must be analyzed for fecal coliforms. There cannot be any fecal coliforms.

[10] Fecal coliform and *E. coli* are bacteria whose presence indicates that the water may be contaminated witih human animal wastes. Microbes in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms.

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Office of Water


Comments

http://www.epa.gov/OGWDW/wot/appa.html

RECOMMENDED MINIMUM DESIGN CRITERIA

FOR

COMMUNITY PUBLIC WATER SUPPLIES

Special Thanks to Sharon Forester Hodge
for her efforts in developing this document.

Mississippi State Department of Health
Division of Water Supply
September 1995

Part III

Wells

A. WELL DRILLER REQUIREMENTS

All wells for public water supplies shall be constructed by a water well contractor licensed by the Mississippi Department of Environmental Quality.

B. WELL PERMITS

All wells shall be permitted as required by the Department of Environmental Quality.

C. LOCATION

Well sites shall be approved by the Division of Water Supply/Mississippi State Department of Health. The following criteria shall be considered in determining an acceptable well site:

1. Susceptibility of flooding - the top of the well casing shall be at least 1 foot above the 100 year flood or the highest year flood, whichever is higher
2. Distance from existing wells (depends on characteristics of the formation)
3. Accessibility
4. Sources of pollution - Minimum distance of 100 feet
5. Potential for development of the surrounding area
6. Proximity of roads, railroads, power lines, underground pipelines, cathodic protection systems and other possible causes of damage
7. Degree of natural protection from surface water
8. The ability to obtain water that is free of sand and which meets the current U.S. EPA primary and secondary drinking water standards.

D. TEST HOLES

Test holes are drilled primarily to locate the depth of the aquifers, determine their relative thickness and to take samples of the aquifers penetrated. All test holes should be a minimum of 8 inches in diameter.

Upon completion of a successful test hole, the following information should be made available to all interested parties.

1. Sand samples of the aquifer taken at 10 foot intervals and for any change in formation
2. Drillers log of the test hole
3. Gamma ray log of the test hole
4. Electric log
5. Sieve analysis of the sand samples for each 10 foot interval of each aquifer penetrated

A legible copy of each of the items listed above should be forwarded to the Division of Water Supply for the official record.

E. TEST WELLS

1. A water sample for chemical analysis should be obtained from each potential aquifer to be considered
2. Test Well Design
   a. Upper casing should have a minimum inside diameter of 6 inches to allow

for pump clearance.

b. Screens should be of wire wrap design with a minimum outside diameter of 4 inches and a minimum length of 20 feet. Slot size should retain from 45% to 60% of the aquifer material.

c. Non-lead packers should be installed above and below the aquifer to limit the influence of other aquifers pierced by the test hole.

d. The test well should be properly developed and water samples should be free of drilling mud and sand.

e. The well should be pumped at a minimum rate of 75 gpm per minute or 20% of the final design capacity.

f. Drawdown measurements shall be made during the first 1500 minutes of pumping and afterward until the static water level in the well has recovered.

3. Physical and chemical analyses shall be made of the samples taken after the pumping test and analyzed by a Mississippi State Department of Health approved laboratory to determine the water's suitability for public water supply use. A legible copy of these analyses should be forwarded to the Division of Water Supply for the official record.

F. OBSERVATION WELLS

1. Observation wells for permanent use shall be properly protected from sources of contaminants in the same manner as permanent wells for a public water supply.
2. The casing should extend at least 1 foot above the expected 100 year flood and be provided with an overlapping, lockable cover with a lock.

G. ABANDONED HOLES, TEST WELLS AND WELLS

1. All abandoned wells, test wells, temporary observation wells and holes to or through any aquifer shall be filled with cement grout introduced at the bottom and pumped to the ground surface in one continuous operation.
2. A registered Professional Engineer may be employed to design an alternate abandonment technique. Any alternate technique must be approved by the Division of Water Supply prior to its application. Written certification of completion from the engineer in charge of the abandonment procedure is required.

H. DESIGN OF WELLS SHOULD MEET THE REQUIREMENTS OF THE LATEST REVISION OF AWWA A100.

1. Capacity

A well or well field shall be designed to operate to prevent excessive depletion of the aquifer and to provide standby capacity.

2. Well Casings

a. Well casings shall be installed to prevent the vertical migration or entrance of adjacent ground or surface water. They should be so constructed and installed to prevent corrosion by aggressive water. They should be sufficiently sized and installed to allow installation, maintenance, or measurements of the pump, water levels, lap pipe and screen. Table 2 indicates recommended casing sizes for various yields, taking into account pump efficiency, head losses and adequate clearance for proper installation of 1760 rpm vertical turbine pumps. In some cases, the casing may need to be larger than indicated by the table to allow for pump settings in the lap pipe. The use of submersible pumps requires additional clearance to prevent excessive head losses in the annulus between the motor and the casing.

Table 2

Recommended Well Casing and Screen Diameters

Proposed well yield, gpm	Nominal size of pump bowls, inches	Optimum size of well casing, inches	Maximum screen size for gravel packed wells
50 - 150	6	10 ID	6
100 - 700	8	12 ID	8
250 - 1500	10	14 OD	10
700 - 2400	12	16 OD	12
900 - 3000	14	20 OD	16
3000 - 4500	16	24 OD	20

b. An annular space on the outside of the casing of at least 2-1/2 inches shall be sealed with cement grout for the full length of the casing. The well casing shall be cemented in place by the Halliburton or other satisfactory method. The Halliburton method requires forcing cement grout in the annular space between the casing and the drill hole from the bottom of the well to the top, thus assuring exclusion of all the water above the water-bearing stratum from which the supply is taken. The grout should be neat cement weighing at least 15 lbs/gal.

c. The top of the well shall be sealed to prevent the entrance of

contaminants. Properly protected vacuum relief openings should be provided except in the cases where prevented by artesian head.

d. The casing should be provided with an access pipe of at least 2 inches to allow for water level measurements. If this is also used as the casing vent, it must be screened and elbowed.

e. The same size casing shall extend from above the top of the foundation to the top of the water bearing stratum.

f. Steel casings shall meet the requirements of the latest revision of the applicable AWWA standard.

g. PVC casings may be allowed provided the justification for their use outweighs the risk of failure. PVC casings shall be designed to withstand the stresses of installation but shall be limited to the following depths:

SDR*	Depth, FT
26	125
21	250
17	500

* Check manufacturers nominal internal diameters

h. The interior of a mild steel outer casing, the interior/exterior of the lap pipe, the pump column and tail pipe in wells with corrosive water should be protected with an EPA or NSF approved coating to prevent corrosion

or constructed of corrosion resistant material such as stainless steel. Special attention should be given to sealing the column pipe, coupling, threads and joints.

i. **Tight joint is required between well casing and pump head**

The pump head shall be connected to the outside casing by a water-tight threaded connection or by the outside casing being carried to a point not less than one inch above the pump head foundation. Before setting the pump head casing, the contractor shall provide a vacuum seal between the foundation and pump head casing when a partial vacuum is created. Where submersible pumps are used, a satisfactory water-tight mechanical seal shall be provided.

j. **Pump head foundation**

The pump head shall be mounted on a chamfered concrete foundation not smaller than 24 inches square at the top, extending not less than 18 inches into the solid ground and not less than 18 inches above the finished grade or the 100 year flood elevation.

3. **Well Screens**

Screens should be designed and installed in such a way as to maximize well efficiency, consistent with constraints of aquifer retention. Refer to Table 2.

a. Screen slot sizes should be designed based on the gradation of the adjacent

gravel pack or aquifer material, as determined by sieve analysis.

b. Total open area of the screen should be such that the maximum entrance velocity is limited to 0.1 feet per second.

c. The screen shall be constructed of type 304 stainless steel, be rod-based and wire wrapped. Other materials when adequately justified will be considered on a case by case basis. Shutter screens are not acceptable.

d. The gradation of the gravel pack material should be based on the gradation of the adjacent aquifer material, as determined by sieve analysis. The thickness of the annular gravel envelope should be between 3 inches and 8 inches to allow complete development of the well.

e. The bottom of the screen should be fitted with a backwash valve if needed to permit washing of the screen and to prevent inflow of sand.

4. Lap pipe

The lap pipe should extend into the casing a distance sufficient to assure concentric alignment of the screen and casing. This should be at least 60 feet for straight wall wells. For gravel packed wells the lap pipe should be 60 feet or at least as long as the screen for alignment and for storage of additional gravel pack. The space between the lap pipe and the casing should be filled with specially graded gravel according to sieve analysis to prevent sand pumpage.

5. Pumping equipment

a. The pumping equipment should be designed to deliver the required flow and pressure at the maximum efficiency available.

b. Appurtenances on wells shall include:

i. 3/4 inch sampling faucet installed between the pump discharge flange and chlorination - if it is installed upstream of the check valve, it should be a non-hose bib design and should not be installed on the blind flange of the discharge tee

ii. Provision for adequate shaft lubrication

I. Water lubrication - line shaft vertical turbine pumps should be of the water lubricated type, if practical, to prevent problems resulting from the introduction of oil into the system.

a. The pre-lubricating water should be from an approved source of water, preferably the well itself. If a foot valve is used to hold the pump column full of water, a simple bypass around the check valve is sufficient.

b. The pre-lubricating water should not be allowed to run continuously into the well. A normally open

solenoid valve should be used so that an electrical failure will not prevent the flow of lubricating water.

II. If oil lubricated, a non-petroleum based product meeting USDA H1 standards should be used.

iii. Test tee

iv. Check and gate valve

v. Freeze protection where needed

vi. A master meter shall be provided for all community public water supply wells. It shall be installed downstream of the check valve according to the manufacturers recommendation and be properly sized to accurately determine well capacity and amount of water pumped.

vii. Lightning and phase failure protection for all three-phase equipment

viii. Anti-reverse ratchet to prevent backspin or a time delay

ix. An air release valve prior to the check valve

x. A screened and elbowed (double ell) casing vent. (For flowing wells a check valve should be installed on the vent)

xi. Single piece non-plastic air line gauge for water level

measurements

xii. Casing access pipe of at least 2 inches diameter for water level measurements

c. The use of a submersible pump with a foot valve eliminates the need for item ii.

d. Corrosion resistant materials should be used for the pumping equipment if the corrosiveness of the water is expected to significantly reduce the life of mild steel components.

I. WELL CONSTRUCTION

1. An electrical resistivity and spontaneous potential log should be completed on each drilled hole and be evaluated in relation to other data prior to installation of the casing.

2. The well should be developed to its maximum practical efficiency and be free of visible sand and drilling mud. Turbidity due to the drilling process should not exceed 5 units.

3. A pumping test of sufficient duration should be completed with the temporary pumping equipment on the final well to determine anticipated capacity and drawdown.

4. The permanent pump bowls should be set to maintain a 30 foot minimum submergence after pumping for 24 hours at open discharge.

5. After drawdown has stabilized on the well, the permanent pump should have step tests performed to determine capacity. The steps should be in increments no greater than 10 psi and should be from open discharge to shut-off head. Drawdown shall be measured after stabilization for each increment of pressure.
6. Well efficiency - should be minimum of 70% for wells utilizing at least 60% of formation.
7. Water samples should be collected and submitted to the Mississippi State Department of Health or a state approved laboratory for chemical analysis.

J. DISINFECTION

1. All water used in the drilling and construction process shall be obtained from sources of proven satisfactory quality and shall meet the primary standards of the Safe Drinking Water Act Regulations.
2. Gravel to be placed in a well should be disinfected with a solution of at least 50 mg/l free chlorine. A residual of no less than 5 parts per million of chlorine shall be maintained in any water used for development.
3. Upon completion of the well, the well and adjacent aquifer shall be disinfected as necessary using a solution of 50 mg/l free chlorine applied for 24 hours. After disinfection, the well shall be pumped until two consecutive chlorine-free samples are collected from the well which show no coliform bacteria and no confluent growth. The samples shall be collected, submitted and analyzed according to the

Mississippi State Department of Health requirements. The second sample shall be collected following at least two hours of continuous pumping after the first sample. A disinfectant must not be applied between samples. The person collecting the official microbiological sample must be a representative of the Mississippi State of Health or the Registered Professional Engineer for the project, or the Certified Operator for the public water supply.

4. If water from a private well is used, microbiological samples shall be examined prior to use. Routine samples from public supplies may be used as a basis for determining if a supply is satisfactory.

5. The disinfection procedure should meet the current AWWA standard (C654). A solution strength of 50 mg/l free chlorine applied for 24 hours is recommended.

6. **IMPORTANT NOTE:** Contracts for the repair of public water supply wells must include a provision requiring the well contractor to properly disinfect the well after the repair(s) are completed. The contractor must comply with the requirements of above section number J. 3.

7. All new well microbiological samples should be analyzed using the membrane filter technique.

APPENDIX N

PROJECTED FOUR YEAR SWAP WORK PLAN & SRF SET-ASIDE EXPENDITURES

STATE FISCAL YEAR 1998
(October, 1997 to June, 1998)

Planned Activities

1. Copy, organize, and file well drillers logs, electric logs, and completion information for public water supply wells in Mississippi from files and/or databases maintained at the MDEQ's Office of Land and Water Resources and Office of Geology, State Department of Health, and the U.S. Geological Survey.

2. Correlate and review collected data to determine presence of adequate confining layers for 25% of the public water supply (PWS) wells in the state.

3. Determine the relative susceptibility of those public water supply wells addressed in Step #2 to contamination based on the confining layer assessment, available DRASTIC ground water model data and the State Department of Health PWS water quality analysis data.

4. Form technical/community advisory committee(s); hold meetings to encourage participate in development of state SWAP strategy.

5. Develop various forms and procedures for all SWAP elements.

6. Initiate drafting of SWAP plan.

7. Delineate Source Water Protection Areas for public water supply wells in confined aquifers that were verified in Step #2.

8. Initiate hydrogeologic investigations and SWPA delineations for PWS wells screened in unconfined aquifers as required.

9. Develop SWPA delineation coverage of those PWS wells screened in unconfined aquifers.

10. Provide training of selected potential contaminant source (PCS) inventory personnel in operation of global positioning system (GPS) equipment.

11. Enter applicable Source Water Assessment data (e.g., aquifer confinement, susceptibility data, etc.) into appropriate databases.

12. Initiate development of integrated PWS water quality analytical data for MSDH's data with GIS.

SRF Expenditures

1. Personnel

   a. $67,207 Environmental Scientist IV

Projected Total Expenditures SFY 98 = $67,207

STATE FISCAL YEAR 1999

Planned Activities

1. Verify aquifer confinement for 33% of the PWS wells in the state.

2. Continue delineation of SWPAs for those PWS wells using verified confined aquifers (as a result of Step #1).

3. Continue hydrogeologic investigations and SWPA delineations for PWS wells screened in unconfined aquifers as required.

4. Delineate SWPA coverages of those PWS wells screened in unconfined aquifers (as a result of Step #3).

5. Research existing databases and files at the State Oil and Gas Board and the Office of Land and Water Resources to determine the existence of oil and gas wells and water wells in delineated SWPAs; integrate with GIS.

6. Complete training of inventory personnel and initiate full scale PCS inventory efforts. Personnel with the UST Branch at MDEQ and the Mississippi Rural Water Association may be used for this effort. Identified PCS sites will be accurately located using GPS technology.

7. Continue data entry of applicable SWAP data into appropriate databases. Some of the data would include information pertaining to aquifer confinement, relative susceptibility, delineations, and PCSs.

8. Pursue use of Oracle relational database -- possibly contract for database development.

9. Develop strategy to address the three surface water PWSs operating in the state.

10. Complete susceptibility analyses for inventoried systems and initiate required public notification process related to completed source water assessments.

11. Conduct required public hearings to gain additional input into state SWAP plan.

12. Convene advisory committees to finalize SWAP plan development.

13. Formally submit state SWAP plan to EPA for review (February, 1999).

14. Address EPA's concerns and suggestions related to state SWAP plan.

15. Complete integration of MSDH data with GIS.

SRF Expenditures

1. Personnel

a.	$79,700	Environmental Scientist IV
b.	$88,521	Environmental Scientist IV -- GIS Coordinator
c.	$33,080	DP Data Control Clerk II

2. Inventory of Contaminant Sources --

a.	$125,000	UST Branch personnel
b.	$ 75,000	Mississippi Rural Water Association personnel

Projected Total Expenditures SFY 99 = $401,301

Cumulative SWAP Expenditures = $468,508

STATE FISCAL YEAR 2000

Planned Activities

1. Receive formal approval of state SWAP plan from EPA (November, 1999).

2. Meet with advisory committee(s) to review and evaluate program accomplishments and deficiencies; adjust approach accordingly to pursue program goals.

3. Complete aquifer confinement verification for the remainder of the PWS wells in the state.

4. Continue delineation of SWPAs for confined aquifer PWS wells.

5. Continue to perform hydrogeologic investigations and SWPA delineations for PWS wells screened in unconfined aquifers.

6. Extend SWPA delineation coverage to include those PWS wells pumping from unconfined aquifers.

7. Facilitate and continue participation in PCS inventory and GPS efforts.

8. Enter applicable SWAP information into Oracle database.

9. Complete delineation of SWPAs for surface water PWSs using watershed approach.

10. Initiate inventory efforts in designated watersheds associated with surface water PWSs.

11. Continue to complete susceptibility analyses for PWSs and make information readily available to PWSs and their customers.

SRF Expenditures

1. Personnel

a.	$79,700	Environmental Scientist IV
b.	$88,521	Environmental Scientist IV
c.	$29,080	DP Data Control Clerk II

2. Inventory of Contaminant Sources

   a. $125,000 UST Branch personnel

   b. $ 75,000 Mississippi Rural Water Association personnel

Projected Total Expenditures SFY 00 = $397,301

Cumulative SWAP Expenditures = $865,809

STATE FISCAL YEAR 2001

Planned Activities

1. Meet with advisory committee(s) and evaluate state SWAP; adjust program activities accordingly if required.

2. Complete SWPA delineations for remaining PWSs using confined aquifers, if needed.

3. Complete hydrogeologic investigations and SWPA delineations for all remaining PWS wells screened in unconfined aquifers.

4. Complete development of SWPA delineation coverage for PWS wells using unconfined aquifers.

5. Continue previous PCS inventory and GPS efforts.

6. Continue entering SWAP generated information into Oracle database.

7. Complete inventory of SWPAs associated with surface water PWSs.

8. Continue to develop susceptibility analyses of PWSs and inform public of their availability.

SRF Expenditures

1. Personnel

   a. $79,700 Environmental Scientist IV

   b. $88,521 Environmental Scientist IV

   c. $29,080 DP Data Control Clerk II

2. Inventory of Contaminant Sources

   a. $125,000 UST Branch Personnel

   b. $100,000 Mississippi Rural Water Association personnel

Projected Total Expenditures SFY 01 = $ 422,301

Cumulative SWAP Expenditures = $1,288,110

STATE FISCAL YEAR 2002
(July, 2001 to September, 2001)

Planned Activities

1. Complete PCS inventories and GPS efforts.

2. Complete susceptibility analyses for all PWSs.

3. Continue data entry of SWAP generated information.

SRF Expenditures

1. $30,000 UST Branch Personnel

Projected Total Expenditures SFY 02 = $ 30,000

Cumulative SWAP Expenditures = $1,318,110

Funding Recap:

10% set aside	=	**$1,634,000**
Projected Expenditures	=	**$1,318,110**
Remaining Funds	=	**$ 315,890**

APPENDIX O

ACRONYMS

ASTs	Aboveground Storage Tanks
CAFOs	Concentrated Animal Feeding Operations
DWSRF	Drinking Water State Revolving Fund
EPA	Environmental Protection Agency
GIS	Geographic Information System
GPS	Global Positioning System
GWUDI	Ground Water Under Direct Influence
MCLs	Maximum Contaminant Levels
MDAC	Mississippi Department of Agriculture and Commerce (Bureau of Plant Industry)
MDEQ	Mississippi Department of Environmental Quality
MEMA	Mississippi Emergency Management Agency
MRWA	Mississippi Rural Water Association
MSDH	Mississippi State Department of Health
NRCS	Natural Resources Conservation Service
OG	Office of Geology (MDEQ)
OLWR	Office of Land and Water Resources (MDEQ)
OPC	Office of Pollution Control (MDEQ)
PCSs	Potential Contaminant Sources
PWSs	Public Water Systems
SDWA	Safe Drinking Water Act
SWAP	Source Water Assessment Program
SWPAs	Source Water Protection Areas
SWPP	Source Water Protection Program
SWTR	Surface Water Treatment Rule
USGS	United States Geological Survey
WHPA	Wellhead Protection Area

APPENDIX P

GLOSSARY

Some of the terms used in this document may be unfamiliar to some readers, or may be used in a way that differs from how some readers use the terms in their state programs. This problem is largely unavoidable in part because different states and individuals attach different meanings to common terms and in part because the terms are targeted to an audience that is likely to include non-technical personnel who need to understand the fundamental concepts of assessing source water susceptibility. The following glossary describes how such terms are used in this document:

Community Water System *(CWS)* refers to a public water system that serves at least 15 service connections and is used by year-round residents of the area served by the system or that regularly serves at least 25 year-round residents.

Class V Injection Wells refers to wells not included in Class I, II, III, or IV in which nonhazardous fluids are injected into or above underground sources of drinking water.

Conveyance refers to canals, aqueduct or piping that carries water from the *intake* or *well* to the general area of the distribution system. It does not include the distribution system itself or storage tanks, treatment plants or other infrastructure associated with the distribution system.

Differential Assessments are assessments tailored to the characteristics of water systems or risk *e.g.*, assessments for transient, non-community water systems may consider only acute contaminants while assessments of community water systems consider both acute and chronic contaminants.

Drinking Water State Revolving Fund *(DWSRF)* refers to section 1452 of the SDWA in which EPA awards capitalization grants to states to develop drinking water revolving loan funds to help finance drinking water system infrastructure improvements, source water assessment and protection activities, to enhance operations and management of drinking water systems, and other activities to encourage PWS compliance and protection of public health.

Ground Water Under Direct Influence *(GWUDI)* is a term used to designate public ground water systems that use aquifers hydraulically connected to and receive recharge from surface water bodies. The water quality of these types of systems potentially could be adversely impacted by surface water and/or ground water contaminants.

Hydraulic refers to fluid, and is used in this document in the context of whether, and how easily, water or water born contamination can move from overland flow to ground water or vice versa. The phrase *directly*

hydraulically connected means that the flow occurs relatively quickly, rather than according to a geologic calendar.

Hydrogeologic usually refers to the geologic characteristics that influence the underground flow or movement of water, as in *hydrogeologic characteristics of the aquifer.*

Hydrologic refers to water, and is often used to refer to the natural geographic characteristics affecting the overland flow of water, as in *hydrologic characteristics.*

Maximum Contaminant Level (MCL) refers to the maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

Non-Community Water System (NCW) refers to a public water system that is not a community water system and does not sell water. There are two types of NCWSs: transient and non-transient systems.

Potential Contaminant Source Inventory refers to the process of identifying and inventorying potential contaminant sources within delineated source water protection areas (SWPAs) by recording existing data, describing potential sources within the SWPA, targeting likely potential sources for further investigation, collecting and interpreting new information on existing or potential sources through surveys, and verifying accuracy and reliability of the information gathered.

Ranking refers to a hierarchy or priority scheme for the assessment results of individual wells and surface water intakes in regard to their relative susceptibility to designated potential sources of contamination.

Significant Potential Contaminant Sources (PCSs) refers to a facility or activity that the State has designated that stores, uses, or produces chemicals or elements, and that has the potential to release contaminants within a delineated SWPA in an amount which could contribute significantly to the concentration of the contaminants in the source waters of the public water supply.

Source Water Protection Area (SWPA) is the area delineated by the State for one or more source water intakes for the purpose of defining the geographic boundaries of a source water assessment.
Surface Water Intake refers to surface water intakes, as distinguished from *wells* which refers to ground water intakes.

Surface Water Treatment Rule refers to the rule that specified MCL goals for Giardia lamblia, viruses, and Legionella, and promulgated filtration and disinfection requirements for PWSs using surface water sources or by ground water sources under the direct influence of surface water. The regulations also specified water quality, treatment, and watershed protection criteria under which filtration may be avoided.

Susceptibility Analysis refers to the analysis used to determine, with a clear understanding of where the significant potential sources of contamination are located, the susceptibility of the PWS(s) in the SWPA to contamination from these sources.

Transient/Non-Transient Non-Community Water Systems refers to those water systems that are non-community systems and do not sell water. Transient systems serve 25 non-resident persons per day for 6 months or less per year; non-transient systems regularly serve at least 25 of the same non-resident persons per day for more than 6 months per year. Examples of transient non-community systems are restaurants, hotels, and some large stores. Non-transient non-community systems include some schools, offices, churches, and factories.

Watershed Management Approach refers to a coordinating framework for environmental management that focuses public and private sector efforts to address the highest priority problems within hydrologically-defined geographic areas, taking into consideration both ground and surface water flow.

Watershed/Basin refers to a topographic boundary area that is the perimeter of the catchment area of a stream.

Watershed/Basin Area refers to a topographic area that is within a line drawn connecting the highest points uphill of a drinking water intake, from which overland flow drains to the intake.

Well refers to ground water intakes including the well structure (i.e., casing, etc) and wellhead.

Wellhead Protection Area (WHPA) refers to the surface and subsurface area surrounding a well or well field, supplying a PWS, through which contaminants are reasonably likely to move toward and reach such water well or well field.