ARKANSAS

SOURCE WATER

ASSESSMENT PLAN

Prepared By:

Arkansas Department of Health
Division of Engineering
Source Water Protection Program

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"Building partnerships with local communities today for the preservation of resources tomorrow"
T. Ramick, R.S, Source Water Protection Specialist, 1999

Request and Justification for 18 month extension

Request

The State of Arkansas is formally requesting the 18 month extension for completion of Source Water Assessments as described in Chapter 2, Sec. II, D-1 of the final guidance. Justification within the criteria set forth in the guidance is described below.

Justification

The State of Arkansas has set forth a timeline to complete all assessments based upon allocated funding from the DWSRF, resources available, and the time needed for data acquisition, development, and completion. Arkansas' schedule of completion and allocation of funding is contingent upon EPA utilizing the entire 9 month review time for plan approval.

In the event that Arkansas' SWAP is approved before November 6, 1999 data acquisition, development, resources, and funding allocations would not be complete and / or available to contracted partners. Furthermore, the timeline set forth by the State (excluding the 18 month extension) does not consider the possibility of undue circumstances that may arise.

Please refer to Appendix J pages 6 – 7 for the US Geological Survey work-plan and timeline of project task completion. The outline for the USGS's workplan timeline for the Federal Fiscal years 1998 – 1999 and 2000 – 2001 are located on pages J-6 and J-7, respectively. Upon review of the timelines and budgets in Appendix J, it becomes apparent final reports for surface sources will not be received by ADH before February 2000 and ground water sources before September 2001. Therefore, if any delays occur and without the 18-month extension, EPA timelines and goals will not be achievable.

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University of Arkansas – Fayetteville, Arkansas Water Research Center
University of Arkansas – Fayetteville, Department of Geology
University of Arkansas – Fayetteville, Center for Advanced Spatial Technology

February 3, 1999

LIST OF APPENDICES

I. Introduction and Executive Summary

PURPOSE

The purpose in establishing the Arkansas Source Water Assessment Program (SWAP) is two-fold:

1) The fulfillment of the source assessment requirements of the Safe Drinking Water Act (SDWA) Amendments of 1996. Under Section 1453 of the SDWA Amendments, each State shall submit to the EPA Administrator for approval, "a source water assessment program within the State's boundaries." The State "shall carry out the program either directly or through delegation." This is to be done "for the protection and benefit of public water systems and for the support of monitoring flexibility."

2) To provide another means to enhance the Arkansas Department of Health's (ADH's) continuing efforts to protect public drinking water supply sources under the State's Public Water Supply Supervision Program (PWSSP). Under the PWSSP, source protection through regulation, education, and technical assistance is an integral program component.

The SWAP will be implemented as a part of the current PWSSP.

This project will develop a management tool for public water systems to enhance the protection of their source of drinking water. This plan will identify sources of drinking water utilized by public water systems, source water assessment areas for drinking water supplies, and potential contaminants within distinct delineated areas. Providing public water systems and their customers with information concerning their drinking water supply will enable them to implement protection activities. Such activities can help to assure a continued safe drinking water supply and in some cases limit capital expenditures for treatment.

SCOPE

The State of Arkansas has approximately 1509 individual public drinking water sources (this number changes frequently). Included in this total are 205 surface sources (68 impoundments, 32 rivers/streams, 30 springs and 75 GWUDI wells) and 1304 ground water sources. Each of these sources will be assessed to determine their vulnerability to contamination.

PLAN

The Arkansas SWAP is a program to establish a methodology to perform vulnerability assessments in an effort to provide information / data to water systems, customers, and government agencies. The information / data will be pertinent to promoting drinking water source protection programs. The vulnerability assessment is a multi-step process consisting of source location, delineation of source water assessment areas, potential contaminant identification, and a susceptibility analysis. The culmination of the Vulnerability Assessment will result in a designation of low, medium, or high source susceptibility. Within a delineated assessment area, each Potential Source of Contamination (PSOC) will be identified, categorized according to its relative public health significance, proximity to the drinking water source intake, and mapped.

We have entered into an agreement with the United States Geological Survey (USGS) to perform database and Geographical Information System (GIS) development. Each water source will have an assessment area delineated and potential sources of contamination to that source located and mapped. Each water source will then be assessed to determine its susceptibility to those contaminants. The USGS will provide the results of their susceptibility analysis and other data to the Arkansas Department of Health. All the data, maps, and the susceptibility analysis will be compiled and summarized. A report will be generated and sent to each public water system for dissemination to their customers. Copies of each summary report will also be placed on the Internet on the ADH Division of Engineering's Site at http://health.state.ar.us/eng/swpframe.htm which is the Source Water Protection Program Home Page.

VULNERABILITY ASSESSMENT

The vulnerability assessment will consist of the delineation of source water assessment areas, a contaminant inventory, and a susceptibility analysis in which each source will receive a low, medium or high susceptibility designation. It is our intent to phase the assessment process in such a fashion as to meet the deadlines that we are confronted with and provide an assessment that will be meaningful. Phase 1 Assessments, to be completed by the statutory deadline, will provide completed assessments that will allow the initiation of local source water protection plans and provide a priority ranking system for the refinement of the assessments on a continuing basis, or Phase 2 Assessments. *(Phase 2 Assessments are summarized in the section titled "Protection Programs and Phase 2 Assessments".)*

- DELINEATION METHODS

  The preferred mechanism for source protection area determinations is to use a delineation methodology that would incorporate site specific information, including such items as hydrologic and geologic information for all sources. The problem encountered in trying to (1) evaluate delineation methodologies and (2) perform extensive investigations into the location and content of all available data sources lies with time constraints and the lack of resources. The Arkansas SWAP will incorporate delineation methods that have been presented to and accepted by the technical and citizens advisory committees. These methods were presented and accepted through the public hearing process. The delineation methods used will utilize a systematic approach specific to each source type. This approach will enable systems to establish protection programs specific to their source, customer needs, and / or concerns.

- CONTAMINANT INVENTORY

  An inventory of potential contaminants will be performed for each assessment area. Consultations were held with all pertinent agencies / divisions that manage PSOCs or have existing PSOC databases. We have evaluated the data types, data locations, quality of data, data availability, and status of documentation. Existing location data (if deemed adequate), Global Positioning System (GPS) methods for field verification of locations, or map verification of locations may be used for locating the PSOCs. The inventory will consist of PSOCs that are categorized by their relative public health significance and proximity to the drinking water source intake.

- SUSCEPTIBILITY ANALYSIS

  An analysis of the susceptibility of the source water to contamination will be performed for each public water supply. The intrinsic characteristics of each source will be evaluated to determine the sensitivity of the source. The factors that will be considered in the evaluation of the intrinsic sensitivity will include hydrologic factors, soil conditions, aquifer characteristics, the local geology and other factors deemed necessary on a case-by-case basis. In the case of wells, above- and below-ground construction conditions will be considered in the overall susceptibility evaluation. Contaminants within the assessment area will be incorporated into the overall analysis. Their location with respect to the source, and the hazard they present, will be considered to determine if the source is susceptible to contamination at a level that may be of public health significance. Potential sources of contamination that are outside the delineated assessment area may be incorporated into the susceptibility analysis and/or vulnerability assessment at the discretion of the State dependant upon the prevalent topographical and hydrogeologic characteristics of the area.

REPORTING RESULTS

We will provide a completed assessment report(s) to each public water system with a source. The water system must advise their customers of the availability of the assessment report(s). We expect to make data available over the Internet and provide copies upon individual request, as appropriate. The notices of the availability of the final vulnerability assessment also will be reported to water system customers, government agencies, and others via the Internet, and public postings at post offices and public libraries.

PUBLIC PARTICIPATION AND OUTREACH

In the developmental process of the Arkansas Source Water Assessment Plan, advisory committees, both technical and citizens were utilized. The committees met independently four times and together twice. The makeup of the committees was diverse and provided helpful insight and assistance in the plan development. In addition to the use of the advisory committees, five public meetings were held across the state to present the plan to the public and take comments. Articles concerning the SWAP appeared in various newsletters with statewide distribution. Presentations of the information concerning the SWAP have also been made at three statewide annual conferences. A press release has been prepared and widely distributed via media outlets.

PROTECTION PROGRAMS AND PHASE 2 ASSESSMENTS

Program activities will be refined and continue to evolve past the statutory deadline as Program Staff assist communities and water systems to develop local watershed and wellhead protection programs. The assessment process should provide information needed by local groups or agencies to develop local source water protection plans that focus their resources to the areas of greatest need. Each local plan may be customized to the particular area and the hazards, both actual and potential, contained therein.

The ADH will assist local governments in the voluntary development of their local source water protection plan(s). Such a plan may include ordinances enacted at the local level, as well as other local options for reducing the threat of drinking water source contamination within the assessment area. In addition, new and / or existing activities with contamination potential within this assessment area will be noted by the ADH and / or the local government and passed on to other involved State agencies for their consideration in permitting or other regulatory activities.

Phase 2 Assessments will utilize the priority ranking system developed by Phase 1 as well as requests for assistance from water systems. These assessments may include any or all of the following:

- Assessment of the entire watershed within the State boundary for rivers and impoundments and recharge basins for springs
- Expand and / or refine the assessment area utilizing more detailed site specific data
- On-site inspections of PSOCs to more accurately evaluate site conditions and locations
- Evaluation of individual PSOCs to determine the likelihood of contaminant release and its actual public health significance
- Re-evaluation and updating of the data used to determine the source's intrinsic susceptibility
- Incorporation of any other new information obtained

II. Vulnerability Assessments

It is our intent to implement the assessment process with a phased approach. The initial phase or Phase I Assessments will be done in full accordance with EPA guidance and will be completed by the statutory deadline. Phase I Assessments will provide completed assessments that will allow the initiation of local source water protection plans and provide a priority system for the refinement of the assessments on a continuing basis.

Within a delineated assessment area, each Potential Source of Contamination (PSOC) will be identified, mapped, categorized according to its relative public health significance and proximity to the drinking water source intake.

We have entered into an agreement with the United States Geological Survey (USGS) to perform database and Geographical Information System (GIS) development. Each water source will have an assessment area delineated and the PSOCs in that area located and mapped. Each water source will then be assessed to determine its susceptibility to contamination. The USGS will provide the results of the susceptibility analysis and other data to the Arkansas Department of Health. The Arkansas Department of Health will compile and summarize all data, maps, and the susceptibility analysis in a report that will be sent to the appropriate public water system for dissemination to its customers.

PHASE I ASSESSMENTS

The vulnerability assessment is a multi-step process consisting of source location, delineation of source water assessment areas, identification of potential sources of contamination, and a susceptibility analysis. The culmination of the Vulnerability Assessment will result in a designation of low, medium, or high source susceptibility. Within a delineated assessment area, each Potential Source of Contamination (PSOC) will be identified, categorized according to its relative public health significance and proximity to the drinking water source intake, and mapped on a GIS database.

A source water susceptibility analysis will be performed for each public water supply. The intrinsic characteristics of each source will be evaluated to determine the sensitivity of the source to possible contamination. PSOC's within the assessment area will be incorporated into the overall analysis. Their location with respect to the source, and the hazard they present, will be considered to determine if the source is susceptible to contamination at a level that may be of public health significance. Potential sources of contamination that are outside the delineated assessment area may be incorporated into the susceptibility analysis and/or vulnerability assessment at the discretion of the State dependant upon the prevalent topographical and hydrogeologic characteristics of the area.

All the data, maps, and the susceptibility analysis will be compiled and summarized. A report on each drinking water source will be generated and sent to the public water system for dissemination to its customers. Copies of each summary report will also be placed on the Internet.

Phase I will provide completed assessments that will allow the initiation of local source water protection plans. After completion of all Phase I Assessments the Arkansas Department of Health (ADH) will provide technical assistance to the public water systems in developing their local source protection program. This assistance will be rendered upon request and / or using the priority system established in Phase I. ADH assistance will include (but not be limited to) implementation of guidance, updating Phase I assessments and / or conducting a more detailed Phase II Assessment.

PHASE II ASSESSMENTS

Phase II Assessments will utilize the priority system developed by Phase 1. These assessments may include any or all of the following:

- Assessment of the entire watershed within the State boundary for rivers and impoundments and recharge basins for springs
- Expand and / or refine the assessment area utilizing more detailed site specific data
- On-site inspections of PSOCs to more accurately evaluate site conditions and locations. Such on-site inventories will include accurate siting of significant PSOCs with GPS.
- Evaluation of individual PSOCs to determine the likelihood of contaminant release and its actual public health significance
- Incorporation of any other new information obtained
- Re-evaluation and updating of the data used to determine the degree of source susceptibility

(The reader should note that this will be an evolving program. Delineation methodology and other program components will continue to be refined as staff gain training and experience in administering the program.)

III. Vulnerability Assessments -- Delineation Methods

The ADH's current "Rules and Regulations Pertaining to Public Water Systems" contain minimum criteria on the location, construction, and protection of public water supply sources. Each public water system must own and effectively control an area around each source. This will be referred to as the “Regulated Area.” Our SWAP plan is to expand this “Regulated Area” and perform a Vulnerability Assessment on a larger, Phase I Assessment Area. The Phase I Assessment Area will be the focus in order to meet the statutory deadline. Phase I Assessment data will be utilized to prioritize Phase II Assessments in the future.

Delineations will conform to the methodologies described in this section or as outlined in the approved Arkansas Well Head Protection Plan (see Appendix B for reference). The Phase I Assessment Areas will be delineated on either 1:24,000 USGS topographic maps or 1:62,500 maps that have been digitized from aerial photographs. Impoundments, rivers, springs, and Ground Water Under the Direct Influence (GWUDI) wells will be delineated using a basin approach utilizing 1:24,000 USGS topographic maps. Some wells previously delineated under the WHPP have also utilized the basin approach and will be mapped.

Source waters requiring separate special consideration will be delineated using criteria specific to their situation. There may be many of these special cases found in portions of the State. An example is areas where PSOCs are high in density and / or certain ground water and surface water conditions where basin or aquifer characteristics warrant additional effort.

DELINEATION METHODS

The Arkansas SWAP will incorporate standard delineation methods and additional methods that have been presented to and agreed upon in the process of public meetings, and technical and citizens advisory committees. Well delineation methods are those approved for the Arkansas Well Head Protection Program. Other delineation methods used will utilize a systematic approach specific to each source type. This approach will enable systems to establish protection programs specific to their source, customer needs, and / or other concerns.

DELINEATION METHOD BY SOURCE TYPE

Wells: Four methods, approved under the Arkansas Well Head Protection Program, are used to delineate wells. One or more of the methodologies may be utilized in defining the delineation area. The methodologies are as follows:

1. **Arbitrary Fixed Radius**: An area as defined in the State of Arkansas’ Wellhead Protection Plan, generally described as an area within a 0.25-mile radius of the well head. This methodology involves drawing a circle with a specific, but arbitrarily chosen, radius around the well. The length of the radius is not scientifically based, but may be based on very generalized hydrogeologic considerations, or on professional judgement. The method is used in the state only where hydrogeologic data for one of the scientifically based methods defined below are not available or usable. The rationale for the selection of the 0.25-mile radius is outlined in an Addendum to this section.

2. **Volumetric**: This method uses a modified formula of the volume of a cylinder to calculate the radius (r) of the WHPA. The ADH assumes a 5 year time of travel.

$$r = \sqrt{Qt / \pi nh}$$

Q	= discharge rate of well (ft^3 / day)
t	= time of travel to well $(days)$
π	= 3.14159
n	= effective porosity of the aquifer (*dimensionless*)
h	= thickness of aquifer zone supplying water to the well (ft)

This method is used for the unconsolidated rocks of the Coastal Plain and for alluvial deposits of the Interior Highlands.

3. **Mathematical flow equation**: The mathematical flow equation most useful to date is the Theis Non-Equilibrium Equation, which requires a knowledge of aquifer hydraulic parameters including transmissivity and storativity. This equation is commonly used in groundwater flow problems and is discussed in most textbooks on groundwater hydraulics or on the theory of aquifer tests (e.g., see the Theory of Aquifer Tests, U.S. Geological Survey Water Supply Paper 1536-E, 1962 by J.E. Ferris, et. al.). This method is used for the unconsolidated rocks of the Coastal Plain and for the alluvial deposits of the Interior Highlands.

Theis Non-Equilibrium Equation

$$s = \frac{Q}{4\pi T} W(u)$$

Where:

$W(u)$	= well function of u	&	$u = r^2 S / 4Tt$
r	= radius of WHPA (ft)	&	$r = \sqrt{4Ttu / S}$
π	= 3.14159		
s	= drawdown at boundary of WHPA assumed to be 0.5 ft		
Q	= discharge of well(s) (ft^3 / day)		
t	= time since pumping started $(days)$		
T	= Transmissivity (ft^2 / day)		
S	= Storativity (*dimensionless*)		

4. **Hydrogeologic mapping combined with a hydrogeologic budget**: This method consists of two steps. The first involves defining, (by the use of topographic and geologic maps), the boundary of the smallest drainage basin containing the well or well field. The second step involves the determination of a simplified hydrologic budget for the basin. If the selected basin is a self-contained hydrologic unit, precipitation on the basin will equal or balance the sum of water losses, assuming no long-term change of storage. If these quantities do not balance, within a reasonable

approximation, the basinal boundary is changed to incorporate a larger basin until a balance is achieved. This method is used for the consolidated-rock terrain of the Interior Highlands.

Impoundments (Lakes, Reservoirs, etc.):

- **Arbitrary Fixed Buffer**: This methodology involves drawing a buffer of a specific distance from the maximum water level of the impoundment or the centerline of its tributaries within a fixed radius around the intake. The fixed radial distance will either be based on time of travel or on professional judgement.

Rivers and Streams:

- **Arbitrary Fixed Buffer**: This methodology involves drawing a buffer of a specific distance from the centerline of the stream or its tributaries within a fixed radius of the intake. The fixed radial distance will either be based on time of travel or on professional judgement.

Springs and GWUDI Wells

- **Arbitrary Fixed Radius**: This methodology involves drawing a circle of a specific radius around the spring / well. The radius is not scientifically based, but may be based on very generalized hydrogeologic considerations, or on professional judgement.

- **Hydrogeologic mapping combined with a hydrogeologic budget***:* This method consists of two steps. The first involves defining (by the use of topographic and geologic maps) the boundary of the smallest drainage basin containing the well / spring. The second step involves the determination of a simplified hydrologic budget for the basin. If the selected basin is a self-contained hydrologic unit, precipitation on the basin will equal or balance the sum of water losses, assuming no long-term change of storage. If these quantities do not balance, within a reasonable approximation, the basinal boundary is changed to incorporate a larger basin until a balance is achieved. This method is used for the consolidated-rock terrain of the Interior Highlands.

The first component of our SWAP will be the delineation of a Phase I Assessment Area for each public water supply source in the State. The Arkansas Wellhead Protection Program (WHPP) will remain unchanged from the current EPA approved program. The SWAP will utilize the delineation and contaminant inventories developed under the WHPP and will incorporate additional data to provide a complete vulnerability assessment. A vulnerability assessment for all surface water sources in the State will be added.

CONJUNCTIVE DELINEATIONS

Most of eastern Arkansas contains aquifers that are confined or have protective caps. However, the Ozark Highlands in northwestern Arkansas and the Ouachita and Athens Plateaus in western Arkansas are characterized by high intrinsic sensitivity. It is in the Ozark Highlands and the Ouachita and Athens Plateaus that the majority of all the springs and GWUDI wells are located. Our experience suggests that in order to provide an accurate analysis of source susceptibility, conjunctive delineations and assessments are necessary for the GWUDI wells and springs located in these physiographic provinces.

Some streams and impoundments are subject to recharge from ground water. We have selected a buffer around these type of sources that is equal to the Phase I Assessment radius for wells. Therefore, additional conjunctive delineation for streams and impoundments is not warranted. (The rationale for the selection of the 0.25-mile radius is outlined in an Addendum to this section.)

DELINEATION OF ASSESSMENT AREAS

The delineation of wellhead assessment areas will be as follows:

Regulated Area - The current Arkansas "Rules and Regulations Pertaining to Public Water Systems" require that a horizontal distance (measured radially from the wellhead) of not less than 100 feet be maintained between any public water supply well and any possible source of contamination. This is a minimum distance that can be increased where local conditions dictate. The actual size of this area may vary dependent on the timeframe of source development and the edition of the Arkansas "Rules and Regulations Pertaining to Public Water Systems" in effect at that time. Therefore, since the protected area is required by state regulation, activities within this area will continue to be regulated by the ADH.

Phase I Assessment Area - An assessment area will be delineated around each wellhead. The arbitrary fixed radius method of delineation will be used to set the boundary of Phase I Assessment Areas at a radial distance of 0.25 miles around each wellhead that has not previously received a site specific delineation under the WHP Program. Site specific delineations will take precedence over arbitrary fixed radius delineations. Refer to the Arkansas WHP Program, Section III, Delineation of Wellhead Protection Areas for further explanation. (Appendix B).

Surface water assessment areas will be delineated according to the type of source. The source types are:

1. Impoundments (Lakes, Reservoirs, etc.)
2. Rivers, streams, etc.
3. Springs
4. Ground Water Under Direct Influence (GWUDI) of Surface Water wells

Each type of source water shall also be delineated as follows:

1. Impoundments (Lakes, Reservoirs, etc.) -

Regulated Area - The current Arkansas "Rules and Regulations Pertaining to Public Water Systems" require public water supply reservoirs to "…own and effectively control a minimum restricted buffer zone including all land bounded by a fixed line which is at least 300 feet horizontally from the shore line when the reservoir is at the maximum high water level contour as established by the ADH". In the case of large multi-purpose reservoirs developed by the federal government, all shoreline within a 0.25-mile radius of the intake must meet the above-described 300-foot buffer zone. The actual size of this area may vary dependent on the timeframe of source development and the edition of the Arkansas "Rules and Regulations Pertaining to Public Water Systems" in effect at that time. Therefore, since the protected area is required by state regulation, activities within this zone will continue to be regulated by the ADH.

Phase I Assessment Area – The entire watershed of the impoundment within the state boundary will be delineated. Within the watershed of the impoundment, the areas defined by the following criteria will constitute the Phase I Assessment Area:

- All lands within a 5-mile radius around the intake that are:
    - Within 0.25 miles of the shoreline at the impoundment's high water level, and
    - Within 0.25 miles of either side of the centerline of all tributaries.
- In addition, all lands within a 0.5-mile radius of the intake, regardless of watershed boundaries.

2. Rivers, streams, etc. -

Regulated Area - The current Arkansas "Rules and Regulations Pertaining to Public Water Systems" establish a minimum restricted buffer zone including all land from the river bank to a line 300 feet back, within a 0.25 mile radius of the intake. The actual size of this area may vary dependent on the timeframe of source development and the edition of the Arkansas "Rules and Regulations Pertaining to Public Water Systems" in place at that time. Therefore, since the protected area is required by state regulation, activities within this zone will continue to be regulated by the ADH.

Phase I Assessment Area - The entire watershed of the intake within the state boundary will be delineated. Phase I Assessment Areas will include all lands within 0.25 miles of either side of the centerline of the river / stream and of all its tributaries within a 3 day time of travel limited by a maximum distance up-gradient from the intake of 20 miles (not to exceed state boundaries). Time of travel (TOT) shall be calculated using median flow conditions and a stream slope determined by the slope of the main stem of the river within the assessment area.

3. Springs -

Regulated Area - The current Arkansas "Rules and Regulations Pertaining to Public Water Systems" require a minimum restricted buffer zone including all property within a 300 foot radius of the spring enclosure. The actual size of this area may vary dependent on the timeframe of source development and the edition of the Arkansas “Rules and Regulations Pertaining to Public Water Systems" in effect at that time. Therefore, since the protected area is required by state regulation, activities within this area will continue to be regulated by the ADH.

Phase I Assessment Area - An assessment area will be delineated around each spring enclosure. The arbitrary fixed radius method of delineation will be used to set the boundary at a radial distance of 0.5 mile around each spring. If the spring is located in the Ozark Highlands in northwestern Arkansas or the Ouachita and Athens Plateaus in western Arkansas and a surface water body intersects the base 0.5-mile radius, conjunctive delineations will performed. In such cases the delineation and assessment area will be increased to include all area within a radius of 3.0 miles of the spring.

(Note: If the spring is the point of origin for a stream, then that stream will not be considered in the conjunctive delineation and assessment. Additionally, delineation and assessment for any waterbody that is at a lower elevation than the spring outlet should not be necessary.)

Recharge basins for springs are not readily available in Arkansas at this time. Some developmental work is underway in northwestern Arkansas to isolate spring recharge basins. If a recharge basin is isolated on any spring prior to completion of the Phase I Assessments, the delineation of the assessment area may be modified to consider the recharge basin on a case by case basis.

4. GWUDI wells - (i.e. Wells determined to be under the direct influence of surface water.)

Regulated Area - The current Arkansas "Rules and Regulations Pertaining to Public Water Systems" require that a horizontal distance (measured radially from the wellhead) of not less than 100 feet be maintained between any public water supply well and any possible source of contamination. This is a minimum distance that can be increased where local conditions dictate. The actual size of this area may vary dependent on the timeframe of source development and the edition of the Arkansas “Rules and Regulations Pertaining to Public Water Systems" in place at that time. Therefore, since the protected area is required by state regulation, activities within this area will continue to be regulated by the ADH.

Phase I Assessment Area – An assessment area will be delineated around each wellhead. The arbitrary fixed radius method of delineation will be used to set the boundary of the Phase I Assessment Area at a radial distance of 0.5 mile around each wellhead. Refer to Section III, Delineation of Wellhead Protection Areas for further explanation (Appendix B). If the GWUDI well is located in the Ozark Highlands in northwestern Arkansas or the Ouachita and Athens Plateaus in western Arkansas and a surface water body intersects the base 0.5-mile radius, conjunctive delineations will performed. In such cases the delineation and assessment area will be increased to include all area within a radius of 3.0 miles of the wellhead.

ADDENDUM: Rationale For Selection of 1/4 Mile Fixed Radius

Based on an analysis of hydrogeologic information for the aquifers of the State, a radius of 1/4 mile around each public water supply well was selected as the generic delineation boundary for the Arkansas Wellhead Protection Plan. This same methodology will be used for the delineation of assessment areas for wells in the SWAP. The rationale for the choice of the 1/4 mile radius is presented in the following paragraphs.

It is a goal of the ADH, in implementing a WHP program, to establish a zone around each well which will generally provide a comfortable degree of protection/warning if contaminant controls and monitoring are implemented within the boundary area. In a groundwater contamination incident sufficient time will be needed to determine the extent of the problem, determine the appropriate actions needed (e.g.; secure new source, install treatment equipment, etc.), secure funding, design and construct the needed facilities. A boundary, which establishes a 5-year time of travel (TOT), is considered the minimum acceptable time frame satisfactory for that purpose.

In determining that the 1/4-mile radius generally provides at least a 5-year TOT around each well the distribution of PWS wells across the various hydrogeologic environments in the state were considered. WHPAs were calculated for selected PWS wells using site specific methods of delineation.

Arkansas is very diverse in terms of geology and hydrology, but can be generally divided into two major regions; 1) Gulf Coastal Plain and 2) Mountains. The population base served by PWSs in the mountainous region, which consists of the Ouachita and Ozark Mountains, generally depends upon surface water as a source of supply rather than groundwater. The Ozark Mountains are generally a Karst area where shallow groundwater is highly vulnerable to contamination. However most community PWSs in this area (which do not depend on surface water sources) depend on deep wells (e.g.; 1,000+ feet) which tap confined aquifers (i.e.; Gunter and Roubidoux).

The great majority of the PWS wells in the State occur in the Gulf Coastal Plain region. A few of the PWS wells withdraw groundwater from alluvial and terrace deposits which are extensive throughout this area, but most are supplied by older, confined aquifers under artesian conditions. One aquifer, the Sparta Sand, supplies more water for PWS wells in the State than all other aquifers combined.

Average groundwater travel times for the 1/4 mile WHPA boundary in the major Gulf Coastal Plain aquifers were calculated on the basis of hydraulic conductivity values provided by the USGS, hydraulic gradients taken from USGS potentiometric maps (selected from areas having high average values), and estimated porosity values. The results are shown in the following table:

AQUIFER	**K** (ft/day)	**POROSITY**	**GRADIENT**	**VELOCITY** (ft/day)	**¼ Mile TRAVEL TIME** (years)
Sparta	45	0.30	0.0022	0.33	11.0
Alluvium	300	0.30	0.0002	0.19	19.1
Cockfield	40	0.25	0.0022	0.29	12.4
Carrizo	15	0.30	0.0022	0.11	32.8
Wilcox	35	0.30	0.0022	0.25	14.1

The hydraulic conductivity values in this table were derived from pump tests on wells screened in the more productive zones of the aquifers. Hydraulic gradient information is not generally available on aquifers other than the Alluvium and Sparta. Because of the similarities between the confined Gulf Coastal Plains aquifers, a high value was selected for the Sparta and applied to all of the aquifers except the Alluvium for which independent values were available.

The calculated travel times are probably very conservative. Although localized hydraulic gradients may exceed the value shown in the table, the gradients were selected to generally exceed the value expected across the state.

In addition to considering groundwater travel times for the 1/4-mile boundary area, a fixed radius based upon a 5-year TOT was calculated for each community PWS well with current data in Union County for comparative purposes. This county was chosen because all the community PWS wells are completed into the Sparta Sand, which is the major source of drinking water in the State, and because historic data on pumping rates and screened intervals was available from the USGS. The calculated fixed radius defines an area on the ground surface overlying that portion of the aquifer which would contain the volume of water pumped by the well during a five year period, neglecting the effect of the local hydraulic gradient. Of the 47 active community PWS wells in the county, complete data were obtained on 45, resulting in the following summary: (Refer to the table on pages 3-9 and 3-10 for individual results.)

5-YEAR CALCULATED FIXED RADIUS (ft)	NUMBER OF WELLS
more than 1320	8
1320 - 1000	2
999 - 800	3
799 - 600	7
599 - 400	15
less than 400	10

The mean radius found for a 5-year TOT was 736. These figures may be somewhat conservative because a porosity of 0.25 was used in the calculation (rather than the 0.30 used for the earlier flow velocity calculations) and it was assumed that the aquifer was no thicker than the screened interval.

All of the wells that exceeded the 1/4-mile radius belong to the City of El Dorado and have pumping rates that are exceptionally high when compared to most PWS wells in the State. It is probable that only a few major pumping centers, such as El Dorado, Magnolia, and Pine Bluff, would have WHPAs larger than 1/4 mile when calculated in this manner.

As a further check on the appropriateness of using a 1/4-mile radius, analytical models were run on four of the PWS wells in Union County. The model used, MWCAP, is part of the EPA's WHPA Code which was designed for use in delineating WHPAs on a site-specific basis. These computer runs were somewhat generalized in that a county average hydraulic gradient of 0.0022 was used for each of the wells and, for convenience of comparison, the flow direction is toward the east in each case. However, aquifer thickness and the well pumping rate are individually specified.

The generalized WHPAs delineated with MWCAP all fall within the 1/4-mile radius, except for a very small portion of the delineated area around the Smackover well. There was an attempt to choose a wide range of circumstances for these examples. The Smackover well is more representative of the larger WHPAs, while the Faircrest example is probably more typical of most wells in Union County. Because the hydraulic gradients in Union County are locally high due to a county-wide cone of depression from over pumping of the Sparta Sand, WHPAs delineated in this manner would be expected to be smaller over most of the rest of the State.

These comparative analyses indicate that the choice of a 1/4-mile fixed radius, as the WHPA boundary is appropriate for protection of PWS wells in general within the State.

PWS	**SCREEN LENGTH** (ft)	**1989 AVERAGE DAILY USE** (gpd)	**5-YEAR CALCULATED FIXED RADIUS** (ft)
Batts Lapile WA	74	25561	328
	30	25561	514
Calion	50	66082	641
	70	0	----
Crabapple Point	--	1250	----
	--	2500	----
El Dorado	70	878071	1974
	105	878071	1612
	100	878071	1651
	115	17797	219
	115	57053	393
	100	878071	1651
	70	844488	1936
	80	680163	1625
	80	680163	1625
	100	680163	1454
Faircrest WA	41	52149	629
	60	52149	450
Felsenthal WA	56	4500	158
	37	4500	194
Huttig	80	179029	834
	60	13000	259
Hwy 82 WA	20	14000	466
Johnson Township WA	60	100000	720
Junction City	52	39076	483
	55	39076	469

PWS	SCREEN LENGTH (ft)	1989 AVERAGE DAILY USE (gpd)	5-YEAR CALCULATED FIXED RADIUS (ft)
Lawson Urbana WA	25	47702	770
	20	47702	860
Marysville	30	53083	741
Mount Holly	40	21145	405
	58	17864	309
New Hope WA	70	39353	418
	40	39353	553
New London WA	51	30837	433
	50	30837	438
Norphlet	53	50527	544
	41	50527	619
Old Union WA	100	88419	524
Parkers Chapel WA	42	62857	682
	50	106848	815
Smackover	60	0	----
	50	161093	1000
	40	0	----
	40	161093	1118
Strong	70	29096	359
	40	8762	261
	30	0	----
	25	6134	276
	40	44693	589
	50	44000	523
Wesson Newell WA	40	39256	552

IV. Vulnerability Assessments -- Contaminant Inventory

Consultations were held with state, local, and federal agencies to determine the existence, structure, validity, and condition of existing electronic and paper databases needed for this project. Agreements with these agencies will be negotiated to update and validate all of these databases. Appendix J includes a copy of USGS's workplan for this project. This workplan outlines the specific tasks and timeline for completion of the data gathering and inventory process.

Selection has been made of the set of data bases to be developed and used in the source water assessments. On page 3 of this section is a general list of GIS layers and databases that will be used in the digital inventory process. Initial efforts will focus on locational data bases for all ground water and surface water sources within the state. Other broad categories of databases will include, but not be limited to; basin characteristics, aquifer characteristics, and land surface characteristics.

All databases used in the development of the SWAP will be given appropriate documentation in the form of data dictionaries. The data dictionaries will fully describe the fields, data within the fields, QA/QC, as well as conform to existing state standard for data dictionaries. The complete package of databases developed will be made available to all interested agencies and parties in Arkansas once the program is implemented.

CONTAMINANT INVENTORY

An inventory of potential contaminants will be established for each assessment area. Consultations were held with all pertinent agencies / divisions that manage PSOCs or have existing PSOC databases to determined the type of data attributes, data locations, quality of data, data availability, and status of documentation. Existing locational data may be used (if deemed adequate), GPS methods may be used for field locations, or map locations may be used for locating the PSOCs.

To assist in this process, maps indicating the location of the source, the assessment area and all PSOCs identified in the initial digital research will be sent to the water system for verification. An example of the proposed verification packet that will be provided to water systems is provided for reference beginning on page 4-10.

The inventory will consist of PSOCs that are categorized according to their health significance. Potential sources of contamination that are outside the delineated assessment area may be considered in the overall vulnerability assessment report.

Contaminant Inventory Report Format

A seamless statewide GIS database will be created by compiling various PSOC databases. Contaminant inventory reports will detail the number, type, health risk category and location of all potential sources of contamination. Additional information on contaminant types and their significance is provided in Appendix C. The inventory will be summarized by listing the number of contaminants in each Health Risk Category (see page 4-4) within specified zones. These zones will vary according to source type and size of the assessment area. A description of these zones is outlined on the following page.

Surface Water – River and Impoundments

The number of PSOCs that lie within the assessment area for river / streams and impoundments will be determined and mapped. They will be categorized by Health Risk and the distance from the intake determined. A summary of the PSOCs will be provided listing the number of PSOCs in each category located within the following zones:

Rivers:	**Impoundments:**
0 - 1 mile	0 - 1 mile
> 1 - 2 miles	> 1 - 2 miles
> 2 - 5 miles	> 2 - 3 miles
> 5 - 10 miles	> 3 - 4 miles
>10 - 20 miles	> 4 - 5 miles
> 20 miles*	> 5 miles*

* Outside the assessment area, but within the watershed

Surface Water – Springs & GWUDI Wells

The number of PSOCs that lie within the assessment area for springs and GWUDI wells will be determined and mapped. They will be categorized by Health Risk and the distance from the well / spring determined. A summary of the PSOCs will be provided listing the number of PSOCs in each category located within the following zones:

Base Assessment Area	**Conjunctive Assessment Area**
0 - 500 feet	0.0 - 0.5 miles
501 - 1000 feet	> 0.5 - 1.0 miles
1001 - 1320 feet	> 1.0 - 1.5 miles
1321 - 2640 feet	> 1.5 - 2.0 miles
	> 2.0 - 3.0 miles
	> 3.0 miles**

**Outside the assessment area, but within the recharge basin where such information is available

Groundwater

The number of PSOCs that lie within the assessment area for wells will be determined and mapped. They will be categorized by Health Risk and the distance from the well determined. A summary of the PSOCs will be provided listing the number of PSOCs in each category located within one of three zones. The following zones were established for a base one-quarter mile assessment area. Assessment areas larger or smaller than this base size will be proportioned accordingly. (i.e. If radius of the assessment area is half as large, the each zone will be cut in half: 0 – 220; 220.5 –440; & 440.5 – 660)

0 - 440 feet
441 - 880 feet
881 - 1320 feet

GIS Layers

1. Geology (1:500k) vector
2. Soils (STATSGO 1:250k) vector
3. Poultry/Swine houses (AHTD cells, all but one county)
4. Land Cover re-class of GAP (30m raster)
5. Canals and Ditches (1:100k vector TIGER/DLG)
6. Irrigation Wells (as determined by ASWCC)
7. NPDES and TRI (EPA, vector data in Arc Info)
8. Highways by classification, railroads, airports, bridges (AHTD)
9. Pipelines (TIGER/DLG? 1:100k)
10. RCRA
11. ERNS
12. Cemeteries (AHTD/GNIS)
13. Schools (AHTD/GNIS)
14. Septic Systems (Rural structures from AHTD)
15. Mines (GNIS)
16. Elevation (30m where available; else 80m)
17. Streams/Rivers/Impoundments (DLG 1:100k)
18. Dairies (Ark. Dept. of Health)
19. Oil and Gas Wells

PSOC databases to be used in the development of statewide GIS layer(s)

1. Above ground storage tanks
2. Under ground storage tanks
3. Leaking storage tanks
4. Agricultural Industry (fertilizer storage, sales, etc)
5. Pesticides applied per acre (Rick Bell at USGS 228-3620 in LR)
6. Airports
7. Repair Shops (Auto, Farm, furniture)
8. Cemeteries
9. Chemical Storage (dealers, paints, solvents)
10. Dry cleaners
11. Electric substations
12. Golf Courses
13. Gravel Pits (PC&E Streaming Mining)
14. Highways
15. Manufacturing facilities (non-specific)
16. Pipelines
17. Oil and gas wells
18. Salvage yards
19. Sewage treatment plants (NPDES facilities)
20. Septic tanks
21. Landfills (PC&E)
22. Water wells (drinking water and irrigation wells)
23. Confined animal operations
24. Aquaculture (AHTD hydro layer)
25. Land application(Solid Waste Div. of PC&E)
26. Waste water lagoon (Discharge data)
27. In-steam gravel removal (PC&E Permits)
28. RCRA
29. CERCLA (Superfund)
30. Marinas (and other recreation on lakes)
31. Mining

Health Risk Categorization

The following is a generalized categorization of the various types of Potential Sources of Contamination that are expected to be found during the contaminant inventory process. These lists are categorized in a fashion that give a generalized rank of contaminant sources taking into account the relative public health significance and the likelihood for a release of contaminants to affect the source. There are 10 categories listed for each type of water system / source. Category 1 is considered to be of the most significance and Category 10 the least significant. A more detailed list of facilities that produce, store or distribute materials that, if released could result in some degree of contamination of a source water is included in Appendix C.

Description of Health Risk Categories for Community and Non-Transient Non-Community Public Water Systems:

	GROUNDWATER (including GWUDI Wells & Springs)	**SURFACE WATER (Rivers & Impoundments Only)**
Category 1	RCRA Site CERCLA Site Superfund Site Leaking UST Railroad Yards Nuclear Power Plants Wood Preserving Facilities Military Bases Electroplating Facilities	RCRA Site CERCLA Site Superfund Site Interstate Hwy Bridge Railroad Bridge Railroad Yards Nuclear Power Plants Wood Preserving Facilities Military Bases Electroplating Facilities
Category 2	Mining Operation Abandoned or Active Dump Manufacturing Facility Class V Injection well UST – Underground Storage Tank Sewer Lines Car Washes Gas / Service Stations Sinkhole or fault Land Application Site Confined Animal Operation Individual Sewage Disposal	U.S. / State Hwy Bridge Interstate Hwy Segment Railroad Segment Leaking UST Processing Facilities
Category 3	Airport Above Ground Storage Tank Interstate Hwy Bridge Railroad Bridge Interstate Hwy Segment Railroad Segment Fuel / Oil Distributors Aquaculture State & Federal Prisons	U.S. / State Hwy Segment Airport Above Ground Storage Tank Mining Operation Dumps Fuel / Oil Distributors State & Federal Prisons

Description of Health Risk Categories for Community and Non-Transient Non-Community Public Water Systems:

	GROUNDWATER (including GWUDI Wells & Springs)	***SURFACE WATER (Rivers & Impoundments Only)***
Category 4	Gravel Pit Class I Landfill Class III Landfill Industrial Waste Lagoon Chemical Storage (MSDS) Asphalt Plants Processing Facilities Composting Facilities Waste Incinerators Recreational – Parks and Camping Fac.	Manufacturing Facility Pesticide App. >900,000 #/year** NPDES Facility Class I Landfill Class III Landfill Asphalt Plants Composting Facilities Waste Incinerators
Category 5	Pesticide App. >900,000 #/year** U.S. / State Hwy Bridge U.S. / State Hwy Segment Domestic WW Lagoon Oil & Gas Well Research Labs	Repair Shop Pesticide App. 700,000-900,000 #/yr** County Road Bridge Golf Course UST – Underground Storage Tank Chemical Storage (MSDS) Marina Sewer Lines Bus & Truck Terminals Furniture Stripping & Refinishing Gas / Service Stations Auto Body – Paint Shop & Rust Proofers Research Labs Machine / Metal Working Shops
Category 6	Pesticide App. 700,000-900,000 #/yr** County Road Bridge County Road Segment Repair Shop NPDES Facility Bus & Truck Terminals Furniture Stripping & Refinishing Auto Body – Paint Shop & Rust Proofers Machine / Metal Working Shops Veterinary Clinic Humane Societies & Boarding Facilities	County Road Segment Pesticide App. 500,000-700,000 #/yr** Land Application Site Confined Animal Operation Agricultural Industry Nurseries Veterinary Clinic Humane Societies & Boarding Facilities Recreational – Parks and Camping Fac.

** See Pesticide Application Rate Distribution Map on page 4-9 of this Section

Description of Health Risk Categories for Community and Non-Transient Non-Community Public Water Systems:

	GROUNDWATER **(including GWUDI Wells & Springs)**	**SURFACE WATER** **(Rivers & Impoundments Only*)***
Category 7	Pesticide App. 500,000-700,000 #/yr** Electric Substation Golf Course Pipeline - 1 mile segment Dry Cleaners / Laundromats Hospital Nursing Homes Photo Processors Printer & Blue Print Shops National Guard & Reserve Armories Transmission Line Right of Ways Schools Coal Powered Electric Generating Fac.	In-Stream Gravel Mining Abandon Landfill Dry Cleaners / Laundromats Pesticide App. 300,000-500,000 #/yr** Electric Substation Class V Injection well Hospital Car Washes Nursing Homes Photo Processors Printer & Blue Print Shops National Guard & Reserve Armories Transmission Line Right of Ways Coal Powered Electric Generating Fac. Schools
Category 8	Pesticide App. 300,000-500,000 #/yr** Agricultural Industry Salvage Yard Class 2 Injection Well Mortuary Nurseries Recycling Facilities Water Well	Pipeline - 1 mile segment Oil & Gas Well Salvage Yard Industrial Waste Lagoon Mortuary Recycling Facilities Tire Dumps
Category 9	Class IV Landfill Pesticide App. 100,000-300,000 #/yr** Class 1 Injection Well Road Maintenance Depots Tire Dumps	Gravel Pit Individual Sewage Disposal Pesticide App. 100,000-300,000 #/yr** Aquaculture Domestic WW Lagoon Class 2 Injection Well Road Maintenance Depots
Category 10	In-Stream Gravel Mining Marina Cemetery Pesticide App. <100,000 #/year** Fire Training Facilities	Class IV Landfill Pesticide App. <100,000 #/year** Cemetery Class 1 Injection Well Fire Training Facilities

** See Pesticide Application Rate Distribution Map on page 4-9 of this Section

Description of Health Risk Categories for Transient Non-Community Public Water Systems:

GROUNDWATER AND SURFACE WATER

Category 1	Class V Injection well Land Application Site Confined Animal Operation Railroad Yards Recreational Facilities (i.e. State/Corps/NFS Parks/Private RV Parks/Resorts) Sinkhole or fault
Category 2	Domestic WW Lagoon NPDES Facility Individual Sewage Disposal Interstate / Railroad / U.S. / State Hwy Bridges Hwy Segments (# of Miles) County Road & City Street Bridges Road and Street Segments (# of Miles)
Category 3	Sewer Lines Industrial Waste Lagoon Airport (Small) Aquaculture Pipeline Segment (# of Miles) Composting Facilities Car Washes
Category 4	Chemical Storage (MSDS) Golf Course Agricultural Industry Printer & Blue Print Shops Nurseries
Category 5	Pesticide App. >900,000 #/year** In-Stream Gravel Mining Military Facilities Pet Boarding Facilities Veterinary Clinics Humane Societies

** See Pesticide Application Rate Distribution Map on page 4-9 of this Section

Description of Health Risk Categories for Transient Non-Community Public Water Systems:

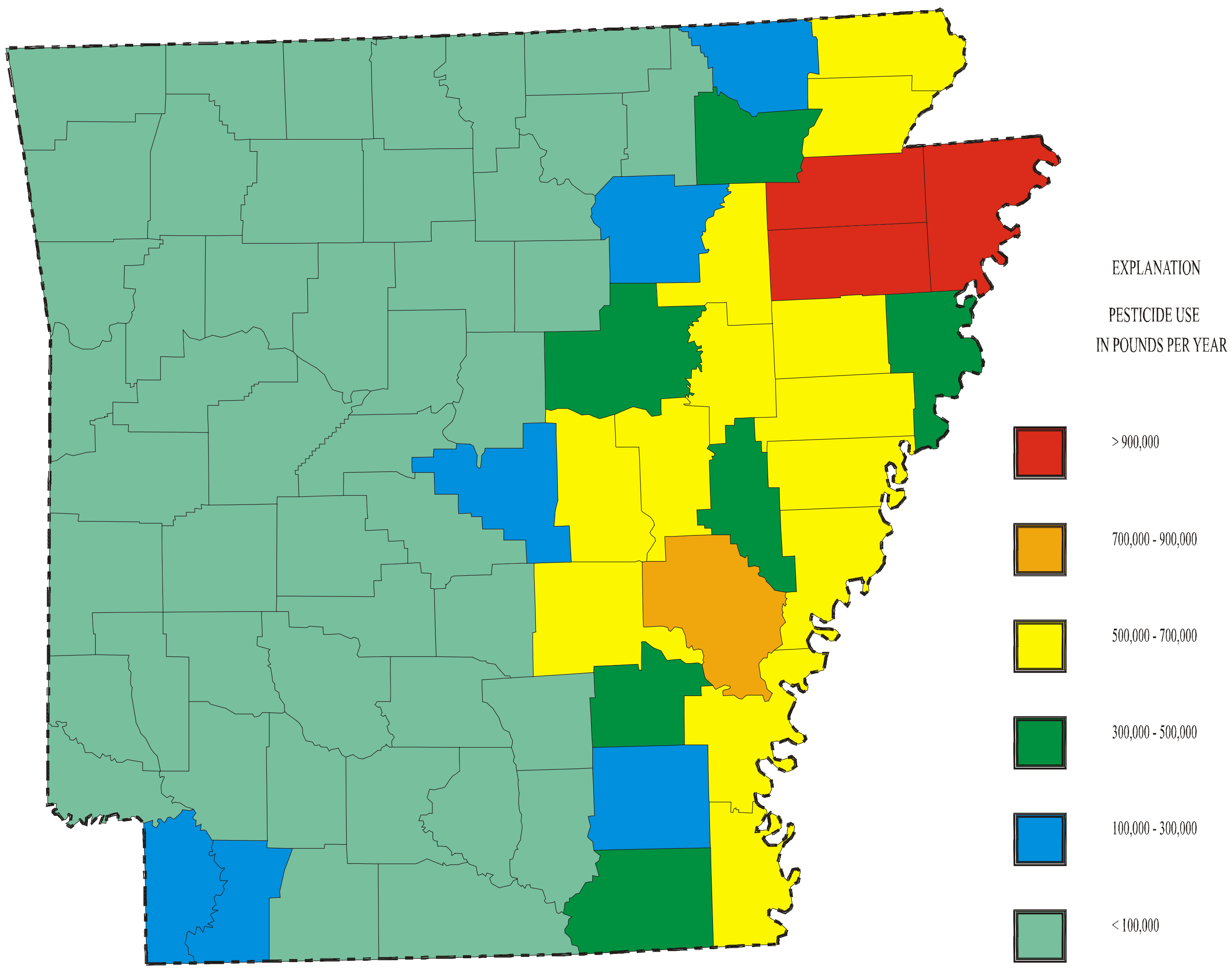
GROUNDWATER AND SURFACE WATER

Category 6	Pesticide App. 700,000 - 900,000 #/year** Marina
Category 7	Pesticide App. 500,000 - 700,000 #/year** Hospital Research Labs Schools
Category 8	Pesticide App. 300,000 - 500,000 #/year** Class I Landfill Water Well
Category 9	Pesticide App. 100,000 - 300,000 #/year** Abandon Dump State & Federal Prison Facilities Waste Incinerators
Category 10	Pesticide App. <100,000 #/year** Cemetery Mortuary Class III Landfill

** See Pesticide Application Rate Distribution Map on page 4-9 of this Section

The list for Transient Non-Community Public Water Systems contains sources that could contribute microbial or nitrate / nitrite contamination to the source water. This is a minimum list of contaminants that will be evaluated during the Phase I Assessment process. Future on-site investigations will not be limited to this list. If an inspection reveals a source of contamination which might adversely affect the water quality nearby, the system will be advised and the initial assessment amended.

Pesticide Use Distribution Map



MEMORANDUM

DATE: February XX, 1999

TO: Public Drinking Water System Operators / Managers

FROM: Tony Ramick, R.S.
Source Water Protection Specialist

RE: Source Water Assessment Program – Assessment Maps

Through Congressional statute, the Environmental Protection Agency (EPA) has mandated a Source Water Assessment Plan (SWAP) be developed by each state. The Arkansas Department of Health (ADH) has partnered with the United States Geological Survey (USGS) and Advisory Committees (made up of citizens and technical professionals throughout the State) to develop a SWAP. The ADH, USGS, and the Advisory Committees have been meeting over the past year to develop this Plan. In addition, Public meetings were held across the State in an effort to allow interested person(s) and / or organization(s) to voice their opinion on the development of this Plan. By mandate, the Plan had to be (and was) submitted to EPA by February 6, 1999.

The implementation of this Plan has begun. Part of the implementation involves the determination of the correct locations of all public drinking water source supply wells / surface intake structures and the Potential Sources of Contamination (PSOCs) that may affect them. Therefore, we are requesting your help in gaining the correct and / or updated information of the well(s) / surface intake structure(s) and PSOCs.

A PSOC is defined as; "a contaminant that has the potential to adversely affect the quality of a drinking water supply". Generally the most commonly found PSOCs are as follows:

Gas / Fuel / Oil / Sales / Storage	Chemical Storage / Mfg. / Sales	Airport / Airstrip
Sludge / Animal Waste / Application Sites	Agri. Chemical / Sales / Storage	Septic Tanks
Landfills / Dumps / Mining Sites	Water / Gas / Oil Wells	Repair Shops
Animal Feeding / Growing Operations	Indust. / Factories	Auto Body Shop

This illustration **is not** to be considered a **complete** PSOC list.

Enclosed you will find map(s) showing the location of your water supply source(s) and PSOCs that we have identified within the assessment area(s). We are asking that you review and verify the information contained on the map(s) and PSOC list(s). You will also find enclosed a copy of Instructions for Editing Maps and examples of an edited map and PSOC list. Please edit your map(s) and PSOC list(s) in the same manner. It is important that you verify the location of your public water supply well / surface intake structure and the PSOCs within the assessment area on the map, and make the appropriate changes as stated in the Instructions for Editing Maps.

Edited maps and PSOC lists **must** be returned by **March 26, 1999** to:

ATTN: Tony Ramick
Arkansas Department of Health
Division of Engineering
4815 West Markham M.S. # 37
Little Rock, Arkansas 72205

Your participation in this process is very important. If you have questions after reviewing the enclosed materials please contact Ginger Tatom, Lyle Godfrey, or myself at 501-661-2623. It is of the utmost importance that you fully understand the Instructions of Editing Maps before making any changes.

Thank you for participation and help in this matter.

INSTRUCTIONS for EDITING MAPS

The map(s) and this survey **MUST** be completed and returned to the Arkansas Department of Health, Division of Engineering by **March 26, 1999**. Please use a **red** ink pen when marking on the map(s).

CHECK ONE

YES	NO	NOT SURE	
____	____	____	1. Is your public water supply (well / surface) intake in the correct location on the map? If not, please place a red triangle **"▽"** at the proper location of the well / intake.
____	____	____	2. Are there any of the Potential Sources of Contamination (PSOC) names and / or addresses that are incorrect on the "PSOC LIST" page(s)? If any PSOC names and / or addresses are incorrect on the "PSOC LIST" please red line through them and write the corrected name and / or address (in red ink) on the blank spaces provided at the end of the "PSOC LIST". Be sure to use the same number as the original PSOC listing (that you marked out) for the corrected PSOC.
____	____	____	3. Are the location(s) of all PSOC(s) correct? If the location(s) of the PSOC(s) are incorrect, please place a red box **"■"** at the correct location on the map and place a number beside it. Make sure that the number you placed beside the box matches the number on the "PSOC LIST".
____	____	____	4. Are there any PSOC(s) that are no longer in business? If so, place a red "**X**" on any PSOC on the map that is no longer in business and draw a red line through it on the page labeled "PSOC LIST".
____	____	____	5. Are there any PSOC(s) that are listed on the "PSOC LIST" that are no longer in business **but** another business has opened at the same location? If so, please mark a red line through the PSOC name and / or address of the incorrect PSOC on the "PSOC LIST" and write the corrected name and / or address (in red ink) on the blank spaces provided at the end of the "PSOC LIST". Be sure to use the same number as the original PSOC listing.
____	____	____	6. Are there PSOC(s) that you are aware of that are not on the map? If so, place a red dot "•" with a new number beside it at the new location. Be sure to write the new number, name, and address of the new PSOC on the page labeled "PSOC LIST". Do not duplicate the use of any number.

Comments:____

____

____

(Additional comments may be written on the back of this page)

Signature: ______________________________ Title: ______________________________

Phone #:______________________________ Date: ______________________________

Anywhere Waterworks

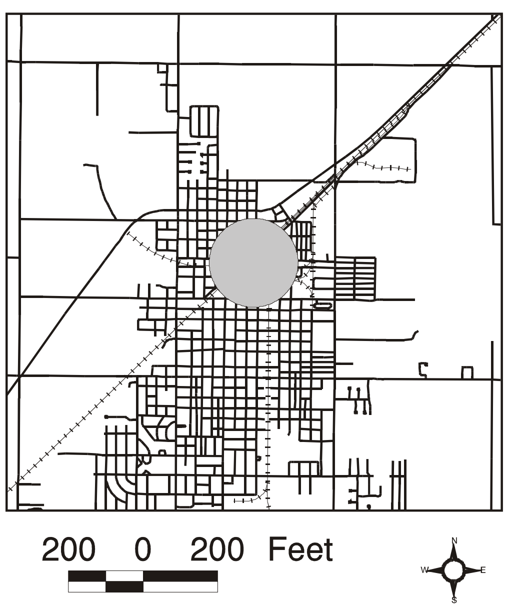
PWS ID# = 999

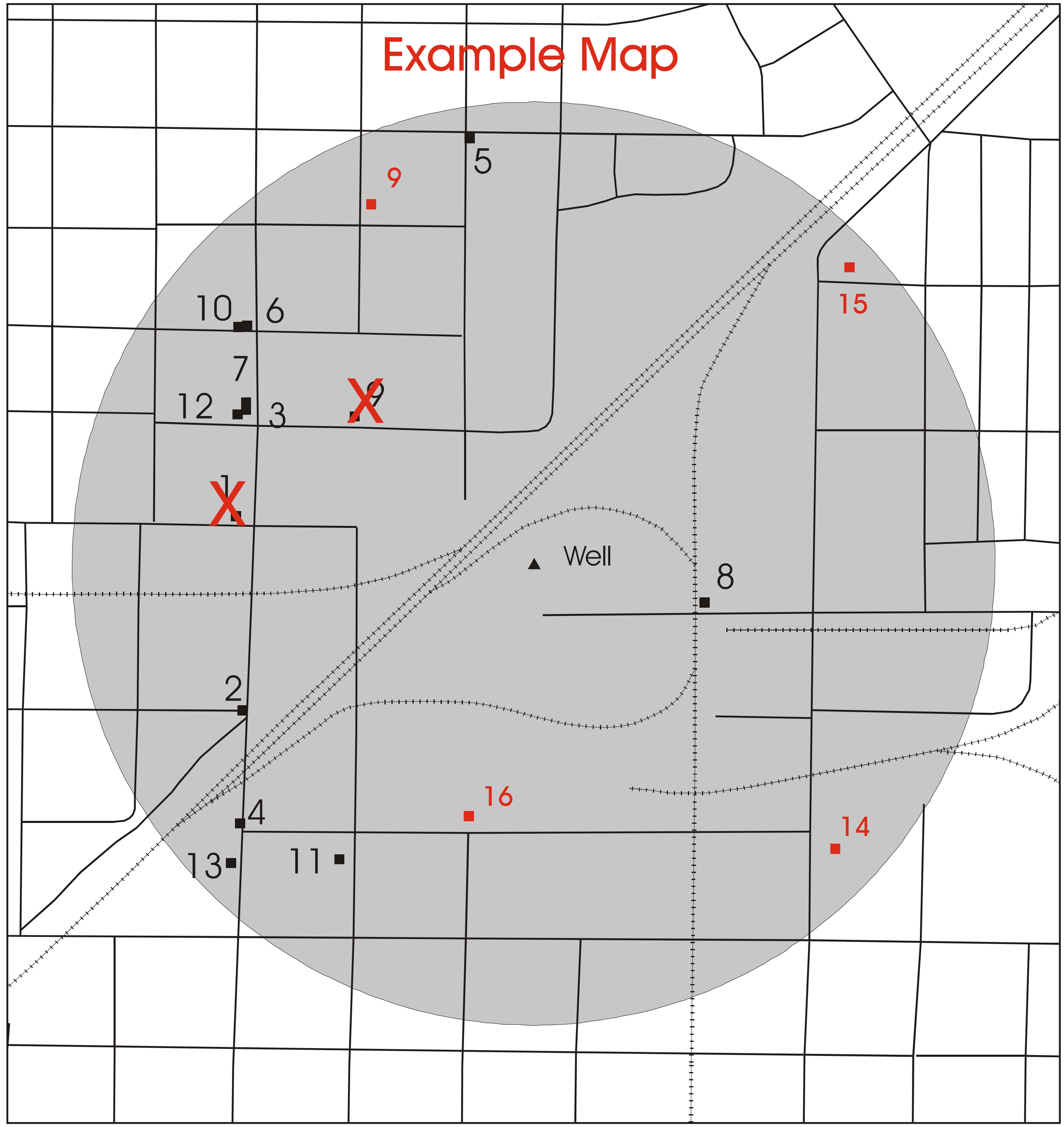
WELL #5

Radius of Assessment Area = 1500 ft

CAST Well ID# = 013105

▲ Well
■ P S O C
Road
Railroad
Stream
Assessment Area





10/13/09

EXAMPLE
PSOC LIST

NUMBER	BUSINESS NAME	ADDRESS	DESCRIPTION
~~1~~	~~BUZZS AUTO SALES~~	~~402 N MAIN ST~~	~~AUTOMOBILE DEALERS-USED CARS~~
1	OUT	OF	BUSINESS
2	CROW BURLINGAME CO	122 S MAIN ST	AUTOMOBILE PARTS & SUP. RETAIL
3	CITY STRIPPER	507 N MAIN ST	FURNITURE-STRIPPING
~~4~~	~~FREEMAN & FREEMAN~~	109 N MAIN ST	~~INDUST. EQUIP. & SUPPLIES-MFRS~~
4	AAA - APPLIANCE SALES		HOME APPLIANCE SALES
5	HORSESHOE WRECKER	302 E WASHINGTON ST	WRECKER SERVICE
~~6~~	~~J MAR CAR WASH~~	600 N MAIN ST	~~CAR WASHING & POLISHING~~
6	BILL'S QUICK SPRAY WASH		HIGH PRESSURE SPRAY CAR WASH
7	MOLL MOTORS	517 N MAIN ST	AUTOMOBILE DEALER-NEW-USED CARS
8	PRODUCERS RICE MILL INC	518 E HARRISON ST	RICE MILLS
9	RICHARDS MACHINE SHOP	~~501 N COLLEGE ST~~	AUTOMOBILE MACHINE SHOP SERVICE
9		701 N COLLEGE ST	
10	SIMMONS AUTO SUPPLY	603 N MAIN ST	AUTOMOBILE PARTS & SUPPLIES-RETAIL
11	STEDMANS INC	110 S COLLEGE ST	HARDWARE-RETAIL
12	SYNERGY GAS CORP	500 N MAIN ST	GAS-LIQ. PETRO-BTTLD/BULK (WHOL)
13	VASEUR MACHINE SHOP	201 N MAIN ST	INDUSTRIAL MACHINERY
14	MAPCO TRUCK STOP	330 INDUSTRIAL BLVD	PETROLEUM STORAGE-SALES-RETAIL
15	JERRY'S DRY CLEANERS	734 EAST MONROE ST.	CLOTHES DRY CLEANING
16	WAL-MART SUPER CENTER	296 WAL-MART DRIVE	RETAIL SALES AUTOMOTIVE SERVICE

10/13/09

V. Vulnerability Assessments -- Susceptibility Analysis

Under this program the susceptibility of a public water system is the potential for that system's drinking water source to be contaminated at concentrations that would pose a public health concern. We will evaluate each assessment area to determine its relative sensitivity to contaminant transport. The degree of susceptibility will be determined from the intrinsic characteristics of the source setting and that of the recharge basin or watershed. The factors that will be considered in the evaluation of the intrinsic sensitivity will include hydrologic factors, soil conditions, aquifer characteristics, local geology and other factors deemed appropriate on a case-by-case basis. In the case of wells, both above- and below-ground construction conditions will be considered in the overall susceptibility evaluation. The location of the source with respect to contaminant sources will also be considered in the assessment process. (The previous section discussed the procedures that will be used to identify, categorize and locate contaminant sources with respect to each drinking water source.)

The United States Geological Survey (USGS) will perform a susceptibility analysis for each source. The analysis will follow a standard methodology developed jointly by the Arkansas Department of Health, the USGS Water Resources Division – Arkansas District, the University of Arkansas – Center for Advanced Spatial Technology (CAST) and the University of Arkansas – Department to Geosciences. This methodology was reviewed and approved by the Technical and Citizen's Advisory committees and other public participation processes. The methodology will result in a relative and general susceptibility ranking. From this ranking, each source will receive a designation of either Low, Medium or High Susceptibility. The relative ranking produced by this process will be used for the purposes of prioritizing future State source water protection efforts. Below is a detailed description of this methodology.

> (The reader should note that this will be an evolving program. Delineation methodology and other program components will continue to be refined as staff gain training and experience in administering the program.)

SUSCEPTIBILTIY ANALYSIS METHODOLOGY

The susceptibility of the source will be determined by evaluating the natural or intrinsic characteristics of the source setting and recharge basin or watershed. The methodology considers the path of contaminant transport and the barriers to contaminant movement. The potential barriers to contaminant transport include soil conditions including land use / land cover, the hydrologic or hydrogeologic conditions and the geologic setting. Well construction will also be considered where applicable. The methodology will be to assign a relative numeric value to the potential for each of the barriers to be breached. Assigning a numeric value to each of the major intrinsic characteristics is designed to provide a relative indication of the likelihood that contaminant movement will or will not be restricted. A low value is an indication that there is a barrier or restriction to contaminant transport. A high value, will in turn, indicate the lack of a barrier to contaminant transport. This numeric value will range between 0 and 100. The numeric value for the potential to breach each barrier will be summed and normalized to yield a value for each source ranging between 0 and 100. This number will be a relative indication of the sensitivity of each source to contaminant transport.

Arkansas is a rural state and, as a result, generally has good water quality. Additionally, the State of Arkansas generally requires complete conventional filtration treatment and disinfection for all community surface water sources and disinfection for all community groundwater systems. This has been the case since the mid 1960's. Historically, we have had a very low number of sources with maximum contaminant level violations (excluding the TCR) or even significant detects of SOCs / IOCs / VOCs. Therefore, historical conditions and monitoring data will be taken into consideration in determining the susceptibility rating for each source. Each source will receive a descriptive susceptibility designation of Low, Medium or High. To arrive at this we will multiply the intrinsic sensitivity value by a weighting factor "B" that is an indication of the historical water quality of the source water and/or the finished product supplied to the customers. The range of the resulting value will also be on a scale of 0 to 100. The susceptibility designation will be selected from the following table.

Susceptibility Designation	"B" X Intrinsic Sensitivity Value
Low	< 34
Medium	34 – 67
High	> 67

The intrinsic barriers to contaminant transfer vary with the type of source being evaluated. The areas to be considered for each type of source and the formula for determining the Intrinsic Sensitivity Values are outlined below.

(Note: The value for each area evaluated is multiplied by a factor indicating its relative importance in order to normalize the outcome of the formula to a 0 to 100 range.)

Intrinsic Sensitivity Values

Surface Water Sources

Rivers & Impoundments **=** (**0.5**)(Soils #)**+**(**0.5**)(Hydrologic #)

Springs **=** (**0.4**)(Geologic #)**+**(**0.4**)(Soils #)**+**(**0.2**)(Hydrologic #)

Groundwater Sources

Wells and GWUDI Wells **=** (**0.25**)(Well Construction #)**+**(**0.25**)(Geologic #)**+** (**0.25**)(Soils #)**+**(**0.25**)(Hydrologic #)

The factor "B" used in conjunction with the Intrinsic Sensitivity Values to determine the Susceptibility designation will be based upon water quality measurements made within the past five (5) years. The value of "B" will be selected from the following table.

	"B"
• MCL Violations [1]	**1.40**
• Exceedance of *Giardia Lamblia* or *Cryptosporidium action level* [2]	**1.30**
• Exceedance of Action Level and/or Other Microbial Concerns [3]	**1.20**
• Detects of Regulated and Unregulated Contaminants [4]	**1.10**
• Insufficient Monitoring Data [5]	**1.05**
• None of the above	**1.00**

Detailed descriptions of these individual categories are provided on the following page.

[1] <u>MCL violations</u> -- For Community or NTNC Systems: MCL violation in treated water, excluding violations of the Total Coliform and Surface Water Treatment Rules and distribution monitoring for Lead and Copper. A MCL violation for lead at the entry point to the distribution system will apply. For TNC Systems: MCL violation for Nitrites or Nitrates only.

[2] <u>Exceedance of *Giardia Lamblia* or *Cryptosporidium* Action Level</u> - The confirmed occurrence of *Giardia Lamblia* cysts or *Cryptospordium* oocysts in the raw source water at a level of $\geq$ 10 cysts or oocysts per liter; or the confirmed occurrence of *Giardia Lamblia* cysts or *Cryptosporidium* oocysts with internal structures or enteric viruses in the treated water.

[3] <u>Exceedance of Action Level</u> - Data / samples collected from a public water system's raw water source or entry point to the distribution system, with confirmed results exceeding a regulatory action level established by the SDWA (i.e. nitrate results of $\geq$ 5.0 mg/l), or exceeding a Health Advisory Level established by the EPA.

and / or

<u>Other Microbial Concerns</u> - The confirmed occurrence of *Giardia Lamblia* cysts or *Cryptosporidium* oocysts with internal structures or enteric viruses in the raw source water. Greater than 50% of the raw source water samples are positive for total or fecal coliform (at least 6 samples must be available). MPA analysis of raw well water yields a result of either Moderate or High according to EPA's Consensus Method rating scale.

[4] <u>Detects of Regulated and Unregulated Contaminants</u> - Data / samples collected from a public water system's entry point to the distribution system with confirmed detects by repeat sampling. To be considered, the detect must be at a level greater than the minimum detection level established by the SDWA. The categories of contaminants that will be considered are IOCs that have an established MCL, and all regulated and unregulated SOCs and VOCs. The occurrence of *Giardia Lamblia* cysts or *Cryptosporidium* oocysts without internal structures in the raw source water.

[5] <u>Insufficient Monitoring Data</u> - Data / samples that were collected from a public water system's raw or treated water in which the test results have not been confirmed or finalized by the Arkansas Department of Health's Public Health Laboratories. Data / samples that were collected from public water systems (raw or treated water) during special investigations or as a result of a consumer complaint will be evaluated on a case by case basis to determined if sufficient data is available for consideration under this paragraph.

INTRINSIC SENSITIVITY VALUES

Assigning a numeric value to each of the major intrinsic characteristics is designed to provide a relative indication of the likelihood that contaminant movement will or will not be restricted. A low value is an indication that there is a barrier or restriction to contaminant transport. A high value, will in turn, indicate the lack of a barrier to contaminant transport.

Well Construction:
The numeric value for "Well Construction" will consider wellhead deficiencies, the casing and grout depth and the reliability of the information concerning the below ground construction of the well.

Sensitivity Value = (Casing/Grout Weight) **X** (Information Weight) **X** (Sum of Wellhead Deficiencies Weight)

Casing/Grout Weight – A relative weighting factor assigned to the well based on the adequacy of the depths of the casing & grout.

Casing & Grout Depth*:	Casing	Grout	**Weight**
N -- Not present	I	N	**5**
I -- Inadequate	I	I	**4**
A – Adequate	A	N	**3**
	A	I	**2**
(*Adequacy determined by ADH)	A	A	**1**

Information Weight – A weighting factor that takes into account the reliability of the below ground well construction information.

Reliability of Information:	**Weight:**
Driller's Report / Well Log	**1**
Reported	**1.5**
No Information	**2**

Sum of Wellhead Weights – The sum of the wellhead deficiency weights. The value of the weight for each type of deficiency is relative to its importance to contaminant transfer. If no deficiencies are noted, the weight will be assigned a value of 1.

Wellhead Deficiencies	**Weight ***
Wellhead subject to flooding or submersion	**3**
Impervious Pad not present	**2**
Top of casing not sealed	**2**
Top of casing 7 - 12" above grade	**1**
Not properly vented	**1**
Discharge below grade (i.e. Pitless Adapter or other unapproved construction.)	**1**
Sum=	$\boxed{.}$

* **Total Weight = 1** if no wellhead deficiencies are documented by the ADH.

Soils -- Land Use / Land Cover:
The numeric value for "Soils – Land Use / Land Cover" will consider the types and percent cover of Land Use / Land Cover in the assessment area. For surface water systems, the relative runoff potential will be considered. To determine the relative runoff potential, slope of the stream channel and average annual rainfall will be evaluated. For wells (exclusive of GWUDI wells) soil characteristics will be considered. For GWUDI wells and springs, soil characteristics and average annual rainfall will be considered.

Surface Water – Rivers & Impoundments

Sensitivity Value = (Sum of Adjusted Land Use/Land Cover Wts.) **X** (Main Channel Slope Wt.) **X** (Avg. Annual Rainfall Wt.)

Sum of Land Use / Land Cover Weights – The sum of the categories of Land Use / Land Cover with the adjusted weight according to the percentage of the assessment area covered. (For instance, if there is 30% forest and 31% agriculture-crops and 39% water, the sum would be [(0.3 x **1)** + (0.31 x **5)** + (0.39 x **10)**] = **5.75**).
Weight values are assigned based on the category of land use / land cover and the likelihood of the transport of contamination (via runoff or percolation). Forested lands are generally associated with fewer activities (development, construction and agriculture) therefore a lower weight is assigned. Surface waters or bare earth are nonrestrictive vehicles of contaminant transport therefore a higher weight is assigned.

Land Use / Land Cover	**Weight**	% of Cover	Adjusted Weight
Forest	**1**	0 - 100	
Agriculture (Pasture & Grassland)	**3**	0 - 100	
Agriculture (Crops)	**5**	0 - 100	
Urban (Residential)	**7**	0 - 100	
Urban (Commercial-Industrial)	**8**	0 - 100	
Bare Earth or Water	**10**	0 - 100	
			Sum:

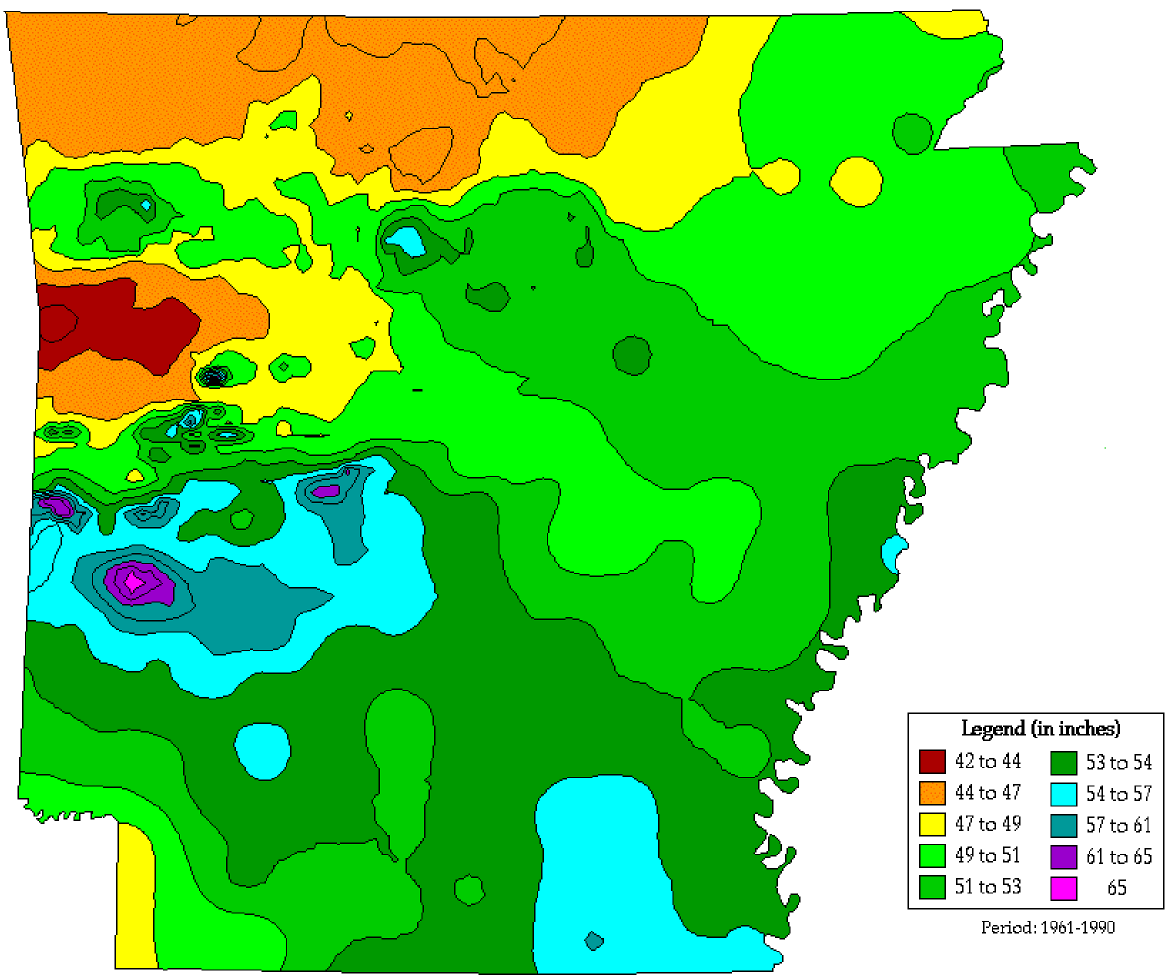
Main Channel Slope Weight – A relative weighting factor assigned to the slope of the main channel of the river or impoundment system. The slope of river systems will be determined by dividing the difference in elevation of the main channel of the stream at a point 20 radial miles upstream of the intake and the elevation at the intake by 20 miles. The slope of impoundment systems will be determined by dividing the difference in elevation of the main channel of the stream at a point 20 radial miles upstream of the dam and the elevation of the stream channel at the base of the dam by 20 miles. (Note that the drainage basin for small reservoirs may be included in an arc smaller than 20 miles. In such cases, the elevation at the point where the main stem of the stream ceases to be a perennial stream and the radial distance from the dam to that point will be used.)

Weight	**Main Channel Slope** (%)
1	<0.10
2	0.10 - 0.30
3	0.31 - 1.00
4	1.01 - 1.75
5	>1.75

Average Annual Precipitation Weight – a relative weighting factor assigned to the average annual precipitation within the assessment area. The highest precipitation value in an assessment area will be used. A map showing the precipitation distribution for Arkansas is provided on the following page.

Weight	Average Annual Precipitation (inches)
0.5	42 – 47
1.0	47 – 53
1.5	53 – 61
2.0	61 – 65

ARKANSAS
AVERAGE ANNUAL PRECIPITATION MAP



http://www.ocs.orst.edu/pub/maps/Precipitation/Total/States/AR/arkansas.gif

Groundwater -- Wells

Sensitivity Value = (Sum of Adjusted Land Use/Land Cover Weights) **X** (Sum of Adjusted Soils Weights)

Sum of Land Use / Land Cover Weights – (see "Surface Water - Rivers & Impoundments")

Land Use / Land Cover	**Weight**	**% of Cover**	**Adjusted Weight**
Forest	**1**	0 - 100	
Agriculture (Pasture & Grassland)	**3**	0 - 100	
Agriculture (Crops)	**5**	0 - 100	
Urban (Residential)	**7**	0 - 100	
Urban (Commercial-Industrial)	**8**	0 - 100	
Bare Earth or Water	**10**	0 - 100	

Sum of Adjusted Soils Weights – The sum of the categories of soil conditions with the weight adjusted according to the percentage of the assessment area covered. Initially, the STATSGO soils data will be used however, SSURGO data may be used in selected areas. When SSURGO data becomes more widely available it will replace the STATSGO data. Soil permeability and depth to bedrock will utilize STATSGO / SSURGO data. The percent slope of the soils will be calculated using DEM data.

Soils	**Weight**	**% Cover of Each Soils Group**	**Adjusted Weight**
Average % Slope (Determined using DEM Data)			
0 – 5%	2	0 - 100	
6 – 10%	1.5	0 - 100	
11 – 15%	1	0 - 100	
16 -- 20%	0.5	0 - 100	
>20 %	0	0 - 100	
Permeability (in/hr) (STATSGO or SSURGO Data)			
<0.2	0	0 - 100	
0.2 -- 0.6	1	0 - 100	
0.6 -- 2.0	2	0 - 100	
2.0 -- 6.0	3	0 - 100	
>6.0	4	0 - 100	
Depth to Bedrock (in.) (STATSGO or SSURGO Data)			
0 -- 20 (in.)	4	0 - 100	
21 -- 40	3	0 - 100	
41 -- 60	2	0 - 100	
>60	1	0 - 100	

Groundwater - GWUDI Wells & Springs

Sensitivity Value = (Sum of Adjusted Land Use/Land Cover Wts.) **X** (Sum of Adjusted Soils Wts.+Average Annual Rainfall Wt.)

<u>Sum of Land Use / Land Cover Weights</u> – (see "Surface Water - Rivers & Impoundments)

Please refer to the Land Use / Land Cover Weight Table under either the "Surface Water – Rivers and Impoundments" or "Groundwater – Wells" Tables

<u>Sum of Adjusted Soils Weights + Average Annual Precipitation Weight</u> – The sum of the categories of soil conditions with the weight adjusted according to the percentage of the assessment area covered plus the Average Annual Rainfall Weight (see table on page 5-6) for the assessment area. (Also see "Surface Water – Rivers and Impoundments" and "Groundwater – Wells" for more information.)

Soils	Weight	% Cover of Each Soil Group	Adjusted Weight
Average % Slope (Determined using DEM Data)			
0 – 5%	2	0 - 100	
6 – 10%	1.5	0 - 100	
11 – 15%	1	0 - 100	
16 -- 20%	0.5	0 - 100	
>20 %	0	0 – 100	
Permeability (in/hr) (STATSGO or SSURGO Data)			
<0.2	0	0 - 100	
0.2 -- 0.6	1	0 - 100	
0.6 -- 2.0	2	0 - 100	
2.0 -- 6.0	3	0 - 100	
>6.0	4	0 – 100	
Depth to Bedrock (in.) (STATSGO or SSURGO Data)			
0 -- 20 (in.)	2.0	0 - 100	
21 -- 40	1.5	0 - 100	
41 -- 60	1.0	0 - 100	
>60	0.5	0 - 100	

Geologic Conditions:
The numeric value for “Geologic Conditions” will consider the percent of recharge area within the assessment area, the relative permeability of the aquifer and a regional factor. This category takes into account conjunctive conditions in the area. (i.e.; surface water’s affect on groundwater)

Groundwater - Wells, GWUDI Wells & Springs

Sensitivity Value = (Protective Cap / Recharge Zone Weight) **X** (Rock Type Weight) **X** (Regional Weight)

Protective Cap / Recharge Zone Weight – a weighting factor based on the percentage of the assessment area which provides recharge to the aquifer.

% Recharge Zone	**Weighting Factor**
0 --------------->100	1.0 -------------> 10

Regional Weight – a relative weighting factor assigned to major geologic zones or physiographic provinces in Arkansas. These provinces tend to exhibit different geologic characteristics that affect the region’s susceptibility. The weighing factors are based on information collected by the ADH in its surface water influence evaluation of wells across the State. (See Arkansas Physiographic Provinces Map on page 5-11.)

Region	**Weight**
Ozark Highlands:	**10**
Ouachita & Athens Plateau	**8**
Arkansas Valley Province	**5**
Boston Mountains	**4**
Western Gulf Coastal Plain	**2**
Mississippi Embayment	**1**

Rock Type Weight – A relative weighting factor taking in to account the water bearing properties of the various consolidated and unconsolidated geological material in the aquifer(s). (i.e. sand, gravel, sandstone, shale & limestone) A further description of the individual categories follows:

Consolidated Rock: Karst – Generally limestone or dolomite material that is characterized by sinkholes, caves, and underground drainage through dissolution channels. The Karst is generally restricted to the Springfield and Salem Plateaus of the Ozark Highlands in north central and northwestern Arkansas.

Consolidated Rock w/ Secondary Porosity: Fractured – Limestone, Shale, Sandstone, etc. Fractured limestone is generally found in the Springfield, Salem and Boston Mountain Plateaus of the Ozark Highlands in north central and northwestern Arkansas. Fractured shale and sandstone are generally found in the Boston Mountain, Ouachita and Athens Plateaus in northwest and western Arkansas.

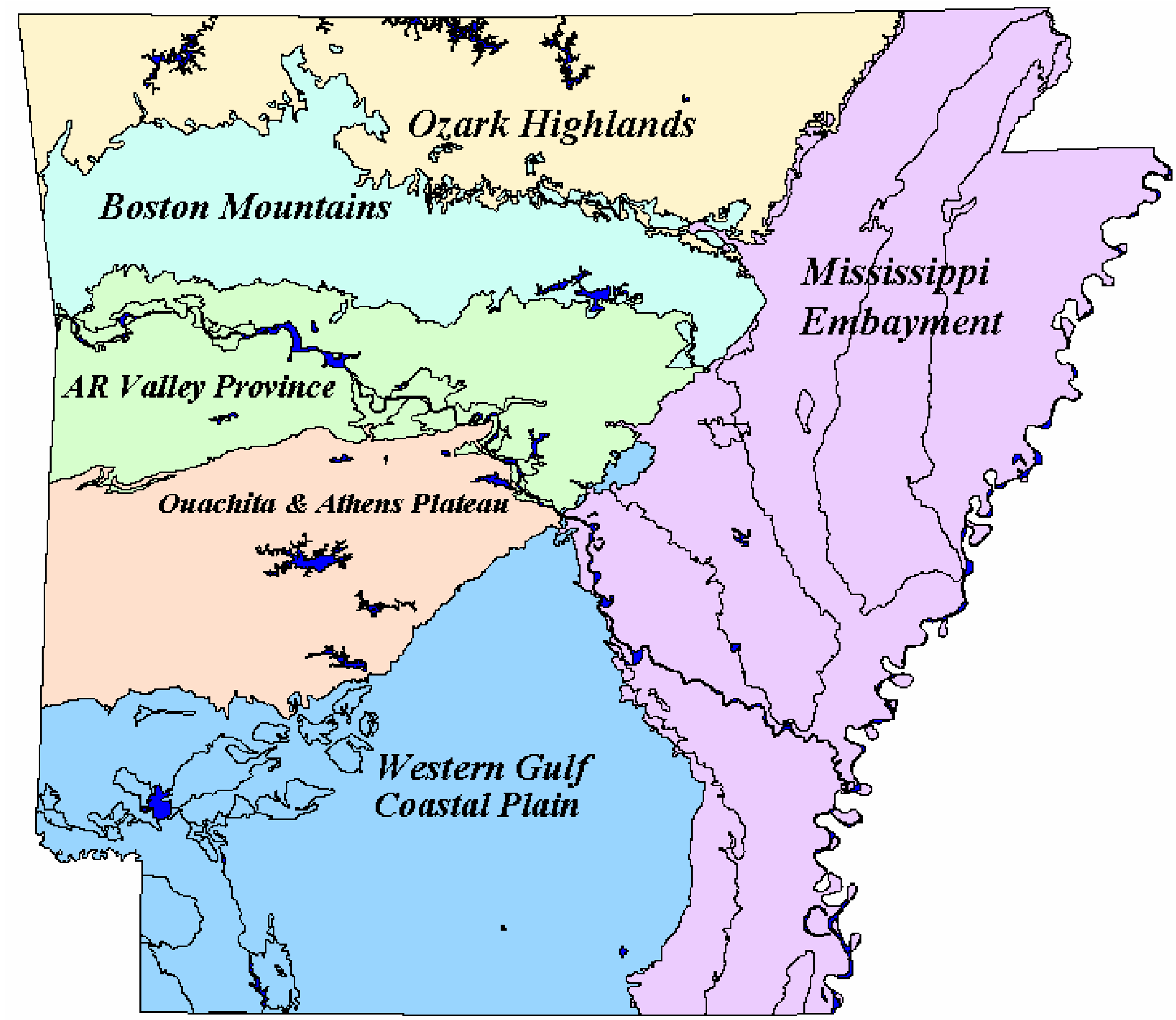
(Quaternary) Alluvial / Terrace Deposits**:** These are unconsolidated formations, generally sand and gravel materials deposited in the river and stream valleys of the Arkansas Valley Province in west central Arkansas, the Western Gulf Coastal Plain in southern Arkansas and the Mississippi Embayment in eastern Arkansas.

(Tertiary & Cretaceous) Sparta / Cockfield / Wilcox / Nacotoch / Tokio / Carrizo / Memphis Sand Formations**:** These are unconsolidated to partially consolidated formations primarily located in the Mississippi Embayment and Western Gulf Coastal Plain.

Consolidated Rock w/ Primary Porosity: Unfractured – Sandstone, Limestone, Shale

Rock Type	**Weight**
Consolidated Rock: Karst	**1**
Consolidated Rock w/ Secondary Porosity: Fractured -- Sandstone, Limestone, Shale	**0.8**
(Quaternary): Alluvial / Terrace Deposits	**0.7**
(Tertiary & Cretaceous): Sparta, Cockfield, Wilcox, Nacotoch, Tokio, Memphis & Carrizo Sand Formations	**0.6**
Consolidated Rock w/ Primary Porosity: Unfractured – Sandstone, Limestone, Shale	**0.2**

Arkansas Physiographic Provinces



Hydrologic Conditions:
The numeric value for "Hydrologic Conditions" will consider the raw water pumping rate; the source capacity/yield or in the case of wells the relative aquifer permeability; and structures that affect the flow patterns of the source water.

Surface Water – Impoundments

Sensitivity Value = (Pumping Rate Weight) **X** (Volume Weight) **X** (Discharge Weight)

Pumping Rate Weight**:--** The maximum pumping rate of the intake pumps.

Pump Rate (gpm)	**Weight**
<25	1
25 – 50	2
51 – 200	3
201 – 650	4
651 -- 1,200	5
1,201 -- 2,500	6
2,501 -- 5,000	7
5,001 -- 9000	8
9001 -- 25,000	9
>25,000	10

Volume Weight**: --** A relative weighting factor based on the size or volume of the impoundment.

Volume (acre – feet)	**Weight**
<150	10
150 -- 300	9
301 -- 1000	8
1,001 -- 3700	7
3701 -- 10,000	6
10,001 -- 34,000	5
34,001 -- 200,000	4
200,001 -- 1,000,000	3
1,000,001 -- 2,000,000	2
>2,000,000	1

Controlled Discharge Weight**: --** A factor which takes into account impoundments with a controlled discharge (i.e.; discharges to maintain stream flow, for power generation, flood control, etc.)

Controlled Discharge (yes/no)	**Weight**
Yes	0.5
No	1

Surface Water – Rivers & Streams

Sensitivity Value = (Pumping Rate Weight) **X** (Flow Rate Weight) **X** (Discharge Weight)

Pumping Rate Weight**: --** The maximum pumping rate of the intake pumps.

Pump Rate (gpm)	**Weight**
<50	1
50 – 300	2
301 – 700	3
701 – 2000	4
2001 – 2900	5
2901 – 5000	6
5001 – 6900	7
6901 – 10,000	8
10,001 – 14,000	9
>14,000	10

Flow Weight**: --** A relative weighting factor based on the median conditions for the river or stream.

Median Stream Flow (cfs)	**Weight**
<50	10
51 – 100	9
101 – 300	8
300 – 450	7
451 – 650	6
651 – 1300	5
1301 – 2000	4
2001 – 3500	3
3501 – 10,000	2
>10,000	1

Regulating Structure Weight**: --** A factor that considers the affect of a regulating structure in the stream such as a weir.

Regulating Structure (yes/no)	**Weight**
No	0.5
Yes	1

Groundwater - Springs

Sensitivity Value = (Pumping Rate Weight) **X** (Permeability Weight) **X** (Containment Structure Weight)

Pumping Rate Weight**: --** The maximum pumping rate of the intake pumps.

Pump Rate (gpm)	**Weight**
<5	**1**
5 – 10	**2**
11 – 25	**3**
26 – 50	**4**
51 – 75	**5**
76 – 125	**6**
126 – 250	**7**
251 – 500	**8**
501 – 1000	**9**
>1000	**10**

Permeability Weight**: --** A relative rating of the capacity of the aquifer material to transmit water or contaminants.

Permeability	**Weight**
Karst	**10**
Fractured Bedrock	**8**
Quaternary Deposits	**7**
Tertiary & Cretaceous	**6**
Unfractured Sandstone	**2**

Containment Structure Weight**: --** A factor which considers the protection provided by a spring containment structure.

Containment Structure (yes/no)	**Weight**
Yes	0.5
No	1

Groundwater - Wells & GWUDI Wells

Sensitivity Value = (Pumping Rate Weight) **X** (Permeability Weight) **X** (Well Influence Weight)

Pumping Rate Weight**: --** The maximum pumping rate of the well pump.

Pump Rate (gpm)	**Weight**
<10	**1**
10 – 50	**2**
51 – 100	**3**
101 – 200	**4**
201 – 300	**5**
301 – 400	**6**
401 – 500	**7**
501 – 700	**8**
701 – 900	**9**
>900	**10**

Permeability Weight**: --** A relative rating of the capacity of the aquifer material to transmit water or contaminants.

Permeability	**Weight**
Karst	**10**
Fractured Bedrock	**8**
Quaternary Deposits	**7**
Tertiary & Cretaceous	**6**
Unfractured Sandstone	**2**

Well Influence Weight**: --** A factor which takes into account the presence of other water wells within the assessment area that penetrate or pass through the aquifer(s).

Well Influence	**Weight**
No	0.3
Unknown	0.6
Yes	1.0

Surface Water – River and Impoundments

The number of PSOCs that lie within the assessment area for river / streams and impoundments will be determined and mapped. They will be categorized by Health Risk and the distance from the intake determined. A summary of the PSOCs will be provided listing the number of PSOCs in each category located within the following zones:

Rivers:	**Impoundments:**
0 - 1 mile	0 - 1 mile
> 1 - 2 miles	> 1 - 2 miles
> 2 - 5 miles	> 2 - 3 miles
> 5 - 10 miles	> 3 - 4 miles
>10 - 20 miles	> 4 - 5 miles
> 20 miles*	> 5 miles*

* Outside the assessment area, but within the watershed

Surface Water – Springs & GWUDI Wells

The number of PSOCs that lie within the assessment area for springs and GWUDI wells will be determined and mapped. They will be categorized by Health Risk and the distance from the well / spring determined. A summary of the PSOCs will be provided listing the number of PSOCs in each category located within the following zones:

Base Assessment Area	**Conjunctive Assessment Area**
0 - 500 feet	0.0 - 0.5 miles
501 - 1000 feet	> 0.5 - 1.0 miles
1001 - 1320 feet	> 1.0 - 1.5 miles
1321 - 2640 feet	> 1.5 - 2.0 miles
	> 2.0 - 3.0 miles
	> 3.0 miles**

**Outside the assessment area, but within the recharge basin where such information is available

Groundwater

The number of PSOCs that lie within the assessment area for wells will be determined and mapped. They will be categorized by Health Risk and the distance from the well determined. A summary of the PSOCs will be provided listing the number of PSOCs in each category located within one of three zones. The following zones were established for a base one-quarter mile assessment area. Assessment areas larger or smaller than this base size will be proportioned accordingly. (i.e. If radius of the assessment area is half as large, the each zone will be cut in half: 0 – 220; 220.5 –440; & 440.5 – 660)

0 - 440 feet
441 - 880 feet
881 - 1320 feet

VI. Reporting Results of Vulnerability Assessment

PHASE I

It is our intent to "phase" the assessment process in such a fashion as to meet the federal statutory time frame and provide an assessment that will be meaningful. "Phase I", to be completed by the statutory deadline, will provide completed assessments that will allow the initiation of local source water protection plans and provide a priority ranking system for the refinement of the original assessments on a continuing basis. The final vulnerability assessment reports will be mailed to each water system, which should then notify their customers of the report's availability. A notice of completion, the corresponding date of completion, and a brief summary of a system's Source Water Assessment is required by federal regulations to be included in the water system's next Consumer Confidence Report to its customers. Technical assistance and guidance will be provided to water systems as necessary to include this notice and other requirements of the CCR Rule.

REPORTING RESULTS

At the conclusion of "Phase I", completed assessment reports will be sent to each applicable public water system. The reports will also be available over the Internet on the ADH/DOE SWP Home Page and provide copies upon individual request, as appropriate. A notice of the availability of the final vulnerability assessment may also be reported to customers, government agencies, and others via the Internet, and postings at public libraries.

A standardized format of reporting will be utilized to convey results to PWSs and consumers. The report will provide a summary indicating each source's intrinsic susceptibility rating in order to give a general indication of the system's overall susceptibility. The outline below depicts the general structural content of each report.

- I. Purpose for Conducting Assessments
    - A. Providing Education and Information.
    - B. Protection for the Future.
- II. How Assessments Were Conducted
    - A. Who Conducted the Assessments.
    - B. Where and How the Information was Obtained.
- III. Results of the Assessment
    - A. Methodologies Used.
    - B. Susceptibility Analysis.
        1. Map of Source and PSOC Locations.
        2. List of PSOCs by Health Risk Category and Zone within the Assessment Area. This will be demonstrated in a table format. (See example on page 6-2.)
        3. Example of Potential Types of Contamination that can be found at a Common PSOC (see example on page 6-3).
- IV. How Assessment Results Can Be Used
    - A. Education and Information for You and Your Customers.
    - B. A Tool for Prioritization, Planning, and Preparation for the Future.
    - C. Developing a Source Water Protection Plan.
- V. Other Assessment Information and How to Get It
    - A. How to Obtain Additional Assessment Data.
    - B. Who to Contact if You Need Help.
- VI. Example of Notice of Report Availability for Customers

(Example)

TABLE OF SUSCEPTIBILITY FINDINGS

PHEASANTVILLE, ARKANSAS
Well #1

The table below lists the number of PSOCs relative to distance from **Well #1** identified within the assessment area. The inherent risk posed by the PSOC is ranked by Health Risk Categories 1 through 10, ("1" representing the highest risk). The intrinsic sensitivity value for the geologic setting of the assessment area for **Well #1** is ranked as a **high susceptibility**.

PSOCs appearing in the upper left corner pose the greatest risk to well #1. PSOCs appearing in the lower right corner pose the lowest risk.

Well #1-- Susceptibility based on PSOC location and Health Risk Category

PSOC Health Risk Category	**Intrinsic Susceptibility Rating -- High**		
	Zone 1 (0 – 440 feet from well)	Zone 2 (441 – 880 feet from well)	Zone 3 (881 – 1320 feet from well)
1	**(PSOCs entered here)**	**(PSOCs entered here)**	**(PSOCs entered here)**
2			
3			
4			
5			
6			
7			
8			
9			
10			

(Example)

POTENTIAL TYPES OF CONTAMINATION THAT CAN BE FOUND AT A COMMON PSOC

TYPE OF PSOC	Automobile - Body Shops / Repair Shops		
POSSIBLE CHEMICALS RELATED TO TYPE OF PSOC	Arsenic Barium Benzene Copper Creosote Fluoride Lead Nickel Tin	Ammonium Persulfate Cadmium cis 1,2-Dichloroethylene Chlorobenzene Ethylene Glycol Nitric Acid Sulfuric Acid Xylene (Mixed Isomers)	trans 1,2-Dichloroethylene 1,4-Dichlorobenzene or P-Dichlorobenzene 1,1,1-Trichloroethane or Methyl Chloroform Dichloromethane or Methylene Chloride Phosphoric Acid (Ortho-) 1,1,2,2-Tetrachloroethane Tetrachloroethylene or Perchlorethylene (Perk) Trichloroethylene or TCE

NOTE FOR CLARIFICATION

The previously approved Wellhead Protection Program (WHPP) contains a “Phase 1” and “Phase 2” not to be confused with “Phase I” and Phase II” of the SWAP. “Phase 1” of the WHPP is the delineation of the Wellhead Protection Area. “Phase 2” is the inventory of the Wellhead Protection Area. “Phase I” of the SWAP will further expand on “Phase 2” of the WHPP (contaminant inventory). On pages 6-3 through 6-8 and 6-9 through 6-18 of this section are examples of the WHPP “Phase 1” and “Phase 2” reports, respectively, that are submitted to PWSs.

WELLHEAD PROTECTION

PROGRAM

Phase 1:
Delineation of the Wellhead Protection Area for

Altheimer

(Public Water System)

Arkansas Department of Health

by
Bob Cordova
Hydrogeologist

3/12/98
(Date)

PURPOSE OF THE REPORT

In 1986, the Arkansas Department of Health (ADH) was selected by the Governor to be the lead agency in the development of the Wellhead Protection (WHP) program in the state. As lead agency, the ADH administers the various aspects of the program including guiding its development, coordinating WHP activities with other state agencies and with lay organizations involved with water-resource protection, developing a management framework that includes educational and training progams, providing the technical expertise required to implement the program, and encouraging the public to actively participate in the program's development.

The purpose of this report is to present the information that directly pertains to the delineation of the Wellhead Protection Area (WHPA) for the public water-supply system of Altheimer. The report accordingly includes (1) hydrogeologic information pertinent to describing and determining the WHPA (Table 1), (2) concise discussion of the specific method used to determine the dimensions of the WHPA (Figure 1), and (3) a map showing the location of the WHPA (Figure 2).

Hydrogeologic information may be from published or unpublished reports of federal and state agencies, from well drillers' reports, or may be based on an investigation by personnel of the states's WHP program. The delineation for this report is determined using the method that is most feasible for the hydrogeologic characteristics of the area of interest. The delineation is drawn on the most appropriate topographic map available.

LIMITS OF REPORT

Delineation of the WHPA for this report is based on available information only, and the method used is one of several standard methods available for solving similar hydrogeologic problems. Therefore, the ADH is not responsible for the accuracy or validity of the information or methodology used. Also, new information acquired in the future may be more accurate and may allow the determination of a more accurate delineation.

TABLE 1: HYDROGEOLOGIC INFORMATION FOR WHP PROGRAM

PWSIDNO	PUBLIC WATER SYSTEM NAME	COUNTY	GENERAL LOCATION	COUNTY CODE	ENG. DIST.	WELLHEAD PROT. PROG. OTHER INFO.
271	Altheimer	Jefferson	Northeast part of county off Highway 79	69	5	

WELL NAME OR NUMBER (1)	LATITUDE/LONGITUDE LOCATION NUMBER (2)	YEAR DRILL (3)	TOTAL DEPTH (ft) (4)	CASING (5) DEPTH (ft)	CASING (5) DIAM (in)	YIELD (gpm) (6)	WHPA (7) RADIUS (ft)	WHPA (7) AREA (sq mi)	AQUIFER NAME/ THICKNESS (ft) (8) / (9)	CHARACTER OF ROCKS, HYDRAULIC CHARACTERISTICS (10) / (11)
3	N34°19'09", W91°50'54" T4S R8W, 35bcd-1	5/27/55	915	845	10	275	1400	-	Sparta 105	Sand, fine Specific capacity = 15
4	N34°19'08", W91°50'54" T4S R8W, 35bcd-2	3/30/79	919	837	10	295	1400	-	Sparta 105	Sand Specific capacity = 15

(1) Number by system; wells 1 and 2 at same location and plugged with cement. (2) Location number by U.S. Geological Survey method. (3) Completion date from driller's report. (4) Completion depth from driller's report. (5) From driller's report. (6) Reported by driller for well 1 and by system for well 2. (7) Determined by R. Cordova. (8) Interpretation by R. Cordova. (9) Based on driller's log. (10) From driller's report. (11) Based on pumping test by driller for well 1 and inferred for well 2; units = gpm/ft of drawdown.

FIGURE 1A

DELINEATION OF THE WELLHEAD PROTECTION AREA (WHPA) FOR THE PUBLIC SUPPLY WELL Altheimer No-3, USING STANDARD MATHEMATICAL FORMULAS FOR GROUND-WATER FLOW.

Aquifer Information

Name: Sparta

Effective thickness (ft): 105

Description: Sand

Calculation of WHPA radius

The radial distance from the public supply well to the WHPA boundary is calculated to be 1,400 ft based on the Theis nonequilibrium formula as follows:

$$s = \frac{Q}{4 \pi T} W(u)$$

Where:

$W(u)$ = well function of u

$u = r^2S/4Tt$ and $r = \sqrt{4Ttu/S}$ = radius of WHPA

π = pi = 3.1416

s = drawdown at boundary of WHPA assumed to be 1.0 ft

Q = discharge of well(s) = 52,941 ft^3/day

t = time since pumping started = 0.04 day(s)

T = Transmissivity (ft^2/day) = 4,000

S = Storativity (dimensionless) = 1×10^{-4}

FIGURE 1 B

DELINEATION OF THE WELLHEAD PROTECTION AREA (WHPA) FOR THE PUBLIC SUPPLY WELL Altheimer No. 4, USING STANDARD MATHEMATICAL FORMULAS FOR GROUND-WATER FLOW.

Aquifer Information

Name: Sparta

Effective thickness (ft): 105

Description: Sand

Calculation of WHPA radius

The radial distance from the public supply well to the WHPA boundary is calculated to be 1,400 ft based on the Theis nonequilibrium formula as follows:

$$s = \frac{Q}{4 \pi T} W(u)$$

Where:

$W(u)$ = well function of u

$u = r^2 S/4Tt$ and $r = \sqrt{4Ttu/S}$ = radius of WHPA

π = pi = 3.1416

s = drawdown at boundary of WHPA assumed to be 1.0 ft

Q = discharge of well(s) = 56,791 ft^3/day

t = time since pumping started = 0.04 day(s)

T = Transmissivity (ft^2/day) = 4,000

S = Storativity (dimensionless) = 1×10^{-4}

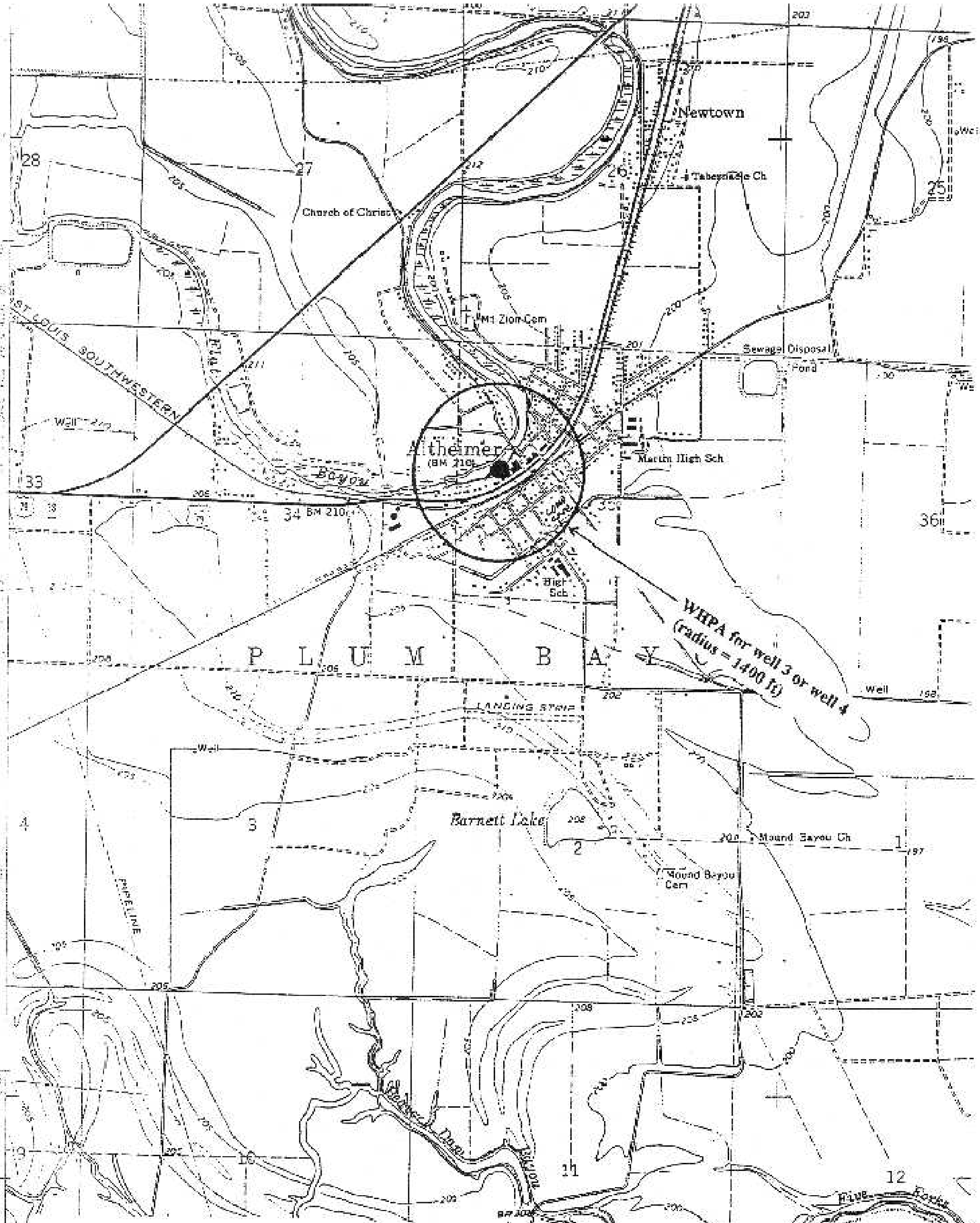


FIGURE 2. Map showing WHPA for the public water-supply wells of Altheimer.

Map scale: 1 inch = 2,000 ft approx.

WELLHEAD PROTECTION

PROGRAM

Phase 2:
Inventory of the
Wellhead Protection Area
for

ALTHEIMER

(Public Water System)

Arkansas
Department
of Health

by
Bob Cordova
Hydrogeologist

9/24/98
(Date)

PURPOSE AND SCOPE OF REPORT

In 1986, the Arkansas Department of Health (ADH) was selected by the Governor to be the lead agency in the development of the state's Wellhead Protection program. As lead agency, the ADH administers the various aspects of the program including guiding its development, coordinating the wellhead protection activities with other state agencies and organizations, developing a management framework such as educational and training programs, providing the technical aid required to implement the program, and encouraging the public to actively participate in the program's development.

The purpose of this report is to present the information that directly pertains to the inventory of potential sources of contamination in the wellhead protection area (WHPA) of the City of Altheimer. The inventory was conducted on September 3, 1998 by ADH as part of its program to provide technical aid. This report includes results of the inventory (Figure 1), selected information pertaining to the wells and WHPA (Table 1), a list with descriptions of the potential sources of contamination commonly found in Arkansas, and recommendations for future action by the city.

The inventory presented in the report is not claimed to be and should not be interpreted as complete. This initial inventory may have missed some potential sources because it was a "windshield" survey and not a detailed door-to-door survey.

TABLE 1: HYDROGEOLOGIC INFORMATION FOR WHP PROGRAM

PWSIDNO	PUBLIC WATER SYSTEM NAME	COUNTY	GENERAL LOCATION	COUNTY CODE	ENG. DIST.	WELLHEAD PROT. PROG. OTHER INFO
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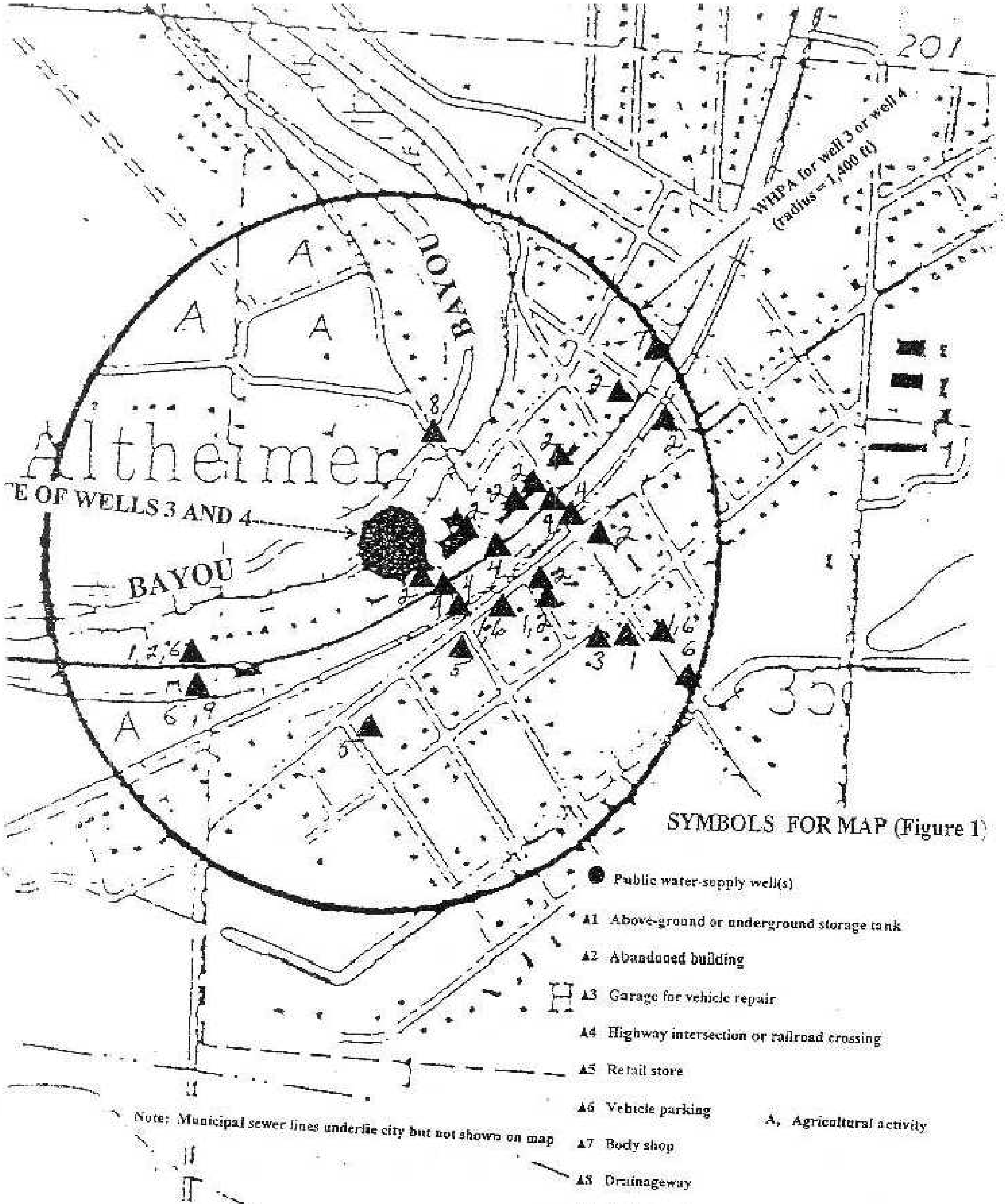


FIGURE 1. Map showing WHPA and potential sources of contamination for the public water-supply wells of Altheimer.

Map scale: 1 inch = 500 ft approx.

LIST OF POTENTIAL SOURCES OF CONTAMINATION COMMONLY FOUND IN ARKANSAS

This list contains short descriptions of each of the potential sources . In general, the potential threat to groundwater is from leaks and spills onto the land surface, and the consequent infiltration of these substances with the aid of irrigation water, overland runoff, or precipitation downwards through the soil and unsaturated zones to the water table. Contamination is especially likely where the depth to the water table is relatively shallow as it is in much of the state. Proper management (use, storage, handling, transportation, disposal) of these substances is the key to reducing the risk of groundwater contamination.

Abandoned building

An abandoned building or warehouse may contain forgotten containers of hazardous or regulated substances, and therefore may be a potential source of contamination if leaks or spills are not containable within the structure. Effort should be made by local officials to ascertain the contents of any building that is inaccessible or has been abandoned.

Above-ground storage tank (see Underground storage tank)

Agricultural activity

Under this category are crop raising and pasturing. Pesticides, herbicides, and fertilizers may be used, mixed, or stored on agricultural land.

Agricultural chemical storage

Agricultural chemicals include fertilizers, pesticides, and herbicides. A building or storage structure that contains hazardous substances may be a potential source of contamination if leaks or spills are are not containable within the structure.

Agricultural product storage

Special facilities like bins, buildings, silos are used to store agricultural products like grains, cotton, soybeans. Agricultural chemicals like insecticides, pesticides, and rodenticides may be used to protect these products during storage. If such chemicals are classified as hazardous substances, and leaks or spills are not containable within the storage structure, the structure is a potential source of contamination.

Airport

Many small local airports are scattered around the state. They generally have a hanger for repair or maintenance purposes, and above-ground storage tanks for petroleum products. The specific threat to groundwater is from petroleum products.

Auto body shop

The auto body shop disposes petroleum-based wastes such as gasoline, motor oil, diesel fuel, and hazardous substances such as degreasing solvents, lacquer, paint, and metallic particles.

Battery distributor

The threat to groundwater from batteries is the lead in the plates and the acid used for cells. Improper handling may result in acid spills or broken batteries and lead plates scattered on the ground.

Cemetery

Potential contaminants include embalming fluids, trace metals, and micro-organisms which may infiltrate to the water table. Older cemeteries are particularly suspect for this kind of contamination.

Chemical storage (non-agricultural)

Non-agricultural chemicals largely include rodenticides, insecticides, solvents, wood-treatment chemicals, and paints. These may be stored in buckets and drums at industrial plants, vehicle repair businesses, lumber processing plants.

Cottonseed oil processing

This type of operation employs toxic organic solvents like hexane, and inorganic solvents like sodium hydroxide, to produce oil and by-products.

Drainageways

Draingeways include rivers, streams, bayous, and ditches. Agricultural, industrial, and other types of contaminants may be transported long distances by drainageways before reaching their final destination. Agricultural chemicals and fertilizers are probably contributed to the flow of drainageways by overland runoff and excess irrigation water draining agricultural land. These substances and other chemicals may be carried by infiltrating water to the water table, especially during high flows from spring runoff or summer storms when heads are greatest in the channels.

Dry cleaner

The dry-cleaning process uses solvents to dissolve and absorb grease and dirt. Unwanted escape of these substances may be from containers or machines to the land surface, or from broken sewer lines.

Electrical transformer storage

The transformer is a potential threat if it contains PCB's for dielectric purposes. This type of transformer is being phased out in accordance with federal regulations, but it is stored by the owner before being transferred to a designated disposal facility. Improper storage and handling of the PCB-containing transformer could result in unwanted escape of the hazardous chemical.

Fish farm or reservoir

Bodies of water that sit on the land surface like the ponds constructed for fish farms or reservoirs for agricultural purposes may be potential sources of contamination. Depending upon construction, they may leak water to the underlying water table, which could become contaminated if this water contains chemicals or substances that are considered injurious to the health of persons.

Garage for motor vehicle, farm machinery, or boat repair

The threat posed by the garage is largely from the disposal of petroleum-based wastes such as gasoline, diesel fuel, oil, and degreasing solvents.

Golf course

The golf course is considered a potential source because of the use of chemicals like fertilizers, pesticides, and herbicides for protecting the grass. Connected to the golf course may be two other potential sources of contamination, namely, a vehicle parking area and a chemical storage building. Vehicles contain petroleum products that may leak or spill. A building that is used for storage of hazardous substances may be a potential source of contamination if leaks or spills are not containable within the structure.

Gravel pit (see Pond)

Highway and railroad

The main transportation routes allow the movement of hazardous and regulated substances on trucks and trains over long distances increasing the risk of contamination. Highway intersections and railroad crossings are especially likely to have accidents. They are not common but may pose difficult problems of contamination when they do occur.

Industrial operation

The potential threat to groundwater of any industrial operation is seen in the management of hazardous and regulated substances. For example, if these substances are warehoused for internal use or external distribution, contamination may result if leaks or spills are not containable within the structure. In other words, the warehouse must be constructed to isolate the hazardous substance.

Machine and other shops

Machine shops, sheet metal shops, electrical, and welding shops comprise the bulk (excluding auto body shops treated elsewhere) of industry-related businesses. Most are small operations but they may still pose a threat to groundwater because solvents, petroleum product wastes, and metallic wastes are generated.

Municipal sewer lines (also see Sewage Disposal Structures)

Many communities are underlain by sewer lines. Groundwater contamination may result from pathogenic micro-organisms and nitrate in sewage fluids where these fluids escape through broken pipe.

Oil-producing, containment, and pipeline structures

Oil-producing facilities are potential sources of contamination of the groundwater reservoir at both shallow and great depths. Contamination of shallow groundwater is most likely to result from leakage through unlined brine pits and from storage facilities that are not protected by impermeable floors and revetments for containing leaks or spills. Contamination of the deep ground water is most likely to result from (1) leaks through well casing that has been perforated by corrosion, and (2) vertical movement along the borehole where the grout sheath is defective or not present. Containment structures (storage tanks and separators) and pipelines carrying petroleum products are potential sources of groundwater contamination. The threat is seen if they should leak or rupture resulting in liquids escaping and spreading out on the land surface.

Oil-field chemicals

Barrels of corrosion inhibitors and demulsifier are often found at oil-well sites. Generally, such chemicals are classified as hazardous by the U.S. EPA, so that special care must be exercised in the use of these chemicals and in the disposal of their containers.

Pond

A pond (or pit or reservoir) is a potential source of contamination if it is not spring-fed but collects only overland runoff that can infiltrate to the water table. Infiltration of the ponded surface water to the water table could result in contamination of groundwater if the ponded water contains hazardous chemicals or septic fluids picked up by the overland runoff. Water that is concentrated in surface-water bodies has an increased chance for reaching the water table compared to overland flow.

Reservoir (see Pond)

Retail store

Certain kinds of stores sell regulated petroleum products and products that contain hazardous substances. Hardware stores and auto parts stores are mainly included in this category. Petroleum products include motor oil mainly. Hazardous substances mainly include anti-freeze, herbicides, pesticides, rodenticides, lubricants, paints, solvents.

Salvage yard

Petroleum products like oil, gas, and lubricants may leak or spill from old or dismantled vehicles. Also, batteries contain acid and lead plates which pose a risk, if broken.

Septic system (see Sewage disposal structures)

Sewage disposal structures (also see Municipal sewer lines)

Sewage disposal that poses contamination risk includes the municipal disposal pond and the septic system. The septic system is the most numerous potential source of contamination in the state. Contamination risk is from pathogenic micro-organisms and nitrate in sewage fluids where these fluids can escape through porous pond materials, or can infiltrate to the water table from septic tank absorption fields.

Underground and above-ground storage tanks

The storage tank used for petroleum products is one of the most numerous potential sources of contamination. The underground tank (UST) is most commonly found at gas stations and convenience stores selling gasoline. The above-ground tank is commonly found at businesses like trucking depots, garages for vehicle repair, petroleum distributor bulk plants, and farms. UST's are regulated by the Arkansas Department of Pollution Control and Ecology, and they must be in full compliance by December, 1998.

Vehicle parking area

The threat to groundwater from areas where trucks and other vehicles are parked or stored is from regulated petroleum products, or from hazardous substances that may be contained in the vehicles.

Waste dump

The waste dump may contain car parts, used tires, batteries, chemical and petroleum-product containers of all sizes, trash and garbage. Generally they are comparatively small, but hazardous and regulated substances or pathogenic organisms pose a problem of contamination because the dumps are not properly contained or monitored like legal land fills.

Water well

The water well includes those used mainly for public supply, domestic purposes, and irrigation. A well is a potential conduit for contaminated water or other fluids if the cement sheath is defective and channelized, or if the casing is perforated by corrosion. Under such conditions, water may move along the borehole from the land surface to the aquifer tapped, or from one aquifer to another. Also, irrigation or precipitation runoff may pick up and transport agricultural chemicals to a well site, and if the well has a defective grout seal or casing, the contaminated water may move down the outside or the inside of the casing to the aquifer.

Wood treatment and furniture finishing

Wood treatment and finishing, and furniture finishing are processes that use organic chemicals. These chemicals include stains, resins, petroleum distillates, enamel, lacquer, and acrylic paints. In addition, if furniture is stripped, methylene chloride and acetone among other hazardous substances are most commonly involved in the process. Most if not all the chemicals used in wood treatment and finishing are injurious to human health, and their use and disposal must be managed closely.

RECOMMENDATIONS FOR FUTURE ACTION

1. Conduct a detailed door-to-door inventory to identify all potential sources of contamination within each WHPA because this inventory was only a windshield survey.
   Be especially careful to identify inactive wells which should be abandoned according to the state's regulations.

2. Verify that active UST's within the community's or public water system's jurisdiction are registered with the Arkansas Department of Pollution Control and Ecology. Also, verify that abandoned tanks are removed (preferably) from the ground and that the soil around the tanks has not been contaminated.

3. Erect wellhead protection road signs. Road signs placed at strategic points along the highways and railroads that pass through a WHPA would be a helpful tool for developing the wellhead protection program. First, it would make the citizens aware of a community program to protect their drinking water supply, which, in turn would enhance appreciation for efforts being exerted by city officials and the water utility. Second, transporters of hazardous and regulated substances seeing signs indicating the presence or nearness of public water-supply wells would most likely be more alert to the need for conducting safer operations in the WHPA. Importantly, these signs are relatively inexpensive to manufacture and erect.

4. Develop an emergency (contingency) plan to be put into operation if a contamination event occurs that forces the water system to take one or more of its wells out of service temporarily or permanently. One main purpose of an emergency plan is to provide a secondary supply of water during the period of emergency. This secondary supply must be used until remediation of the damaged water supply is accomplished, or until a permanent replacement supply can be obtained and activated.

5. Adopt a wellhead protection ordinance or resolution to show intent to develop the program over the long term, and to establish a general ability to enforce the program in the future.

VII. Public Outreach and Participation

Public Outreach

1997 **Arkansas Water Works & Water Environment Association State Conference** – A conference that is designed for water/wastewater operators/managers. This conference provides information related to water/wastewater management, operation, education, and training involving practices and new technologies. The ADH Division of Engineering presented the rudiments of a SWAP. Public participation and involvement was stressed at this time. Approximately 2200 people (made up of operators/managers, mayors, city council representatives, and others) attended the conference.

1997 **Arkansas State Water Conference** – This conference is jointly sponsored by the University of Arkansas Cooperative Extension Service and the USGS. This technical conference provides research information to academia, related professionals, water operators/managers, students, and the general public regarding water research within Arkansas and surrounding states. Presenters at the conference included ADH Division of Engineering, USGS, Arkansas Soil and Water Commission, University of Arkansas – Fayetteville Professors, and graduate students from the U of A – Fayetteville.

1997 **National Drinking Water Week Water Fair at Little Rock** – A grass roots effort to educate K-4 grade students of schools within the Central Arkansas area about water and water related topics. Topics are presented in a “hands on” fashion. Educational materials presented include protection and saving the source, water production, and efficient use. Staff within the Little Rock, North Little Rock public utilities, ADH Division of Engineering, USGS, University of Arkansas Cooperative Extension Service, Arkansas Game and Fish Commission, and other public works departments volunteer their time to serve as “tour buddies” and presenters.

1997 **League of Women Voters Teleconference and Local Panel Discussion** – The League of Women Voters sponsor various teleconferences within the City of Little Rock. The ADH Division of Engineering was asked to attend the teleconference to serve on the panel, answer questions, and provide additional information.

1997 **Northeast Arkansas Environmental Association** - This is a group of environmental professionals from Arkansas State University, consulting firms, and local industries that meet on a regular basis to discuss environmental issues relevant to their particular careers. The ADH presented a program on Watershed Protection and the Source Water Assessment Program.

1997 **Arkansas Rural Water Association** – An annual state conference sponsored by the Arkansas Rural Water Association. The conference is directed toward the water/wastewater manager/operator to enhance their knowledge and skills of operation. Emphasis is place on new or emerging technologies, practices, and upcoming/proposed regulation change(s). The ADH Division of Engineering presented information on SWAP development and timeframes. Public involvement and participation was stressed at this time.

1997-1998 “**Arkansas Drinking Water Update**” articles - Multiple articles in different issues. This quarterly newsletter published by ADH is distributed to PWS, consultants, municipal officials, and others. (Articles that appeared in the Winter 1997 and Winter 1999 issues are located on pages 7-18 and 7-19, respectively.)

1998 **Arkansas Rural Water Association** – An annual state conference sponsored by the Arkansas Rural Water Association. The conference is directed toward the water/wastewater manager/operator to enhance their knowledge and skills of operation. Emphasis is place on new or emerging technologies, practices, and upcoming/proposed regulation change(s). The ADH Division of Engineering presented the strategy of developing the SWAP. A status update of the SWAP was presented.

1998 **Arkansas Water Works & Water Environment Association State Conference** – A conference that is designed for water/wastewater operators/managers. This conference provides information related to water/wastewater management, operation, education, and training involving practices and new technologies. The ADH Division of Engineering presented the strategy for the development of the SWAP. An update of the SWAP was also presented. Approximately 2500 people (made up of operators/managers, mayors, city council representatives, and others) attended the conference.

1998 **National Drinking Water Week Water Fair at Little Rock** – A grass roots effort to educate K-4 grade students of schools within the Central Arkansas area about water and water related topics. Topics are presented in a “hands on” fashion. Educational materials presented include protection and saving the source, water production, and efficient use of water and its source. Staff within the Little Rock, North Little Rock public utilities, ADH Division of Engineering, USGS, University of Arkansas Cooperative Extension Service, Arkansas Game and Fish Commission, and other public works departments volunteer their time to serve as “tour buddies” and presenters. The Fair is conducted at the Little Rock Municipal Waterworks which utilizes surface water as its source, therefore source water protection is a primary focus within the presentations and activities.

1998 **ADH Division of Engineering Homepage established – Source Protection Links** – Anyone that has Internet access can go to the ADH Division of Engineering homepage for information and updates of the activities that occur within the Division. A section of the page has been dedicated for the SWAP and the activities leading to its development.

1998 **Statewide press release (SWAP)**. – A Statewide press release was submitted to all state newspapers and media (A copy of the press release is provided on pages 7-12 through 7-14.) An article was also published in the Arkansas Municipal League monthly publication of Town and Country (A copy of this article is provided on pages 7-15 through 7-17.) The articles gave a brief outline of the SWAP, its development, benefits to the consumer and the water utility, its practical approach, and usefulness as a tool. Furthermore the articles addressed the need for public involvement and a call for volunteers to serve on the Technical and Citizens Advisory Committees.

1998 **Presentations to EAST program** – EAST (Environmental and Spatial Technologies) is a extracurricular program that originated at Greenbrier High School, that teaches high school students to use computer enhanced graphics, GIS, GPS, and mapping programs. High School teachers across the state attend two-week training sessions to learn programs and curriculum to utilize during the school year. Presentations on the Arkansas SWAP were given to two groups of teachers as potential projects for students in their communities.

1998 **Formation of Technical and Citizens Advisory Committees** – A Technical Advisory Committee (TAC) was formed that consisted of representatives of the following: University of Arkansas – Cooperative Extension Service, Arkansas Department of Pollution Control and Ecology, Arkansas Game and Fish Commission, Arkansas Forestry Service, Arkansas Department of Health, Arkansas Geological Commission, Arkansas Highway and Transportation Department, Arkansas Oil and Gas Commission, Arkansas Parks and Tourism, Arkansas Rural Water Association, Arkansas Soil and Water Conservation Commission, Arkansas State Plant Board, Arkansas Water and Waste Water Managers Association, Arkansas Water Resources Center, Arkansas Water Works and Water Environment Association, Arkansas Public Water Systems, United States Environmental Protection Agency, United States Geological Survey, University of Arkansas – Center for Advanced Spatial Technology - Fayetteville, University of Arkansas – Little Rock, Office of the Governor – Health Liaison, United States Corps of Engineers, United States Park Service, United States Department of Agriculture – Natural Resources Conservation Service, and the United States Forest Service.

A Citizens Advisory Committee (CAC) was formed that consisted of representatives of the following: Arkansas Canoe Club, Arkansas Cattleman's Association, Arkansas Department of Health – AIDS / STD, Arkansas Department of Health – Office of Communications, Arkansas Department of Health – Division of Engineering, Arkansas Department of Pollution Control and Ecology – WET Program, Arkansas Environmental Education Association, Arkansas Forestry Association, Arkansas Home Builders Association, Arkansas Municipal League, Arkansas Nature Conservancy, Arkansas Poultry Federation, Arkansas Game and Fish Commission – Stream Team, Arkansas Water Resources Center, Arkansas Wildlife Federation, Arkansas Associated Milk Producers, Inc., Citizen's for Clean Water, Arkansas County Judges Association, Arkansas Division of Volunteerism, Arkansas Public Water Systems, Entergy – Arkansas, Entergy Services, Inc., Farm Services Agency, FTN and Associates Engineering, Greenbriar High School – EAST Program, League of Women Voters, St. Vincent's Infirmary – Oncology, Ozark Society, Sierra Club, United State Environmental Protection Agency, United States Geological Survey, University of Arkansas – Fayetteville.

Each committee met separately and jointly throughout the year. The first meetings were in March of 1998 and the last meeting was in December of 1998. (See Appendix D for additional information on the Advisory Committees.)

1998 **SWAP Public Meetings** – There was a series of public meetings held to allow interested parties to comment on the Arkansas Source Water Assessment Plan. Public notices were published in the statewide newspaper, and additional advertisements were placed in the major local newspapers around the state. The meetings were held at the following times and locations:

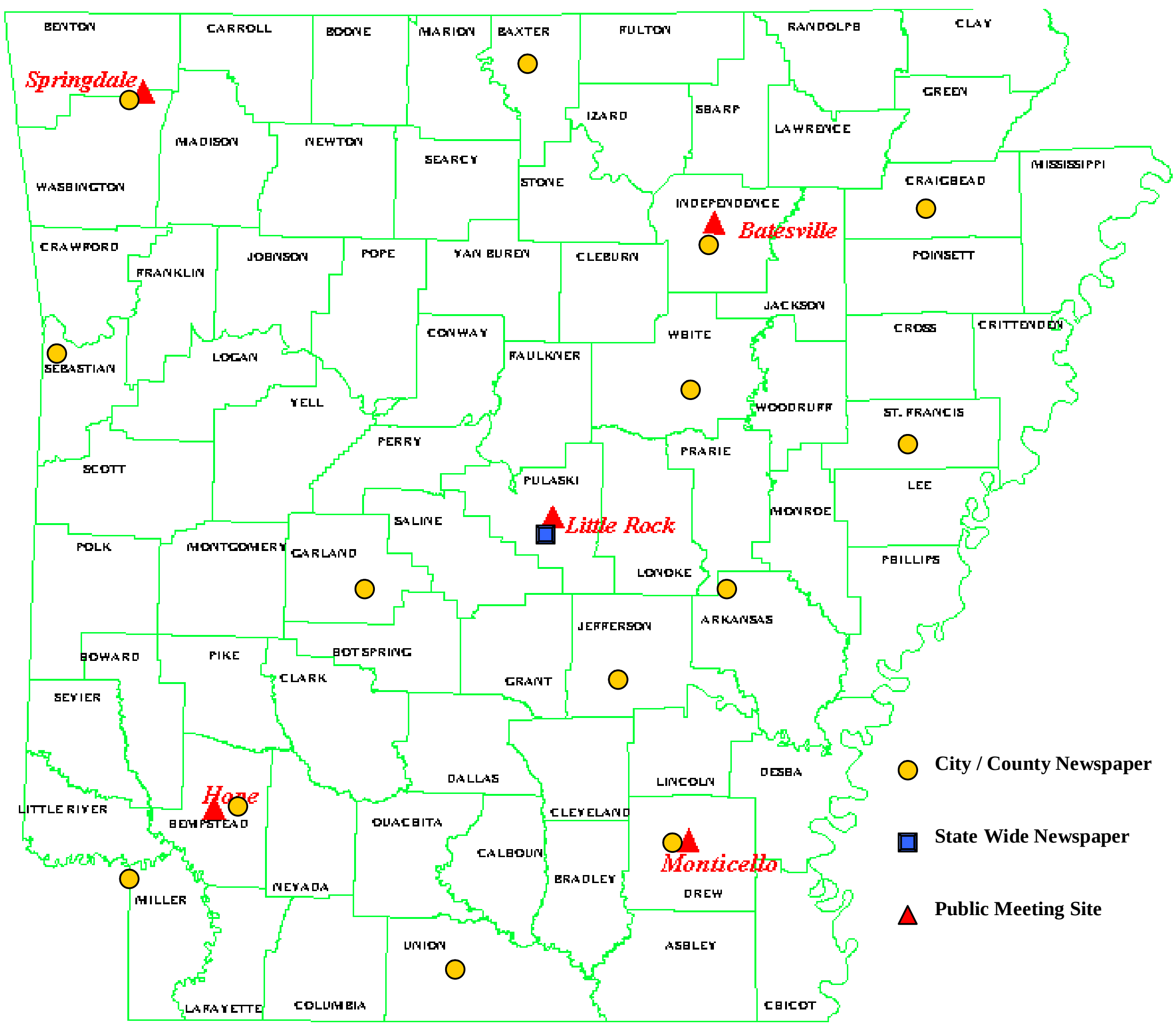
Date	**Time**	**Location**
December 07, 1998	6:00 p.m.	Harvey and Bernice Jones Center - Chapel Hwy 265 and Emma Street Springdale, Arkansas
December 08, 1998	6:00 p.m.	Hope Community Center Hope City Park Hope, Arkansas
December 10, 1998	6:00 p.m.	Area VII Health Office 447 West Gaines Monticello, Arkansas
December 14, 1998	5:00 p.m.	ADH Auditorium 4815 West Markham Little Rock, Arkansas
December 15, 1998	6:00 p.m.	Citizens Bank 200 South 3rd Batesville, Arkansas

Copies of the executive summary of the Source Water Assessment Plan were available for public inspection at the Division of Engineering's office of the Arkansas Department of Health prior to the public meeting.

The public was invited to submit written comments to the Arkansas Department of Health no later than 8:00 a.m. on January 8, 1999.

Note: A map showing the distribution of the public meeting sites throughout the State is provided on the following page.

Distribution of Newspapers Running Notice of Public Meeting
&
SWAP Public Meeting Locations



SWAP Public Meeting Announcements

The Public Meeting notice below appeared in the following Arkansas City / County newspapers:

Batesville Guard, Batesville
Forrest City Times – Herald, Forrest City
Hope Star, Hope
Jonesboro Sun, Jonesboro
Mtn. Home Baxter Bulletin, Mtn. Home
Searcy Daily Citizen, Searcy
Stuttgart Daily Leader, Stuttgart
South Arkansas Sunday News, El Dorado
Fort Smith Southwest Times, Fort Smith
Hot Springs Sentinel – Record, Hot Springs
Monticello Advance, Monticello
Pine Bluff Commercial, Pine Bluff
Springdale Morning News, Springdale
Texarkana Gazette, Texarkana

NOTICE OF PUBLIC MEETING

There will be a series of public meetings held to allow interested parties to comment on the Arkansas Source Water Assessment Plan. The meetings will be held at the following times and locations.

Date	Time	Location
December 7, 1998	6:00 p.m.	Harvey & Bernice Jones Center -Chapel Hwy 265 & Emma St., Springdale, AR
December 8, 1998	6:00 p.m.	Hope Community Center Hope City Park - Hope, AR
December 10, 1998	6:00 p.m.	Area VII Health Office 447 West Gaines, Monticello, AR
December 14, 1998	5:00 p.m.	Ark Dept of Health Auditorium 4815 West Markham, Little Rock, AR
December 15, 1998	6:00 p.m.	Citizen's Bank 200 South 3rd Batesville, AR

Copies of the executive summary of the Source Water Assessment Plan will be available for public inspection at the Division of Engineering's office, Area 1100, of the Arkansas Department of Health prior to the public meeting. Copies of the executive summary may be requested by contacting the Arkansas Department of Health, Division of Engineering at 501/ 661-2623 Monday through Friday between 8:00 a.m. - 4:30 p.m. or on the Internet at http://health.state.ar.us/eng/swpframe.htm which is the Source Water Protection Home Page.

The public may submit written comments to the Director of the Division of Engineering, Arkansas Department of Health, 4815 West Markham, Slot 37, Little Rock, AR 72205 no later than 8:00 a.m. on January 8, 1999.

The Public Meeting notice below appeared in the Arkansas Democrat – Gazette, Arkansas' only Statewide newspaper:

AD COPY

NOTICE OF PUBLIC MEETING

There will be a series of public meetings held to allow interested parties to comment on the Arkansas Source Water Assessment Plan. The meetings will be held at the following times and locations:

Date December 07. 1998. Time 6:00 p.m.. Location Harvey and Bernice Jones Center - Chapel. Hwy 265 and Emma Street. Springdale. Arkansas

Date December 08. 1998. Time 5:00 p.m.. Location Hope Community Center. Hope City Park. Hope. Arkansas

Date December 10. 1998. Time 5:00 p.m.. Location Area VII Health Office. 447 West Gaines. Monticello. Arkansas

Date December 14. 1998. Time 5:00 p.m.. Location Arkansas Department of Health Auditorium. 4815 West Markham. Little Rock. Arkansas

Date December 15. 1998. Time 6:00 p.m.. Location Citizens Bank. 200 South 3rd. Batesville. Arkansas

Copies of the executive summary of the Source Water Assessment Plan will be available for public inspection at the Division of Engineering's office. Area 1100. of the Arkansas Department of Health prior to the public meeting. Copies of the executive summary may be requested by contacting the Arkansas Department of Health. Division of Engineering at 501-661-2623 Monday - Friday between 8:00 a.m. - 4:30 p.m. or on the Internet at http://health.state.ar.us/eng/swpframe.htm which is the Source Water Protection Program Home Page.

The public may submit written comments to the Director of the Division of Engineering. Arkansas Department of Health. 4815 West Markham. Slot 37. Little Rock. AR 72205. no later than 8:00 a.m. on January 8. 1999.

9066610

A Notice to be posted at each Area Health Unit (10 offices) and each County Health Unit (94 offices) and handout to be distributed to the public was created and distributed in December of 1998. Both publications contained information on how to obtain a copy of the Executive Summary of the Arkansas Source Water Assessment Program by mail, email, or on the Internet. They were a request for public comment on our plan. (Examples of both are on pages 7-11 and 7-10, respectively). The following is a list of all the Area Health Offices and County Health Units and the cities where they are located. (Note there is not an Area II Health Office.)

Area I. Fayetteville
- Benton County - Bentonville
- Boone County - Harrison
- Carroll County - Berryville
- Crawford County - Van Buren
- Franklin County - Ozark
- Madison County - Huntsville
- Newton County - Jasper
- Sebastian County - Fort Smith
- Washington County - Fayetteville

Area III. Russellville
- Conway County - Morrilton
- Faulkner County - Conway
- Johnson County - Clarksville
- Logan County - Booneville
- Logan County - Paris
- Perry County - Perryville
- Pope County - Russellville
- Scott County - Waldron
- Yell County - Danville
- Yell County - Dardanelle

Area IV. Hot Springs
- Clark County - Arkadelphia
- Garland County - Hot Springs
- Hot Spring County - Malvern
- Montgomery County - Mount Ida
- Polk County - Mena
- Saline County - Benton

Area V. Nashville
- Hempstead County - Hope
- Howard County - Nashville
- Lafayette County - Lewisville
- Little River County - Ashdown
- Miller County - Texarkana
- Nevada County - Prescott
- Pike County - Murfreesboro
- Sevier County - DeQueen

Area VI. Hampton
- Bradley County - Warren
- Calhoun County - Hampton
- Cleveland County - Rison
- Columbia County - Magnolia
- Dallas County - Fordyce
- Grant County - Sheridan
- Jefferson County - Pine Bluff
- Ouachita County - Camden
- Union County - El Dorado

Area VII. Monticello
- Arkansas County - DeWitt
- Arkansas County - Stuttgart
- Ashley County - Crossett
- Ashley County - Hamburg
- Chicot County - Dermott
- Chicot County - Lake Village
- Desha County - Dumas
- Desha County - McGehee
- Drew County - Monticello
- Lincoln County - Star City

Area VIII. Little Rock

- Lonoke County - Cabot
- Lonoke County - England
- Lonoke County - Lonoke
- Prairie County - Des Arc
- Pulaski County - College Station
- Pulaski County - Eastgate
- Pulaski County - Jacksonville
- Pulaski County - North Little Rock
- Pulaski County - Pulaski Central
- Pulaski County - Southwest

Area IX. Forrest City

- Crittenden County - Earle
- Crittenden County - West Memphis
- Cross County - Wynne
- Lee County - Marianna
- Mississippi County - Blytheville
- Mississippi County - Osceola
- Monroe County - Brinkley
- Phillips County -Helena
- St. Francis County - Forrest City
- Woodruff County - Augusta

Area X. Batesville

- Baxter County - Mountain Home
- Cleburne County - Heber Springs
- Independence County - Batesville
- Izard County - Melbourne
- Marion County - Yellville
- Searcy County - Marshall
- Stone County - Mountain View
- Van Buren County - Clinton
- White County - Beebe
- White County - Searcy

Area XI. Walnut Ridge

- Clay County - Corning
- Clay County - Piggott
- Craighead County - Jonesboro
- Fulton County - Salem
- Greene County - Paragould
- Jackson County - Newport
- Lawrence County - Walnut Ridge
- Poinsett County - Harrisburg
- Poinsett County - Marked Tree
- Poinsett County - Trumann
- Randolph County - Pocahontas
- Sharp County - Ash Flat

ARKANSAS
SOURCE WATER ASSESSMENT PROGRAM

Health Department Creating Plan to Protect Sources of Drinking Water

The Environmental Protection Agency (EPA) has been mandated by Congress to guide states in implementing programs that protect the sources of drinking water. It is EPA's goal that by the year 2005, 60% of the populations served by community water systems will have these programs in place. These programs can identify any potential contaminants entering public water system wells or intakes. Additionally, the geographic areas with the most critical needs can receive the greatest allocations of limited financial and human resources to address those needs.

The Arkansas Department of Health, Division of Engineering, is preparing a state plan to comply with these guidelines. ***We are requesting public comment by 1/15/99.*** Call and request a copy of the Executive Summary or visit our web site.

Arkansas Source Water Assessment Program Home Page
http://health.state.ar.us/eng/swpframe.htm

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Tony Ramick, R.S. Source Water Protection Specialist	tramick@mail.doh.state.ar.us

Phone (501) 661-2623

ARKANSAS SOURCE WATER ASSESSMENT PROGRAM

We are requesting public comment by 1/15/99. Call and request a copy of the Executive Summary or visit our web site.

Arkansas Source Water Assessment Program Home Page

http://health.state.ar.us/eng/swpframe.htm

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Ginger R. Tatom, R.S.
SWTR/SWAP
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Source Water
Protection Specialist

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Press Release

For More Information, Contact
Ginger R. Tatom (501) 661-2623

FOR IMMEDIATE RELEASE

OCTOBER 5, 1998

Health Department Creating Plan To Protect Sources of Drinking Water in State

Little Rock—The Environmental Protection Agency (EPA) has been mandated by Congress to guide states in implementing programs that protect the sources of drinking water. It is EPA's goal that by the year 2005, 60% of the populations served by community water systems will have these programs in place. These programs can identify any potential contaminants entering public water system wells or intakes. Additionally, the geographic areas with the most critical needs can receive the greatest allocations of limited financial and human resources to address those needs.

The Arkansas Department of Health, Division of Engineering, is preparing a state plan to comply with these guidelines. The Health Department is required to increase public involvement in this process and will be conducting a series of five hearings in the near future to assure that the plan responds to constituent needs and concerns.

Drinking Water Source Water Protection and Assessment Program Background

On August 6, 1996, Amendments to the Federal Safe Drinking Water Act were passed by Congress. These amendments included requirements for each State to implement a Source Water Assessment Program (SWAP), and an optional Source Water Protection Program (SWPP). The SWAP is a mandatory program for all states and the SWPP is voluntary. The Amendments required the Environmental Protection Agency (EPA) to publish guidance for the states to utilize in implementing these programs.

In August 1997, the EPA published the *State Source Water Assessment and Protection Programs Guidance*. The Arkansas Department of Health's (ADH) Division of Engineering is the responsible entity for regulating public drinking water systems within the state of Arkansas. The Division of Engineering is in the process of preparing a State SWAP plan in compliance with the SDWA and the guidance document.

It is EPA's goal that "by the year 2005, 60% of the population served by community water systems will receive their water from systems with source water protection programs in place." The goal will be reached in the following ways:

- By building on past accomplishments resulting from the original Safe Drinking Water Act of 1974 and its 1986 Amendments.
- By maximizing the use of new tools and resources provided under the 1996 Amendments, with an emphasis on public involvement and the new Source Water Assessment Program.
- By building on other key foundations, such as EPA's Watershed Approach.

The Arkansas Department of Health, Division of Engineering is working to develop a delineation and analysis method universal enough to enable the assessments to be completed by the deadline set by Congress and EPA. The Division of Engineering is consulting with the Water Resource Division of The United States Geological Survey, the Arkansas Water Resources Center, the Center for Advanced Spatial Technologies, and the EPA Region 6 staff to develop this methodology.

Using the results of these assessments, local Source Water Protection Programs can be developed to protect the sources of drinking water. Therefore, it is imperative that the results of the assessments be made available to the public. The 1996 Amendments also emphasize public involvement for the Source Water Assessment Program. Prior to the submittal of Arkansas' plan to EPA, a series of public hearings will be held to present the plan to the general public for comment. At this time, the Division of Engineering is proposing to hold five hearings. Dates, times, and locations will be announced at a later date.

There is an obligation for public information and involvement to ensure that states' choices respond to their constituents' needs and concerns. The Guidance requires that all parts of this process be accomplished with the assistance and input of advisory committees, both citizens and technical. These committees will review Arkansas' proposed plan and methodology and provide advice and other input on the plan. Committee meetings will continue until a plan is completed and submitted to EPA.

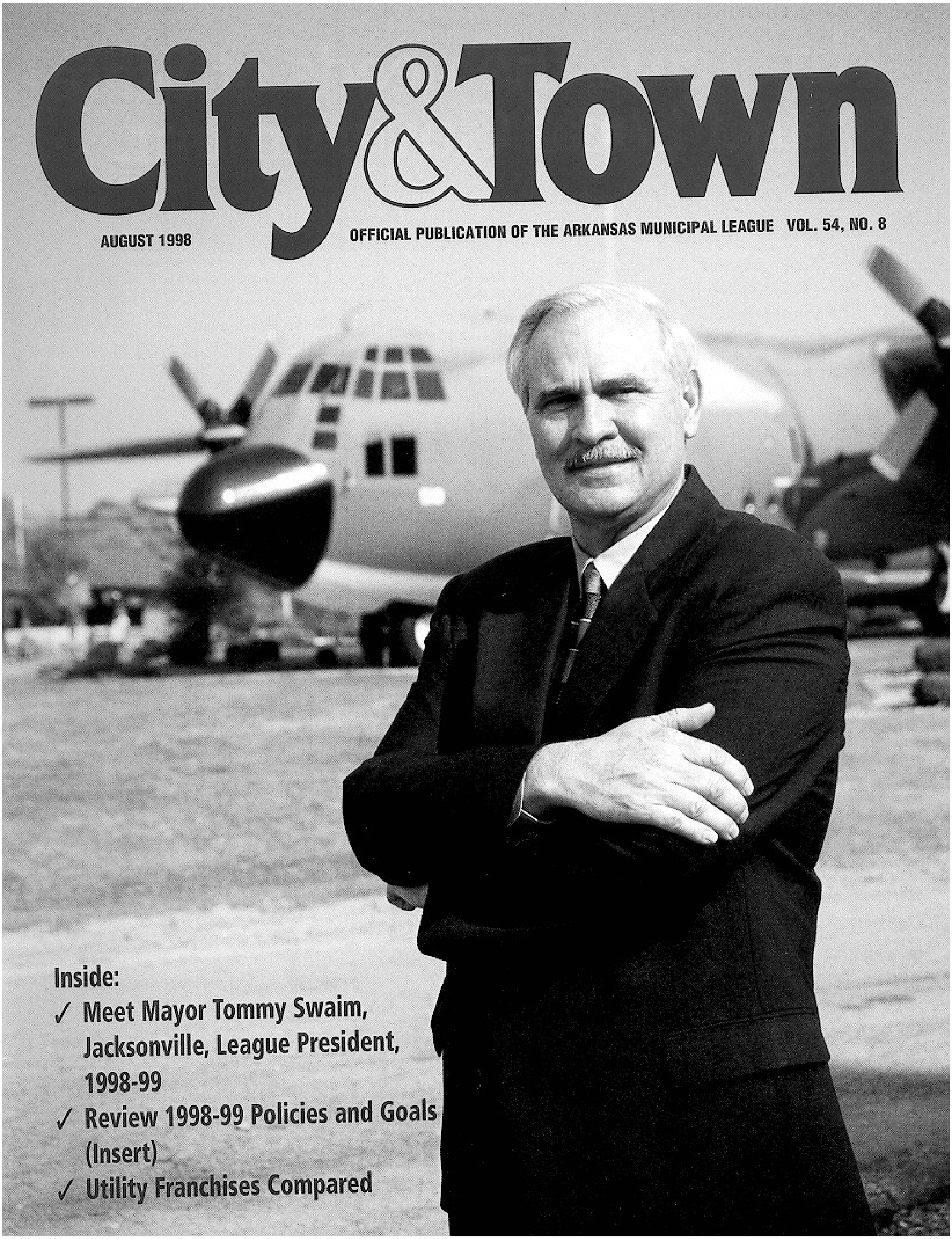
This program will be refined and continue past the first round of assessments. It will be utilized to assist communities and water systems in Arkansas to develop local watershed and wellhead protection programs. The assessment should give direction to local groups or agencies to develop plans to protect against hazards and to focus their resources to areas of need. Each local plan can then be customized to the particular area and any hazards contained therein.

EPA's Watershed Approach focuses Federal, State, and local government programs and citizen efforts for environmental and public health management within hydrologically defined geographic areas. The results of the assessment efforts can be used by all levels of government in understanding the cumulative impacts of various human activities and determine the most critical problems within the watershed. This facilitates the allocation of limited financial and human resources to address the areas with the most critical needs. The Watershed Approach promotes teamwork between the public and private sectors to achieve the greatest environmental improvements with the available resources.

The results of the Source Water Assessment Program can be utilized by and provide benefits to other State and EPA programs. As the assessments are completed, other state and federal programs will be able to set priorities for prevention efforts to reduce or eliminate potential contaminants entering public water system wells or intakes. This should also increase awareness of State and Federal managers of other programs on the need to place a high priority on the protection of public health through source water protection efforts.

FOR MORE INFORMATION CONTACT:

Lyle Godfrey lgodfrey@mail.doh.state.ar.us
Ginger R. Tatom gtatom@ mail.doh.state.ar.us
Tony Ramick tramick@ mail.doh.state.ar.us
Telephone (501) 661-2623



City&Town

AUGUST 1998

OFFICIAL PUBLICATION OF THE ARKANSAS MUNICIPAL LEAGUE VOL. 54, NO. 8

Inside:

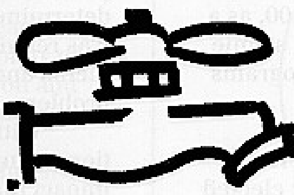
- ✓ Meet Mayor Tommy Swaim, Jacksonville, League President, 1998-99
- ✓ Review 1998-99 Policies and Goals (Insert)
- ✓ Utility Franchises Compared

State Seeks to Protect Sources of Public Water Systems

The state is preparing, in response to a new program to assure clean sources of all public water systems in Arkansas.

The program, called Arkansas' Source Water Assessment Program, is being developed through the Arkansas Department of Health in response to orders from the federal Environmental Protection Agency.

The EPA tentative goal is that by the 2005, 60 percent of the population served by community water systems will receive water from systems with source water protection programs in place.



That is, plans must be developed to protect public water system sources from such contamination as livestock, industry and businesses, agricultural origins such as chemicals, municipalities and others.

Ginger R. Tatom of the Health Department provided to *City & Town* information about the Source Water Assessment Program, or simply, SWAP.

How will the EPA goal be reached? The program is using accomplishments already reached through 10 or more years of federal clean water regulations and standards, such as the EPA's Watershed standards.

The Health Department has invited other public and private interests to act as an advisory committee to help develop the statewide plan so individual communities and their public water systems can each have a safe water protection program.

Among participants of the advisory committee are organizations representing wildlife, fishing, municipal, environmental, utility, farm, health and other interests.

The plan to find, or assess potential or actual contamination threats to public water systems, then can be used as a tool to improve the water sources or as a tool for other uses.

The EPA published the assessment guidelines in 1997. They followed the 1996 amendments to the federal Safe Drinking Water Act.

The state wants to submit an Arkansas program to the EPA by next Feb. 6, and get a federal EPA response by Nov. 6, 1999. If the plan is approved, the state would set about immediately to implement the plan. It wants to complete its program by Nov. 6, 2001.

Each state has a flexibility of designing a safe drinking water assessment program that is tailored to its own needs. A predominantly rural state, for example, would have a different assessment plan from that of a predominantly urban state.

The advisory committee is to help provide the information and advice so the needs and concerns of all of the state are considered.

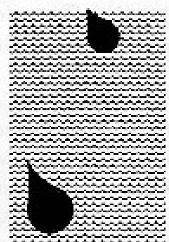
But the EPA stipulates guidelines. Each state, in assesssing what might adversely affect each system's water, must delineate the boundaries of the areas providing source waters for the public water systems. This assessment plan must identify, to the extent practical, the origins of regulated and certain unregulated contaminants in each delineated area.

And each of those assessment plans must determine the susceptibility of the public water systems to such contaminants.

And the federal rules also lay down specific public and private opinions and comments that must be considered and the EPA also orders public hearings and asks for procedures used to develop assessment and protection plans.

In Arkansas, the state seeks to fulfill this purpose in a Source Water Assessment Program: *To develop a management tool for public water utilities to enhance the protection of their sources of drinking water.*

The plan must identify sources of drinking water used by public water systems; the source water assessment areas of the drinking water supplies and potential contaminants within the distinctly delineated areas.



The state says it has about 1,535 individual public drinking water sources, but the number changes frequently. Those are natural and manmade lakes, reservoirs, wells, springs, rivers and streams.

Figuring what area around a water source, such as a lake or spring that must be protected, uses data such as topography, soil conditions, manmade or natural barriers and so on.

Within the watershed, the areas defined by specific criteria will be a part of the total assessment area. Assessment areas won't jump state lines. For example, around a lake or reservoir, the assessment area could extend to a five-mile radius around a distance that begins 1,320 feet out from the high water mark of the shoreline.

But around a spring, the assessment area might not be more than a half-mile distance, not to cross the state boundaries.

However, potential sources of contamination that are outside the delineated assessment area may be incorporated into an assessment at the discretion of the state and depending on the prevalent terrain and soil conditions of the area.

Results of all this research will be written into documents called vulnerability assessments. They will delineate the water source assessment areas; contain

(see Protecting Public Water Sources, page 13)

public officials.

Public Technology, Inc. is a non-profit technology organization sponsored by the National League of Cities, the National Association of Counties, and the International City/County Management Association. PTI is to develop and advance effective use of technology by cities and counties.

Protecting Public Water Sources

(continued from page 11)

an inventory of significant contaminants in each area; determinations will be made of the susceptibility of each public water system to the contamination and activities will be listed leading to protecting the drinking water sources.

The vulnerability assessment reports, the EPA says, must be written in easily read and understood terms and the reports must be widely circulated.

These reports then can be used to promote better understanding of the cumulative impacts of human activities and help determine the most critical problems within each watershed. Also, the reports can help set priorities to address the problems with limited resources in the worst areas.

Source Water Assessment and Protection Programs

Ginger Tatom, R.S.

On August 6, 1997, EPA released the *State Source Water Assessment and Protection Programs Guidance*. It contains EPA's recommendations for what should be the elements of a state Source Water Assessment Program (SWAP) and Source Water Protection Program (SWPP). It is EPA's draft goal that "by the year 2005, 60% of the population served by community water systems will receive their water from systems with source water protection programs in place."

How will this goal be reached? First, is to build on past accomplishments that resulted from the 1986 Amendments, such as the Wellhead Protection Program. The second step is to build on other key foundations such as EPA's Watershed Approach. This Watershed Approach provides a means to better focus water pollution control efforts on the protection of drinking water supplies. Third, is to maximize the use of the new tools and resources provided under the 1996 Amendments, with its emphasis on public involvement and new SWAPs, which *should* lead to SWPPs.

A consistent theme in the new law and the guidance is that States have both new flexibility and resources to tailor programs to State needs and conditions, especially in the prevention area, and the obligation for public information and involvement to ensure that States' choices respond to their constituents' needs and concerns. The State SWAP must delineate the boundaries of the areas providing source waters for public water systems, and identify, to the extent practical, the origins of regulated and certain unregulated contaminants in the delineated area to determine the susceptibility of public water systems to such contaminants.

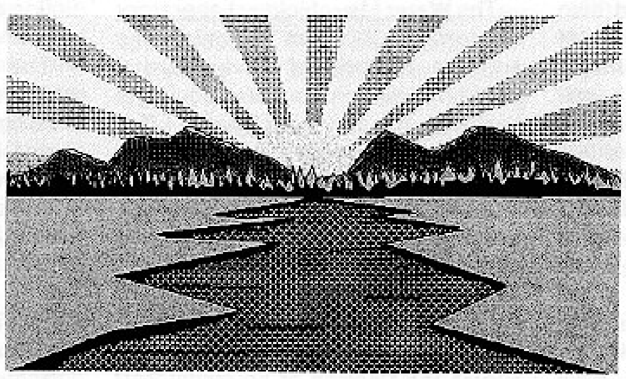
We are currently working to develop delineation and analysis procedures that will meet the technical and time constraints mandated by Congress and the EPA. To assist us in this endeavor, we have been consulting with the Water Division of the United States Geological Survey, the Arkansas Water Resources Center and the Centers for Advanced Spatial Technologies (both associated with the University of Arkansas at Fayetteville), and persons from EPA Region 6.

Due to the facts that we have over 1500 sources of public drinking water in the state, and only a two-year timeframe for completion, we have reached the conclusion that we will have to outsource portions of this project. Negotiations have begun with the aforementioned groups, but no contracts have been awarded to date. The Guidance requires that all parts of this process be done with the assistance and input of Advisory Committees, both Citizens' and Technical. We are currently working to compile a list of people and organizations to invite to serve on a Technical Advisory Committee. Our plan is to convene this committee to review our proposed plan and methodology and provide advice and other input on the plan prior to finalizing any contract agreement. This Committee will, hopefully, meet in early January to begin work. We welcome your input and suggestions for individuals to serve on either of these committees. Please contact Ginger Tatom or Tony Ramick at (501) 834-0748 with any input you may have.

Each assessment is for the benefit and protection of the public water system, that is, for the purpose of developing a SWPP to protect the drinking water for that area. Therefore, States must make the results of the assessments available to the public. Assessments are a tool for further efforts, not a complete process in and of themselves. EPA believes that States should plan for protection programs simultaneously as they plan for and implement their SWAP.

This program will be refined and evolving past the deadline date and will be utilized to assist communities and water systems in the State to develop local watershed and wellhead protection programs. The assessment should guide local groups or agencies to develop their plans to protect against the worst hazards and to focus their resources to the greatest areas of need. Each local plan should be customized to the particular area and the hazards, both actual and potential, contained therein.

The results of the SWAP can be utilized and provide benefits to other EPA programs. As the assessments are completed, other State and Federal programs will be able to reset priorities for prevention efforts to reduce or eliminate contaminants flowing into PWS wells or intakes. This should also increase awareness of State and Federal managers of other programs that action in these areas should be a high priority in the protection of public health..



finished water, unaccounted for water, rate structure, and the utility's financial history.

Special studies were conducted that investigated the present and maximum capabilities for the unit processes of flocculation, sedimentation, filtration, and disinfection; determined the filter flow distribution among the four filters; assessed backwash and rewash effectiveness; compared turbidimeter performance and accuracy to standards and to ADH equipment. Also, Filter #1 was physically entered and inspected by two members of the CPE Team, Lance Jones and Don Murray. The inspection of the media included inspecting for cracks, mudballs, and channeling. It also included probing the media for uniform thickness of the sand and gravel along with any other abnormalities that could be noticed. A distribution profile for the filter media and supporting gravel was developed along with the physical observations noted.

These and other activities completed during the intensive three days of system evaluation resulted in ten factors that the CPE Team felt could be addressed by Pangburn in a cost effective manner to facilitate optimized performance for their plant. An EPA Region VI representative, Mr. Bill Davis, observed the last day of the Pangburn CPE and participated in identifying the performance limiting factors. He also attended the Exit Meeting and, after leaving Pangburn, presented the latest developments in CPEs to ADH staff in Little Rock.

The ADH is considering the use of CPEs to assist surface water systems that are having Safe Drinking Water Act (SDWA) compliance problems. If you would like to volunteer your plant to participate in the CPE program during this present training and development phase, or simply wish more information about the program, please contact Don Murray of the Division of Engineering, or your district staff at (501) 661-2623.

Public Hearings Scheduled for Source Water Assessment Program

Ginger Tatom, Env. Specialist Supervisor

The 1996 SDWA Amendments required each state to implement a Source Water Assessment Program and the Division of Engineering is in the process of preparing a plan to comply. The Division is working to develop a delineation and analysis method universal enough to enable the assessments to be completed by the deadline of next year set by Congress and EPA. The Division of Engineering is consulting with the Water Resource Division of The United States Geological Survey, the Arkansas Water Resources Center, the Center for Advanced Spatial Technologies, and the EPA Region 6 staff to develop this methodology.

Using the results of these assessments, local Source Water Protection Programs can be developed to protect the sources of drinking water. The assessment should give direction to local groups or agencies to develop plans to protect against hazards and to focus their resources on the areas of greatest need. Each local plan can then be customized to the particular area and any hazards contained therein.

The 1996 Amendments also emphasize public involvement for the Source Water Assessment Program. Prior to the submittal of Arkansas' plan to EPA, a series of Public Meetings will be held to present the plan to the general public for comment. The Division of Engineering has scheduled five Public Meetings around the state. Dates, times, and locations are listed below and have been published in various newspapers around the state. These meetings are open to everyone, and all interested parties are encouraged to attend.

The meetings will be held at the following times and locations:

Date	Time	Location
December 7, 1998	6:00 p.m.	Harvey and Bernice Jones Center Chapel; Hwy 265 and Emma Street; Springdale, Arkansas
December 8, 1998	6:00 p.m.	Hope Community Center; Hope City Park; Hope, Arkansas
December 10, 1998	6:00 p.m.	Area VII Health Office; 447 West Gaines; Monticello, Arkansas
December 14, 1998	5:00 p.m.	Arkansas Department of Health; Auditorium; 4815 West Markham Little Rock, Arkansas
December 15, 1998	6:00 p.m.	Citizens Bank; 200 South 3rd Batesville, Arkansas

Copies of the executive summary of the Source Water Assessment Plan will be available for public inspection at the Division of Engineering's office, Area 1100, of the Arkansas Department of Health prior to the public meeting. Copies of the executive summary may be requested by contacting the Arkansas Department of Health, Division of Engineering at 501-661-2623 Monday – Friday between 8:00 a.m. – 4:30 p.m. or on the Internet at http://health.state.ar.us/eng/swpframe.htm which is the Source Water Protection Program Home Page. Written comments may be made to the Director of the Division of Engineering, Arkansas Department of Health, 4815 West Markham, Slot 37, Little Rock, AR 72205, no later than 8:00 a.m. on January 8, 1999.

For more information contact Lyle Godfrey, Ginger Tatom, or Tony Ramick at 501-661-2623.

VIII. Protection Programs and Phase II Assessments

After completion of all Phase I Assessments, the Arkansas Department of Health (ADH) will provide technical assistance to the public water systems in developing their local source protection program. This assistance will be rendered upon request and / or using the priority system established in Phase I. ADH assistance will include (but not be limited to) providing implementation of guidance to local water systems, updating Phase I assessments and / or conducting a more detailed Phase II Assessment.

GUIDANCE

The ADH will assist local governments in the voluntary development of a local source water protection plan. We will provide guidance to the system in the development of a management plan to protect against the most significant hazards. Each local plan may be customized to the particular area and the hazards, both actual and potential, contained therein. Such a plan may include ordinances and / or resolutions enacted at the local level and / or of the local Source Water Protection (SWP) Teams. The involvement and cooperation of the local community is of primary importance. This team can assist in gathering information, public education, the development of contingency and emergency plans, as well as other local options for reducing the threat of drinking water source contamination within the delineated assessment area. In addition, new and / or existing activities with contamination potential within this assessment area will be noted by the ADH and / or the local government and may be passed on to other involved State agencies for their consideration in permitting or other regulatory actions.

UPDATING PHASE I ASSESSMENTS

During the development of local source water protection plans, it is expected that local data gathering efforts will provide additional information that should to be incorporated into the Phase I Assessment. As a part of our continuing level efforts, such information may result in the need to update or append the initial assessment report. This has been the case in Arkansas' WHPP. We will continue these efforts under our continuing level effort for the SWAP program.

PHASE II ASSESSMENTS

Phase II Assessments will expand on Phase I Assessments with updated data / information expanded assessment areas and delineations. Phase II Assessments will be an ongoing process that will benefit by the experiences gained in the completion of Phase I Assessments. Program activities will be refined and continue to evolve past the deadline date as Program Staff assist communities and water systems to develop local watershed and wellhead protection programs.

DELINEATION OF PHASE II ASSESSMENT AREAS

Wells

Phase II Assessment Area – As outlined in the WHP Program, a methodology that involves a rational, analytical method will be used to delineate the Phase II Assessment Area. It takes into account hydrogeologic factors, times of travel, well construction, and other local factors. This method can change the fixed radius area or be utilized in its place. This area will be delineated instead the Phase I Assessment Area if the timeframe and resources permits.

Impoundments (Lakes, Reservoirs, etc.) -

Phase II Assessment Area - After all Phase I Assessments are completed, and the systems are prioritized, the entire watershed of each impoundment within state boundaries will be studied. A methodology that involves a rational, analytical method will be used to delineate the Phase II Assessment Area. It may take into account hydrogeologic factors, times of travel, treatment plant capabilities, and other local factors. This method can change the Phase I Assessment Area or be utilized in its place. This area will be delineated in place of the Phase I Assessment Area if the timeframe and resources permits.

Rivers, Streams, etc. -

Phase II Assessment Area – After all Phase I Assessments are completed, and the systems are prioritized, the entire drainage basins within state boundaries will be studied. A methodology that involves a rational, analytical method will be used to delineate the Phase II Assessment Area. It may take into account hydrogeologic factors, times of travel, treatment plant capabilities, and other local factors. This method can change the Phase I Assessment Area or be utilized in its place. This area will be delineated in place of the Phase I Assessment Area if the timeframe and resources permits.

Springs -

Phase II Assessment Area - After all Phase I Assessments are completed, and the systems are prioritized, the entire recharge zone within state boundaries will be studied. A methodology that involves a rational, analytical method will be used to delineate the Phase II Assessment Area. It may take into account hydrogeologic factors, times of travel, treatment plant capabilities, and other local factors. This method can change the Phase I Assessment Area or be utilized in its place. This area will be delineated in place of the Phase I Assessment Area if the timeframe and resources permits.

GWUDI Wells - (i.e. Wells determined to be under the direct influence of surface water.)

Phase II Assessment Area - After all Phase I Assessments are completed, and the systems are prioritized, the entire recharge zone within state boundaries will be studied. A methodology that involves a rational, analytical method will be used to delineate the Phase II Assessment Area. It may take into account hydrogeologic factors, times of travel, treatment plant capabilities, and other local factors. This method can change the Phase I Assessment Area or be utilized in its place. This area will be delineated in place of the Phase I Assessment Area if the timeframe and resources permits.

CONTAMINANT INVENTORIES AND SUSCEPTIBILITY ANALYSIS

Phase II Assessments will utilize the priority ranking system developed by Phase I and requests for assistance from water systems. These assessments may include any or all of the following:

- Expansion of Assessment Area
- On-site Contaminant Inventories
- Site visits of PSOCs to determine if Best Management Practices (BMPs) are in place or other management practices are utilized which warrant a reduction of Health Risk Category for a particular site
- Gathering of additional data which leads to re-evaluation of a drinking water source's Intrinsic Susceptibility

IX. Interstate Issues

Arkansas has approached interstate issues in a variety of ways, both formally and informally.

GENERAL MEETINGS

On May 1, 1998, EPA Region 6 sponsored a one-day Interstate Issues Meeting for any interested parties. There were twenty-five people in attendance representing EPA Regions 4, 6, 9, and Headquarters. Agencies / Programs that were represented included USGS from Texas and Arkansas, SWAP representatives from Louisiana, Texas, Oklahoma, Arizona, New Mexico, and Arkansas' Drinking Water Programs. One topic of discussion centered on specific state border areas where drinking water sources are of concern, in particular, drinking water sources that are common and on both sides of state lines. The discussion included questions regarding consumers living in areas where their drinking water may come from within a watershed or source outside of their resident state. Where would those customers receive information regarding their watershed / source? Information that is shared from one state to another may not contain all information needed to be consistent with “in-state” susceptibility analysis and vulnerability assessments. Arkansas plans to put as much of the Vulnerability Assessment results on the Internet as possible, so citizens, government agencies, and other interested parties of either state can access the information.

ARKANSAS RIVER

Representatives from Oklahoma and Arkansas comprise an ongoing and very active group whose focus of concern is the Arkansas River. This group is called the Arkansas-Oklahoma Arkansas River Compact Commission, and their 1998 Engineering Report can be found in Appendix H.

Another group that has been formed out of concern for their watershed is the Millwood River Basin Study Steering Committee. It encompasses members from Federal agencies; numerous State agencies from Arkansas, Oklahoma, and Texas; Indian tribes; City governments; Drinking Water Suppliers; and local citizen’s groups. This large group is working together on a large watershed that includes at least two reservoirs and a river basin.

Kim Parker from the Colorado Water Quality Control Division is organizing a group to hold meetings on Interstate Coordination on the Arkansas River. Arkansas plans to participate with this group.

MISSOURI

We have been in contact with Mr. Donald Scott of the Missouri Department of Natural Resources, Division of Environmental Quality's Public Drinking Water Program. Communications have centered on water systems in Arkansas whose watersheds are primarily in Missouri, and water systems in Missouri with watersheds primarily in Arkansas. (See attachment Page 9 - 4.) Given the geologic formations of the Ozarks, it is logical to assume that aquifers utilized in Arkansas as drinking water sources have extensive recharge areas in Missouri. These aquifers have not been studied to the extent of being mapped as to exact locations. Work on these will have to be done at a time beyond the deadline for completion of Phase 1 of the SWAP.

TENNESSEE AND MISSISSIPPI

Due to the fact that no drinking water source watersheds extend across the Mississippi River a contact has not been made with either state. Arkansas has no public water system that utilizes the Mississippi River as a drinking water source. All groundwater systems in areas along the Mississippi River have wells that are drilled into aquifers deep enough to preclude any surface water influence.

LOUISIANA

Arkansas has no drinking water sources whose watersheds or wellhead assessment areas extend into the State of Louisiana. Representatives from Louisiana have been in attendance at the meetings mentioned in the section labeled General Meetings above. We have offered to share information and data with Louisiana upon request.

TEXAS

We have met with Ken May of Texas Natural Resources Conservation Commission at a variety of meetings. Discussions began at the Interstate Issues meeting sponsored by EPA in Dallas in May of 1998, and continued at the "1998 Annual Forum and Technical Exchange Exposition - A Technical Conference on: Ground Water, Watershed, Source Water, Wellhead Protection, and Underground Injection Control" meeting in Sacramento, California in September of 1998. We have agreed to share information and data, in particular regarding those areas that have drinking water sources that are in common and on both sides of the Arkansas-Texas border, especially regarding the City of Texarkana. This discussion included where information would be available to consumers living in areas where their drinking water may come from a source whose watershed crosses state lines or whose drinking water source is in another state. Arkansas plans to put as much of the Vulnerability Assessment results on the Internet as possible, so this information is accessible to any citizen of either state.

OKLAHOMA

We have met with Mike Houts of Oklahoma DEQ at a variety of meetings. At the May 1, 1998, Interstate Issues Meeting, we discussed specific state border areas where drinking water sources are of concern. In particular were drinking water sources on both sides of the Arkansas-Oklahoma border. This discussion included where information would be available to consumers living in areas where their drinking water may come from a source whose watershed crosses state lines or whose drinking water source is in another state. Arkansas plans to put as much of the Vulnerability Assessment results on the Internet as possible, so this information is accessible to any citizen of either state. We also have had numerous telephone conversations on this and other issues. There are tentative plans for more formal meetings in the future, as Oklahoma has applied for EPA Interstate Cooperation grant money. The plan is to hold a series of meetings in Arkansas and Oklahoma to discuss the specific Source Water Assessment areas of concern to either state. This may include revising Assessment Area boundaries to match on both sides of state lines and / or sharing Contaminant Inventory data for these areas.

November 7, 1997

Mr. Donald Scott, Environmental Engineer
Public Drinking Water Program
Division of Environmental Quality
Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102-0176

Dear Mr. Scott:

In response to your October21, 1997 letter requesting location data for water systems in Arkansas, we have the following to offer. Three water systems in Arkansas utilize water sources that drain out of Missouri. Following is a summary of the information requested for those systems.

Marion County Water Regional Water District has an intake on Bull Shoals Lake located near the town of Bull Shoals in Marion County, Arkansas with a latitude of 36^0 23’ 31” and a longitude of 92^0 34’ 49”. Mt. Home Waterworks has an intake on the Pigeon Creek arm of Norfork Lake in Baxter County, Arkansas with a latitude of 36^0 23’ 30” and a longitude of 92^0 19’ 45”. Pocahontas Waterworks has an intake on the Black River within the city limits of Pocahontas in Randolph County, Arkansas with a latitude of 36^0 15’ 30” and a longitude of 90^0 58’ 00”. Currently there are no water systems using the other surface water bodies that you listed.

We would appreciate notification of chemical spills or other emergency incidents that may adversely affect the above water supplies. We, in turn, will reciprocate for incidents on the Upper White River Basin and the Kings River. Thank you for your interest and concern. If you have any questions, please call me at (501) 661-2623.

Sincerely,

Lyle Godfrey, Engineer Supervisor
Source Protection Program
Division of Engineering

HRS,BM,RH,LG,MM,TS:lg

X. Progress Reports to EPA

In EPA's "State Source Water Assessment and Protection Programs Guidance", Chapter 2 Section II.D.5, requirements are listed for reporting the State's progress in completing their SWAP. These requirements and the ADH response follows:

1. Total number of PWSs, categorized as ground water, surface water, or combined.

   - ADH is currently utilizing SIDWIS-FED for data reporting and this data should be available as part of this reporting. If EPA requires separate reporting of this data, it can be compiled and forwarded upon request.

2. The number of PWSs by category with "completed" delineations, source inventories, and susceptibility determinations.

   - This data is part of the benchmarking we are requesting from our cooperative partners in this process. As noted in the timeline in Appendix I, all delineations will be completed, then susceptibility determinations will begin. Seamless statewide GIS layers are currently being compiled of all PSOC data available. This data will be utilized in the susceptibility determinations. Reporting of this data can be done in the regular biennial reports to EPA or as a separate report, depending upon EPA's request.

3. The population served by the PWSs in source water protection areas.

   - This data is currently being reported for groundwater systems in the WHPP biennial reports. Arkansas is not currently planning a mandatory source water protection program, but plans to address the surface water Watershed Protection program in the same manner as the WHPP does groundwater source protection (See Appendix B). This will include, but not be limited to, public education and technical assistance to encourage and aid water systems in developing a local Source Water Protection Plan. These plans will be based on the particular characteristics of each drinking water source, the needs and resources of the local stakeholders, and the level of protection they find necessary and sustainable. Some PWSs in Arkansas have taken the initiative and already have some form of protection program in place. Data on Watershed Protection Plans can be reported along with the WHPP reporting, or in a separate report upon EPA request.

4. How completed local assessments have been made available to the public.

   - A timeline for completion is included in the Workplan for USGS (See Appendix J). This includes all phases of the project up to the compilation of the final reports. When their product is forwarded to ADH, we will review all data, then complete the reports (See Section VI.). As soon as all the data for each water system is gathered into the final report, it will be mailed to the PWS for final review. If inaccuracies are noted by the water system, ADH will review this data and edits made as deemed necessary. If no corrections are needed, or when the edited reports are returned to the PWS, the water systems will be asked to notify their customers of the report's availability. ADH also plans to put the notice of the report's availability on the Internet. We are currently investigating the possibility of putting all completed reports on the Internet.

Additional reporting requirements are included in the "Final DWSRF Guidelines". These include how funds have been expended, especially using the set-aside funds for assessments. This information will be included in the required biennial reports.

Appendix A -- Glossary and Acronyms

Assessment Area:	A delineated area around the intake or well head of a public water system that establishes the general boundary for Vulnerability Assessment. The area will not extend past the State boundaries and will be determined by a fixed radius, and / or topographical or hydogeological method.
Ground Water:	Naturally occurring water occupying the zone of saturation in the ground below the surface of the earth.
GWUDI:	Ground Water Under the Direct Influence of Surface Water. Water beneath the surface of the ground with significant occurrences of insects or other macro-organisms, algae, or large diameter pathogens such as Giardia-lamblia, or significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions.
High Water Level:	The line on the shore of an impoundment that is reached at the normal spillway elevation.
Off Stream Storage:	A natural or man made basin used for the purpose of storing raw water for use by a public water system as a supplement to the primary source of raw water.
Median Stream Flow:	The rate of flow for which there are an equal number of greater and lesser occurrences during a specified period.
Permeability Weight:	A relative rating of the capacity of the aquifer material to transmit water or contaminates.
Phase I Assessment Area:	The area delineated for the purpose of the Source Water Assessment Program. This is the minimum area that will be considered in the vulnerability assessment.
Phase II Assessment Area:	Upon completion of vulnerability assessments for all water sources, and if resources allow, an expanded area for each source will be delineated and evaluated. The Phase II Assessment Areas will be based on either State prioritization of systems, new data acquired, or in the process of providing technical assistance in the development of a Protection Plan.

PSOC:	Potential Sources of Contamination. A contaminant that has the potential to adversely affect the quality of a drinking water supply.
Significant PSOC:	A contaminant that has the potential to adversely affect the quality of a drinking water supply at such a magnitude as to exceed an MCL or health advisory level.
Surface Water:	Water that flows over or rests upon the surface of the earth. The term surface water includes rivers, lakes, impoundments, reservoirs, and springs in addition to other man-made and naturally occurring bodies of water on the surface of the earth.
Time of Travel:	The time necessary for contaminants to travel a given distance from the source of contamination to the intake or well.

Acronyms
ADEQ - Arkansas Department of Environmental Quality (formerly DPC&E)
ADH - Arkansas Department of Health
AEF - Arkansas Environmental Federation
AGC - Arkansas Geological Commission
AHTD - Arkansas Highway & Transportation Department
AO&GC - Arkansas Oil & Gas Commission
ARWA - Arkansas Rural Water Association
ASWCC - Arkansas Soil & Water Conservation Commission
AWRC - Arkansas Water Resources Center
AWW & WEA - Arkansas Water Works & Water Environment Association
AWWA - American Water Works Association
BMPs - Best Management Practices
CAC - Citizen Advisory Committee
CAST - Center for Advanced Spatial Technologies
CD - Compact Disc
CERCLA - Comprehensive Environmental Response, Compensation, and Liability
CFR - Code of Federal Regulations
CWA - Clean Water Act
CWS - Community Water System
DEM - Digital Elevation Model
DLS - Digital Line Graph
DOE - Division Of Engineering (Arkansas Department of Health)
DOQ - Digital Orthophoto Quadrangle
DRG - Digital Raster Graphics
DWSRF - Drinking Water State Revolving Fund
EAST Program - Environmental And Spatial Technologies
EPA or USEPA - Environmental Protection Agency
ERNS - Emergency Response Notification System
FOI - Freedom of Information
GIS - Geographic Information System
GPS - Global Positioning System
GWUDI - Ground Water Under the Direct Influence of surface water
MCL - Maximum Contaminant Level
MSDS - Material Safety Data Sheet

MSWLF - Municipal Solid Waste Landfill
NCWS - Non-Community Water System
NIPDWR - National Interim Primary Drinking Water Regulations
NPDES - National Pollution Discharge Elimination System
NRCS - National Resource Conservation Service
NTNCWS - Non-Transient Non-Community Water System
OES - Office of Emergency Services
PSA - Public Service Announcement
PSOC - Potential Sources Of Contamination
PWS - Public Water System
PWSSP - Public Water System Supervision Program
QA/QC - Quality Assistance/Quality Control
RCRA - Resource Conservation and Recovery Act
SDWA - Safe Drinking Water Act
SIC - Standard Industrial Codes
SSURGO - Soil Survey Geographic Data Base
STATSGO - State Soil Geographic Data Base
SWAP - Source Water Assessment Program
SWP - Source Water Protection
SWPP - Source Water Protection Program
TAC - Technical Advisory Committee
TCR - Total Coliform Rule
TNCWS - Transient Non-Community Water System
TOT - Time Of Travel
USCOE - United States Army Corps Of Engineers
USDA - United States Department of Agriculture
USFS - United States Forest Service
USGS - United States Geological Survey
UST - Underground Storage Tank
WEF - Water Environment Federation
WET Program - Water Education Team program
WHPA - Well Head Protection Area
WHPP - Wellhead Protection Program
WWTP - Waste Water Treatment Plant

Appendix B Arkansas Wellhead Protection Program

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

September 27, 1990

Honorable Bill Clinton
Governor of Arkansas
State Capitol, Room 250
Little Rock, Arkansas 72201

Dear Governor Clinton:

On June 19, 1989, the State of Arkansas submitted its Wellhead Protection Program (WHPP) to the Environmental Protection Agency (EPA), pursuant to Section 1428 of the Safe Drinking Water Act (SDWA), as amended in 1986. Under Section 1428, EPA is required to evaluate each State program to determine whether it is adequate to protect public water supply wells as required by Section 1428 from contaminants that may have any adverse effects on public health.

Since June 19, 1989, my ground water staff has been working with the staff of the Division of Engineering of the Arkansas Department of Health in refining your State's submittal to ensure that the goal of the SDWA will be achieved and that the State will produce an effective WHPP. A better understanding of the potential threats to ground water quality and the approaches needed for their management are direct results of our joint effort.

I am pleased with the development of Arkansas' WHPP and have determined that it satisfies the requirements of the statute. Therefore, the Arkansas WHPP is fully approved for the purposes of Section 1428 of the SDWA.

In summary, Arkansas has taken a major step forward in further protecting its ground water resources by developing a comprehensive WHPP that adds an additional level of protection for the State's public water supply wells.

We commend the Department of Health on the hard work that has gone into developing your State's program and look forward to working with them during program implementation.

Sincerely yours,

Robert E. Layton Jr., P.E.
Regional Administrator

cc: Joycelyn Elders, Director
[illegible] Department of Health

[illegible] for Natural Resources
Office of the Governor

[illegible]ndall Mathis, Director
[illegible]kansas Department of Pollution Control and Ecology

[illegible], Director
[illegible] Soil and Water Conservation Commission

Jerry Hill, Director
Bureau of Environmental Health Services
Arkansas Department of Health

[illegible] Walford, Director
[illegible] of Engineering
Arkansas Department of [illegible]

Harlan [illegible], Director
Office of Ground Water Protection

WELLHEAD PROTECTION PROGRAM

STATE OF ARKANSAS

DEPARTMENT OF HEALTH

DIVISION OF ENGINEERING

SEPTEMBER 1990

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I. PROGRAM SUMMARY & PURPOSE

The purpose in establishing the Arkansas Wellhead Protection Program (AWHPP) is two-fold:

1)Fulfillment of the wellhead protection requirements of the Safe Drinking Water Act Amendments of 1986 (SDWA). Under Section 1428 of the SDWA, each State shall submit to the EPA Administrator "a State program to protect wellhead areas within their jurisdiction from contaminants which may have any adverse affect on the health of persons." In a letter to Lee M. Thomas, then Administrator of the EPA, Governor Bill Clinton designated the Department of Health (ADH) to be the lead Agency in implementing the new amendments to the SDWA.

2)To provide another means to enhance the ADH's continuing efforts to protect public drinking water supply sources under the State's Public Water Supply Supervision Program (PWSSP). Under the PWSSP, source protection through regulation, education, and technical assistance is an integral program component.

The AWHPP will be implemented as a part of the current PWSSP. The ADH's existing "Rules and Regulations Pertaining to Public Water Systems" contain minimum criteria on the location, construction, and protection of public water supply wells.

A major component of the wellhead program will be the delineation of a wellhead protection area for each public water supply wellhead or well field in the State. The wellhead protection area will be subdivided into two zones:

First Zone - The existing state "Rules and Regulations Pertaining to Public Water Systems" require that a horizontal distance (measured radially from the wellhead) of not less than 100 feet be maintained between any public water supply well and any possible source of contamination. This is a minimum distance which can be increased where local conditions dictate. Since this protected zone is required by state regulation, activities within this zone will continue to be regulated by the ADH.

Second Zone - A secondary wellhead zone will be delineated around each wellhead, supplemental to the first zone. The arbitrary fixed radius method of delineation will be used to set the boundary of the second zone at a radial distance of 1/4 mile around each wellhead. Refer to Section III, Delineation of Wellhead Protection Areas for further explanation.

The ADH will assist local governments in the development of a management plan for potential contaminant sources within the secondary zone. The management plan may include land management controls enacted at the local level, as well as, other local options for reducing the threat of groundwater contamination within the delineated WHP area. In addition, new and/or existing activities with pollution potential within this WHP area will be noted by the ADH and/or the local government and passed on to other involved State agencies for their consideration in permitting or other regulatory actions.

(The reader should note that this will be an evolving program. Delineation methodology and other program components will continue to be refined as staff gain training and experience in administering the program.

Initially, general wellhead delineation areas will be designated by the 1/4 mile radius. As the program obtains funding and employs full time staff and equipment to implement program activities, it is anticipated that delineation methodolgy will evolve into a rational, analytical method which will take hydrogeologic factors, times of travel, and other local factors more closely into account.)

II. DUTIES

The Governor of the State of Arkansas has designated the Arkansas Department of Health (ADH) to be the lead Agency in implementing the new amendments to the Safe Drinking Water Act, including the State's Wellhead Protection Program. In particular, the Governor advised the EPA Administrator to work with the Department's Division of Engineering. See Appendix A for a copy of the letter from Governor Bill Clinton dated July 31, 1986 to Lee M. Thomas, then Administrator of the USEPA.

The responsibility for accomplishing activities under the AWHPP, and/or coordinating their accomplishment, lies with the ADH and the local PWS authority. Activities under the AWHPP will include among other items: review and retrieval of data (state and local), incorporate data into a GIS system (state), delineate minimum wellhead areas (state), assist in contaminant source inventory (state and local), coordinate and assist in field verifications of contaminant sources (state and local), assist in development of local contaminant control measures/strategies (state and local), insure compliance with ADH regulations on source protection (state), provide source protection information to other agencies (state and local) for regulatory action as appropriate (typically, other agencies give protection of public water supplies a high priority), and provide oversight and advice to local wellhead programs (state).

The "coordination mechanisms" to be used with other agencies will consist of informal working agreements/arrangements between the ADH and the other agencies. Agencies will be contacted as their regulatory authority and technical expertise are needed in specific instances or in developing general policies and program guidance (e.g.; underground storage tanks, hazardous waste disposal facilities, animal waste management). This arrangement has worked effectively in the past and should continue to be so. If circumstance dictates that an MOU or other formalized agreement is needed at some point in time to accommodate an agency or particular situation, then such will be developed on an as needed basis.

The state agency with the most program activities which could impact upon groundwater protection is the Department of Pollution Control and Ecology. DPC&E activities which could have an impact upon the AWHPP will be monitored by the ADH and the results of such activities will be incorporated into or used to supplement wellhead activities as appropriate. This monitoring will be through both formal and informal arrangements (e.g.; ADH review and comment on DPC&E permit applications, involvement with any groundwater steering committees, inter-staff communications). Special attention will be given to DPC&E activities in the Ground Water and UIC programs.

PWS wells located on federally owned and/or managed lands will be treated the same as other PWS wells in complying with federal law. The ADH has primacy from EPA to administer the PWSSP under the terms of the SDWA, and facilities on federal lands are subject to federal regulations. Granted there may be some requirements specific to state regulation which may not be enforceable on federal lands. To date however, we have experienced little difficulty in obtaining cooperation on federal lands where public drinking water systems are involved.

The authorities of various state and local government entities to control contamination of groundwater are presented in Table 1. These authorities and duties are aimed toward groundwater protection in general, which serves to provide protection in wellhead areas.

TABLE 1: SUMMARY OF GOVERNMENTAL AUTHORITY

Subdivision of Government	Authorizing Statute	Regulation/Code	Affected Facility
Arkansas Department of Health	Act 96 of 1913, as Amended	Rules and Regulations Pertaining to Public Water Systems	Public water systems
		Rules and Regulations Pertaining to Semi-Public Water Supplies	Semi-public water systems
		Rules and Regulations Pertaining to General Sanitation	Pollution of ground and surface waters. Domestic wastewater collection, treatment, and disposal
	Act 402 of 1977, as Amended - Arkansas Sewage Disposal System	Rules and Regulations Pertaining to Sewage Disposal Systems, Designated Representatives and Installers	Septic tank systems and alternate disposal systems for individual residences
Arkansas Department of Pollution Control & Ecology	Act 472 of 1949, as Amended - Arkansas Water and Air Pollution Control Act	Regulation No. 1 - Regulation for the Prevention of Pollution by Salt Water and Other Oil Field Wastes Produced by Wells in New Fields or Pools.	Oil and gas well operations
		Regulation No. 2 - as Amended Regulation Establishing Water Quality Standards for Surface Waters of the State of Arkansas	Municipal and industrial wastewater treatment and disposal facilities
		Regulation No. 4 - Regulation to Require a Disposal Permit for Real Estate Subdivisions in Proximity to Lakes and Streams in Arkansas	Subdivisions/Developments with septic tanks

TABLE 1 (CONTINUED)

Subdivision of Government	Authorizing Statute	Regulation/Code	Affected Facility
Arkansas Dept. of Pollution Control & Ecology (Cont'd)	Act 472 of 1949, as Amended - Arkansas Water and Air Pollution Control Act	Regulation No. 3 - Underground Injection Control Code	Underground injection operations
			In general, all operations discharging pollutants or potential pollutants into waters of the State
	Act 237 of 1971 - Arkansas Solid Waste Management Act	Arkansas Solid Waste Management Code	Landfills or other solid waste disposal facilities
	Act 406 of 1979 - Arkansas Hazardous Waste Management Act	Arkansas Hazardous Waste Management Code	Hazardous waste treatment, storage and disposal facilities
	Acts 172 & 173 of 1989 - Underground Storage Tank Tanks	Regulations No. 12 - Storage Tank Regulations	UST's
	Act 452 of 1985 - Arkansas Emergency Response Fund Act		Emergency situations involving a threat to the environment and/or populous
	Act 479 of 1985 - Arkansas Remedial Action Trust Fund		
	Act 336 of 1977, as Amended by Act 824 - Arkansas Open Cut Land Reclamation Act		Open cut mining operations
	Act 134 of 1979, as Amended by Act 647 of 1979 - Arkansas Surface Coal Mining and Reclamation Act		

TABLE 1 (CONTINUED)

Subdivision of Government	Authorizing Statute	Regulation/Code	Affected Facility
Arkansas Oil and Gas Commission	Arkansas Codes Annotated, Title 53	General Rules and Regulations Underground Injection Control Program	Oil and gas wells, salt water injection wells (Class II)
Arkansas Water Well Construction Commission	Act 641 of 1969 as Amended	Arkansas Water Well Construction Code Rules and Regulations	Water well construction and abandonment. Licensing of well drillers
Arkansas Soil and Water Conservation Commission	Act 217 of 1969 Act 1051 of 1985 Act 408 of 1989 Act 469 of 1989		General supervision of waters of the State through development of and compliance with a State Water Plan
Arkansas State Plant Board	Act 389 of 1975, as Amended - Arkansas Pesticide Use and Application Act Act 410 of 1975 - Arkansas Pesticide Control Act Act 488 of 1975 - Arkansas Pest Control Law	Arkansas Regulations on 2, 4-D, 2,4,5-T and Other Hormone-Type Herbicides Rules and Regulations of the State Plant Board	Pesticide applicators Pesticide useage and sales

TABLE 1 (CONTINUED)

Subdivision of Government	Authorizing Statute	Regulation/Code	Affected Facility
Arkansas Public Service Commission	Act 285 of 1971 - Arkansas Natural Gas Pipeline Safety Act	Arkansas Gas Pipeline Code	Pipeline facilities to transport natural gas
State Fire Marshal, Criminal Investigation Division, Arkansas State Police		Standard Fire Prevention Code of 1982	UST's
Office of Emergency Services	Arkansas Emergency Services Act 511 of 1973, as Amended		Coordinate state resources during disaster situations
Municipalities	Arkansas Codes Annotated 14-54-702		Established power for 5 mile planning area beyond corporate limits
	A.C.A. 14-56-402		Zoning powers
	A.C.A. 18-15-301/18-15-303		Powers of eminent domain
	A.C.A. 14-56-501/14-56-509		Regional planning/zoning (city and county)

III. DELINEATION OF WELLHEAD PROTECTION AREAS

The preferred mechanism for wellhead protection area determinations is to use a delineation methodology which would incorporate site specific information, including such items as hydrologic and geologic information, well pumping rates, and well construction data. The problem encountered in trying to (1) evaluate delineation methodologies and (2) perform extensive investigations into the location and content of all available data sources lies with a lack of program staff to do such. The location of data sources is generally known, but the resources to explore each of them at the outset of this program and use them as a basis to determine an appropriate, compatible delineation method are not currently available.

The ADH's current regulations address wellhead protection through a fixed radius method. The Arkansas "Rules and Regulations Pertaining to Public Water Systems" require that a horizontal distance (measured radially) of not less than 100 feet be maintained between any public water supply well and any possible source of contamination. This distance is to be used where conditions indicate it to be safe and greater distances may be required where local conditions necessitate. There is no doubt that a more sophisticated methodology or combination of methodologies is preferred. However, until such time as adequate staffing can be retained to explore these options, the fixed radius method will continue to be used in the wellhead protection program.

Therefore, to maintain consistency within the existing State PWSS program and to best utilize existing staff, the delineation method of choice is use of an arbitrary, fixed radius. A distance of 1/4 mile was selected as the delineation boundary. Refer to Appendix B for the rationale behind this boundary distance.

In actual practice the delineated wellhead protection area will contain two concentric zones:

a) The first zone is the 100 foot horizontal distance from the wellhead required by state regulation. By regulation there are to be no sources of contamination located within this zone.

b) The second zone is the remainder of the delineated wellhead protection area extending a radial distance of 1/4 mile around all public water system wellheads. The presence or mediation of potential contaminants within this zone will be regulated by local governmental authorities with assistance as needed from state agencies when state regulations are involved.

With the method of delineation selected, the next critical item to be addressed is an accurate location of wellheads. The ADH has for the past several years been updating its records to include the latitude and longitude of each community public water supply well or well field. Within the next two years, the data inventory system will be modified to include the location of each wellhead and discontinue general location by well field.

This information is routinely collected during the sanitary survey of each water system. Sanitary surveys are required at least every three years on each groundwater supplied community PWS. The location of the well or well field is also plotted on a U.S.G.S. quadrangle map or county map. Under the AWHPP the delineated wellhead area will also be shown on these location maps. In addition to well name and location, other information collected during the survey includes date drilled, total depth, casing size and depth, depth of grout seal, well yield, and protection radius provided. While the majority of this information is retained on file in hard copy, the source locations are maintained in a computerized inventory system.

The current database includes approximately 700 community public water systems, 75 nontransient noncommunity public water systems, and 900 noncommunity public water systems. Of the community systems, about 400 have groundwater sources and serve a total of about 525 community systems. Most of the noncommunity systems are supplied from a groundwater source. This database will continue to be updated as water systems are surveyed and new sources and/or systems are constructed.

It is recognized by the ADH that the groundwater protection afforded by use of the fixed radius method of delineation alone is limited (e.g.; Karst areas, confined aquifers). Area delineations based upon site specific information would be more desireable and realistic for individual wellheads. Should adequate resources become available from the State or EPA, refinements in delineation methodology and more detailed analyses of delineation areas on an individual basis could be performed. Added resources would include the addition of technical staff who could prioritize the wellheads and provide the technical assistance and organizational guidance needed by the appropriate local authority to implement wellhead protection programs. Ultimately all wellhead areas could be delineated using methodologies incorporating hydrogeological information, time of travel criteria, and other information to replace, or be used in conjunction with, the fixed radius method of delineation.

It is envisioned that individualized wellhead protection area delineations will be undertaken on a voluntary basis based upon requests submitted by public water systems. In the event that the influx of delineation requests received is great enough to create competition for available staff time, requests will be prioritized based upon vulnerable geological formations and population served over date received. Vulnerability assessment criteria will be determined by ADH Division of Engineering (DOE) personnel using best judgement and any guidance provided by the EPA under new requirements of the SDWA Amendments of 1986. After the area has been delineated and mapped, a contaminant source inventory can be made within the area and the local government can adopt appropriate protection strategy and authority.

The delineated wellhead protection areas will be mapped on the ADH's GIS system which uses USGS maps as a base. The GIS system is capable of mapping on a scale from statewide to a city block. Ultimately the GIS system overlays will contain all relevant and mappable information which can be gathered pertinent to groundwater protection including (but not limited to) wellhead locations, delineated protection areas, various potential sources of contaminants, and water service areas. This data will be obtained from Department of Health files, as well as files at other state and federal agencies such as the Department of Pollution Control and Ecology, Arkansas Geological Commission, and U.S. Geological Survey.

The GIS system can produce printouts of delineated wellhead protection areas which will be maintained on file and used for planning purposes as needed. The printouts will indicate the limits of the delineated area (e.g.; 1/4 mile radius) and will show selected information within the area specific to the intended use of the map.

The ADH anticipates approval of some financial assistance under the Clean Water Act, Section 106 funds to employee two water resource engineers/hydrologists. These personnel will be assigned to work on the AWHPP with one of their initial tasks being to design a vulnerability/risk related ranking system for PWS wells. Characteristic regions will be identified based upon PWS source aquifers and distinctive geographic features. The regions will then be prioritized based upon health risk and population served factors and will enable the ADH to focus its wellhead protection activities.

Following grant approval for the Section 106 funding, and assuming the funding is continued, the ADH plans to (1) have the regionalized ranking system completed 12 months after new staff members are on board, (2) have at least one site specific wellhead protection area delineated within each identified region the following year, and (3) have a site specific wellhead protection area delineated for 30% of the PWS wells within 5 years.

IV. SOURCE IDENTIFICATION

Source identification will be accomplished through both data record reviews and field inspections.

All available records containing information on potential anthropogenic sources of contaminants will be reviewed to identify the location of such contaminant sources. Available records will include ADH data files, DPC&E data files (state and federal permits), SARA data base, Arkansas Geological Commission data files, USGS data files, Water Well Construction Commission, Soil and Water Conservation Commission, and those of other federal, state, and local agencies. The ADH also has direct access to STORET and other federal data bases which can be examined for relevant data.

Following the review of various data sources, field inspections will be made to locate and/or confirm the location of potential contaminant sources in wellhead protection areas. Inspections will be made through locally organized group efforts. The ADH will strive to coordinate and guide local effort such that it may be used as efficiently as possible. The type and degree of local effort which may be available to aid in the source inventory process will vary greatly due to type of PWS (i.e.; community, rural association, water improvement district, private ownership). These efforts will include such means as windshield surveys, site visits, door-to-door inquiries, available land use data, county records, aerial photos, area master plans and similar activities at the local level.

ADH activity involving source inventory around PWS wellheads will include all potential contaminant sources in the delineated wellhead area. Actual inventory within this area will be phased in depending upon the degree of threat, population served, local government involvement, PWS classification, and staff availability. A crucial part of the inventory will be to establish with PWS and local government officials a commitment to wellhead protection and a means of providing routine updating of the inventory.

Refer to Section V, Management Approaches for more explanation of technical assistance to be provided to local government.

Until such time as a site specific delineation area is developed for a wellhead, the DOE's sanitary survey of the PWS will routinely include only the mandated 100-foot protection zone around the wellhead. Inspections for potential contaminants outside this zone will be limited to specific complaints and/or knowledge of possible contaminant sources received from the public, the PWS operator, or other informants. The PWS manager/operator will be advised to provide a vigilant lookout for potential sources of contamination to system groundwater source(s) within the 1/4 mile radius. Once local interest has grown to a point of active participation in the AWHPP, then the sanitary survey will be expanded to include the full extent of the delineated WHP area. At such time, oversight of and protection measures in the WHP area will be reviewed routinely with PWS officials.

Drinking water source vulnerability assessments mandated under the SDWA regulations for VOC's, SOC's, surface water treatment rule, and other promulgated regulations will extend well beyond the 100-foot zone and may extend beyond the 1/4 mile radius. Information gathered during these assessments will be used to supplement contaminant source inventories and will be made a part of the GIS data base.

Table 2 contains a list of categories of potential contamination sources relative to wellheads. The source for this table was a review of suggested sources contained in Exhibit 2, "Wellhead Protection Programs: Tools For Local Governments" with a mind to various activities ongoing in the State. The ADH believes Table 2 to be as comprehensive a listing as can be determined at this time. The list will be used as the base inventory for all data record reviews and field inspections for potential contaminants. The list will be updated as new source types are identified.

The ADH and the DPC&E have informally implemented an approach to the interdepartmental review of permit applications (e.g.; NPDES, animal waste disposal, landfills, etc.) processed through the DPC&E. As permit applications are received and/or as permit conditions on particular facilities are established/revised copies are transmitted to the ADH for review. There is also direct communication between the two staffs to head off any possible problems before they surface. DPC&E staff normally assign a high priority to protecting a PWS source.

This system allows for a quick look at each permit application and an evaluation of any potential impact upon public water supply sources, including the relation to any WHP areas. Pertinent comments are then transmitted to the DPC&E for incorporation into its review. Unless notified otherwise by the DPC&E, it is assumed that the permit was issued and the facility location will be entered into the ADH's GIS system. This system has worked well and no change in the working relationship is anticipated.

A database for existing and proposed pollution sources is available at the DPC&E. This database would include the location and other pertinent information on such facilities as: underground injection sites, UST'S, landfills, hazardous waste sites, NPDES and State permits, mining operations, and others.

All information on potential source contaminants collected from ADH files, the ADPC&E, other state and federal agencies, and field inspections will be incorporated into the ADH's GIS data base system where the information can be updated on a routine basis. This will be an ongoing project and will not be dependent upon a local governmental authority requesting to participate in the AWHPP.

TABLE 2: POTENTIAL CONTAMINATION SOURCE LIST

NO.	DESCRIPTION
1.	Gas stations, service stations, truck terminals underground storage tanks containing toxic substances (abandoned and existing sites)
2.	Fuel/oil distributors and stores
3.	Oil pipelines
4.	Auto repair shop, body shop, rust proofers, radiator shop
5.	Auto chemical supplies storage and retailer; pesticide, herbicide storage & retailers
6.	Small engine repair shops
7.	Dry cleaners, furniture strippers, painter/finisher, photo processors, appliance repairers, printers
8.	Auto washes
9.	Laundromats, beauty salons, medical/dental/vet offices
10.	Research laboratories
11.	Food processors, meat packers, slaughter houses
12.	Concrete/asphalt/tar/coal companies (abandoned and existing sites)
13.	Salt piles/sand-salt piles
14.	Railroad yards, storm water impoundment sites, urban runoff, graveyards
15.	Airport maintenance fueling operations areas
16.	Industrial manufacturers: refineries, chemicals, pesticides/herbicides, paper, leather products, textiles, rubber, plastic/fiber-glass, silicone/glass, pharmaceutical, electrical equipment, etc.
17.	Machine shops, metal platers, heat treaters, smelters, annealers, decalers
18.	Wood preservers/treatment
19.	Chemical reclamation facilities
20.	Boat builders/refinishers
21.	Industrial waste disposal, storage, impoundment areas; municipal waste water treatment plants; landfills, dumps, transfer stations, illegal dumping sites
22.	Junk and salvage yards
23.	Subdivisions using private wastewater disposal (individual or cluster)
24.	Single-family & industrial septic systems
25.	Above ground fuel-oil storage tanks (abandoned and existing sites)
26.	Golf courses, parks, nurseries
27.	Sand & gravel, coal, bauxite, and other mining operations
28.	Manure piles
29.	Feed lots
30.	Land application areas (wastewater, wastewater by-products, animal wastes)
31.	Agricultural pesticide, herbicide storage
32.	Agricultural pesticide, herbicide, fertilizer use
33.	Accidental spills of toxic substances
34.	Petroleum pipelines, storm water and sewer lines
35.	Oil and gas production wells
36.	Injection Wells
37.	Exploration and monitoring wells
38.	Water supply wells (private, public, stock, irrigation and industrial)
39.	Ground water contamination plumes
40.	Salt water intrusion and upconing
41.	Abandoned wells (all types)
42.	Others, list as needed

V. MANAGEMENT APPROACHES

Management of activities within wellhead protection areas will be on two levels: State and Local. Regulation of potential contaminants within WHP areas will lie primarily with local governmental authorities with assistance from state agencies.

The ADH has the authority to carry out the AWHPP under its Rules and Regulations Pertaining to Public Water Systems which were promulgated under authority of Act 96 of 1913 as amended, the enabling legislation for the ADH. Under this regulation the ADH regulates all PWS's and has the authority to issue orders to PWS's to take corrective actions to protect the public health.

The State of Arkansas currently relies upon several state agencies and specific programs within these agencies to protect and maintain groundwater quality. These include programs established within the Department of Health and the Department of Pollution Control and Ecology. The activities of these two agencies constitute the majority of regulatory authority associated with groundwater protection. Further components of groundwater protection are associated with other state agencies (see Table 1). There exists a constant cycle of cooperative interaction amongst the various state agencies and between state and federal agencies.

When wellhead areas are delineated, the primary responsibility for managing activities within the areas will be focused at the local level with oversight by the ADH. Local governments and water utilities have a responsibility to safeguard their water source. Under state law, counties and municipalities have broad authorities which can be utilized in groundwater protection. These authorities include the power to go beyond territorial limits "to prevent or punish any pollution or injury to the stream or source of water, or to waterworks," to an extent of five (5) miles beyond corporate limits". Methods available for local protection of groundwater include such items as zoning ordinances, subdivision ordinances, site plan reviews, design and operating standards, and general use prohibitions. This local authority is generally used to supplement and/or expand upon the regulatory powers of the various state agencies.

Through the AWHPP we can expect a growth in the depth and quality of cooperation among state and local agencies. State level management of groundwater protection activities will be provided through the existing regulatory framework and informal interdepartmental working relationships. Formal working agreements can be negotiated as the need arises.

There is currently a Governor's Water Quality Monitoring Task Force composed of representatives of all state agencies that are involved in groundwater monitoring, quality, or regulation. The purpose of the work group is to assess monitoring practices used by the various agencies, and then determine if practices need to be changed in order to accurately assess groundwater quality throughout the state. An example of the type of tasks to be undertaken by the group is to review pesticide/herbicide usage and analytical procedures to determine the appropriate laboratory testing that should be performed on groundwater samples in each area of the state in order to assure that contamination would be detected.

Department of Health: All public water systems are regulated under the "Rules and Regulations Pertaining to Public Water Systems". Under these regulations a minimum protection zone (a horizontal distance of 100 feet) is prescribed around each public water supply wellhead, as well as acceptable well design and construction features. The minimum protection zone limit may be increased where local conditions necessitate. New well sites must be approved by the ADH. Sanitary surveys are routinely scheduled for each water system, which includes an inspection of each wellhead and the protective zone prescribed under state regulations.

A variety of other activities are performed under these regulations including water quality monitoring in accordance with Safe Drinking Water Act requirements, review of plans for drinking water and wastewater facilities, review of and comment on permitting of facilities by other state agencies as regards public health and drinking water (e.g.; DPC&E, Oil & Gas Commission), review of proposed cemetery locations, and review of other facilities/situations which could impact drinking water aquifers. In addition to SDWA monitoring requirements, other potential contaminants posing a risk to public health found in a delineated WHP area will be monitored to determine the extent and degree of risk. Such monitoring would typically be at the PWS wellhead and in the water distribution system. However, depending upon the degree and type of contaminant incident, the monitoring could be expanded to other local area wells (e.g.; monitoring wells, irrigation wells) to determine the extent of the problem.

The working policy of the ADH is and has been to promote the use of the best quality of raw water available as a source of drinking water and the continued protection of these sources. In keeping with this policy, one of the key items considered during the review of any proposals submitted to the DOE office is the potential effect upon drinking water sources. This review process will take into account all delineated WHP areas. Any identified problems are brought to the attention of the applicant for resolution. Appropriate state agencies and local authorities are also notified to facilitate a coordinated project review.

The ADH holds responsibility in regards to the design, installation, location, and operation of individual septic tank systems. These requirements are contained in the ADH's "Rules and Regulations Pertaining to Sewage Disposal Systems, Designated Representatives and Installers". The use of public sewer systems is stressed as the preferred sewage disposal system of choice and the use of septic tanks in developing areas must be justified. The regulations on septic tank installations include among other items: minimum lot sizes, soil suitability analyses, minimum setback distances, and design criteria on the various system components. These regulations also include requirements for registration of system designers and installers. Since the suitability of septic tank systems is so site specific, local governments will be encouraged to investigate the practicality and appropriateness of adopting more stringent provisions in WHP areas.

The ADH is in the process of establishing a GIS database system dealing with the activities of the various programs within the ADH. This data will include information which has been collected on the state's public water supplies. Once the system is fully on line the data will be readily retrievable for use in the wellhead program. All appropriate information collected during wellhead delineation and management activities will be incorporated into this system. This will be an ongoing process with continuous updating.

Additional management activities associated with local wellhead protection programs will be resource dependent and will emphasize technical assistance to local authorities. A strong local commitment will be needed to implement and nurture such programs. Technical assistance will be available to local water authorities and governments who express an interest in establishing a wellhead protection program. The extent of assistance will depend upon ADH staff availability and will be tailored to the particular situation to insure best utilization of state and local resources.

In general, technical assistance by the ADH under the WHP will include the following:

1) Inform PWS officials of the existence of a state WHPP and the benefits of participation in the program.

2) Educate PWS officials on the responsibilities and commitment required at the local level to insure WHPP implementation.

3) Obtain a commitment from the PWS authority that it wishes to pursue a WHPP.

4) Delineate a wellhead protection area after compiling, reviewing, and evaluating available data bases.

5) Assist in compiling a contaminant source inventory within the delineated area. ADH will review its files for potential contaminant locations and interface with the DPC&E and other agencies to obtain locations of other potential contaminant sources. These source locations can then be plotted on a GIS data base system for later field verifications.

6) Assist the local authority in identifying the means (e.g.; retired persons, local civic and church groups, other volunteer groups) by which to perform field verifications of identified contaminant sources and locate additional sources. Provide guidance and coordination in the performance of the verifications and the compilation of the final data on a GIS system.

7) Educate local authority as to the various state and federal regulations/programs which can be used to control/prohibit contaminant sources in the delineated areas. Provide guidance to local authority on creating local land use controls and other jurisdictional powers to supplement and/or replace existing non-local regulatory powers. Advise local authority on other management options not involving land use controls.

8) Provide each participating local authority a map showing the WHP area boundary and a summary report on the local WHP plan.

9) Provide oversight to the local WHPP and, when found necessary, reeducate persons or redirect specific program activities. Insure that inventory updating is a continuous activity.

10) Monitor PWS wells for compliance with SDWA standards and for other contaminants of concern in the WHP area such as those found during the potential contaminant source inventory.

The ADH will continue to implement program activities of the PWSSP under the SDWA. There will be areas of mutual concern between the AWHPP and PWSSP activities such as water quality monitoring and vulnerability assessments for various regulated contaminants.

<u>Department of Pollution Control and Ecology:</u> There are a variety of facilities regulated by the DPC&E which have the potential to contaminate groundwater. This range of facilities includes the likes of: municipal and industrial wastewater discharges, solid

waste landfills, underground storage tanks, hazardous waste storage and disposal sites, surface aspects of underground injection wells, mining operations, and other facilities having the potential to discharge pollutants. The DPC&E has regulatory control over the review of project proposals, permitting, inspections, and monitoring of these facilities. It is anticipated that the agency's current procedural and management framework will continue to be implemented. The current working arrangements between the DPC&E and the ADH will continue with the addition of consideration for delineated wellhead protection areas.

Oil & Gas Commission: The O&GC regulates the permitting of oil, natural gas, and Class II injection wells. Groundwater protection activities are currently coordinated through two means. A summary of the oil and gas well drilling permits is mailed to the ADH each week for review and comment with comments being sent directly to the owner and a copy going to the O&GC. Also, the ADH is kept informed on the status of proposed injection wells through the permit review process established with the DPC&E with comments being sent to DPC&E and copies to the facility owner and O&GC. The O&GC will be notified when a facility is permitted in a delineated wellhead protection area.

Other State Programs: There are other state agencies having legislation which can affect groundwater quality, as listed in Table 1. The potential effects are minor in comparison to the previously listed agencies, but do play an important part in the overall protection of groundwater.

Local Government: The Arkansas Legislature has granted authority to municipal and county governments in the areas of land use planning and regulation. More specific authority is granted in the area of preventing pollution to the source of water. Municipalities can exercise land planning up to five miles beyond their corporate boundaries. This planning is only a guide however, requiring the adoption of actual zoning ordinances and regulations. Additionally, municipalities and counties can join forces and create municipal and regional planning commissions to jointly cooperate in the planning powers provided by state law. Although these planning powers are available, most local governments have not taken full advantage of them. Reasons for this range from political undertones to lack of local resources. Local governments will have to overcome any reluctance towards exercising area planning powers in order to achieve the most effective WHP program.

VI. CONTINGENCY PLAN

Contingency planning for public water systems in Arkansas is accomplished on multiple levels. There is an overall state emergency plan, the various state agencies have emergency response plans, and the local authorities (county, city, and public utility) should each have their own emergency management plan.

Under the Arkansas Emergency Services Act 511 of 1973 as amended, the State of Arkansas has a responsibility to develop and maintain a capability to coordinate use of all available resources during periods of disaster or national emergency; to provide the general framework under which statewide emergency operations will be conducted; to provide for statewide coordination of disaster operations by state government; to outline and assign emergency functions of state departments, agencies and activities; and assign responsibility for the development of plans for carrying out such responsibilities. The state Office of Emergency Services has been delegated responsibility to act for the Governor as coordinator of various state agencies and resources in disaster situations. All local governments and state agencies are to relay all information concerning disasters to the OES. The state plan exists in narrative form addressing the role and resources of each state agency in natural and man-made disasters.

The Department of Health is delegated the responsibility under the state plan for coordinating supply of safe drinking water following a disaster and to assist in determination of damage to public water systems. Upon notice of a water shortage or possible contamination incident in a water system, ADH staff is notified and an assessment of the situation is initiated. The assessment would include direct contact with staff of the affected water system by phone, radio, and/or site visit. The extent of the problem would be determined and a course of action decided upon.

Should an alternate/supplemental source of drinking water be required all reasonable options will be explored to determine the most appropriate and timely option or combination of options to safeguard the public health and welfare. Short term options could include: connection to a neighboring water system; hauling water from a neighboring water system via National Guard tank trucks, milk transport trucks,etc.; importing of bottled water. Long term options could include: providing additional treatment or distribution equipment; developing new wells; permanent connections to other water systems.

In all instances of water outage, low system pressures, or suspected contamination incidents the water quality in the distribution system and/or source would be monitored to insure its safety before unconditioned public use is reauthorized. Intermediate measures could also include the issuing of Boil Water Orders or Do Not Use Orders.

Financing for the short term options could come from such sources as the Governor's Emergency Relief Fund, emergency loans and grants from various state and federal agencies, local funds, voluntary contributions of services, and other good neighbor acts. Long term option financing would probably have to be obtained from more traditional loan and grant resources. The ADH is available to support the water system in its solicitation of the various funding agencies.

The need for emergency planning on the local level is constantly emphasized by ADH staff during sanitary surveys, at district AWWPCA meetings, in our quarterly newsletter, and other meetings/discussions with PWS personnel. The ADH encourages the development of local emergency plans and ADH staff are available to provide assistance in the development of these plans.

If a PWS has no emergency plan of operation in place at the time ADH staff begin WHPP delineation and protection assistance, the issue of contingency plan development will be addressed and will become a part of the overall efforts to set up a local wellhead program. In general, an emergency plan should incorporate such items as the following:

1. An assessment of water system characteristics.
    a. Detailed system layout maps showing the locations of all components (e.g.; source, treatment, distribution piping, valves, storage tanks, etc.)
    b. Component sizes and capacities.
    c. System use demands.

2. Identification of potential emergency situations (e.g.; contamination, power outage, flood, earthquake, water shortage, loss of pressure) and response procedures for each situation.
    a. Establish guidance for performing an initial incident assessment to determine the severity of an emergency situation and the appropriate response.
    b. Establish step by step procedures to be followed in response to a particular event and a complete list of names and phone numbers for all federal, state, and local officials to be contacted.
    c. Evaluate the level of service to be sustained during a particular situation and prioritize uses.
    d. Identify means to notify system users of the extent of the emergency, actions being initiated, and precautions to be taken (e.g.; public announcements).
    c. Identify equipment and manpower needs for particular

situations. Assess in-house capabilities to respond and identify additional sources of assistance which may be needed.

d. Identify alternate sources of water supply for both short term and long term duration.

3. Identify all federal, state, and local funding sources available for response activities.

4. Establish procedures for an ongoing assessment of the situation and documentation of all actions taken in regard to the incident.

5. Provide for periodic review and updating of all emergency planning.

VII. NEW WELLS

Under ADH regulations, the location of each proposed public water supply well must be approved in writing prior to commencing construction. An evaluation of the proposed well site is made with an emphasis on identifying all potential sources of contamination. The 1/4 mile delineated wellhead area will be surveyed during this source inventory. Information contained in the ADH's GIS system will be used in this evaluation process.

A minimum protective zone containing no possible source of contamination must be provided around each wellhead for a horizontal distance of 100 feet by State regulation. This distance is a minimum and can be increased where local conditions necessitate. Should the ADH increase the size of this minimum protective area, it will be incorporated into the WHP area in the same fashion as the minimum distance. The 1/4 mile radius will, however, continue to be the delineated area for each public water supply wellhead.

Detailed engineering plans and specifications on proposed well construction must be submitted to the ADH for review and approval. No well construction is to commence before this approval is obtained. Any applicant for a new PWS well will also be informed about the WHP program and encouraged to participate to the extent possible for the applicant.

Both existing and proposed public water supply wells will be dealt with on an equal basis under the AWHPP.

VIII. PUBLIC PARTICIPATION

The SDWA 1986 Amendments require each State to include in its public participation procedures a notice and opportunity of public hearing on the State wellhead protection program before it is submitted to the Administrator. A notice of public hearing was published in the two newspapers having statewide circulation. This notice ran for seven consecutive days beginning 30 days prior to the date of the hearing. See Appendix C for a copy of the notice. Also, the date, time, and place of the public hearing was printed in a related article in the ADH's May 1989 newsletter. The public hearing was held on the advertised date. No comments were received.

The ADH's policies and procedures require a public hearing be held on each proposed new rule/regulation or rule/regulation revision. All oral and written comments are made a part of the Agency's file.

With the exception of no discharge permits issued solely under state authority, new and revised permits issued by the DPC&E are subject to a 30 day comment period with the opportunity for a public hearing. New and revised regulations are subject to public comment as well.

ADH staff routinely attend monthly meetings of the Arkansas Waterworks and Pollution Control Association district meetings. These meetings provide a good forum for both formal and informal information exchange and education on groundwater protection. Staff frequently participate directly in presentations and make topic recommendations for these meetings. Upon request, staff members also make presentations to local organizations and civic groups on groundwater quality and the value of protecting our groundwater resources from potential pollutants.

The quarterly newsletter, composed and distributed by the ADH staff, provides another vehicle for disseminating changes in regulatory strategy and new programs. The newsletter mailing list is composed of over 1,200 recipients. It is distributed to a wide cross-section of parties interested in the waterworks industry. Newsletter recipients include public water systems, consultants, other state and federal agencies, and other interested groups or individuals. The newsletter has already been used to disseminate information on the WHP program and will continue to be used as a primary means of publicizing the program in the future. To date the newsletter has proven itself a very effective means of mass communication within the waterworks industry.

The ADH has been and will remain receptive to input from other government agencies. Information on regulatory authority and program activities were solicited from other agencies during initial development of the AWHPP. Other agencies were provided a copy of the AWHPP document for comment in June 1989. Only three comments were received: (a) a matter of clarification on one agency's public hearing proceedures, (b) a question on monitoring wells, and (c) an offer to make data files available.

The ADH believes that more aggressive promotional activity for the AWHPP should be reserved until such time as it is a funded and staffed program capable of responding to public needs. Initially, publicity on the wellhead protection program will rely heavily on such means as ADH newsletter articles and staff interaction at monthly AWWPCA meetings. Once the AWHPP is approved by EPA, a general News Release will be made. Appropriate followup actions will then be initiated dependent upon the degree of response received and availability of staff. Aggressive promotional activity within the AWHPP as it interacts with the general public, local governments, and the press will inherently be dependent upon the additional staffing and resources made available to the DOE.

INSERT APPENDICES

APPENDIX A

GOVERNOR'S LETTER

STATE OF ARKANSAS
OFFICE OF THE GOVERNOR
State Capitol
Little Rock 72201

Bill Clinton
Governor

July 31, 1986

Lee M. Thomas, Administrator
United States Environmental
  Protection Agency
401 M. Street S.W.
Washington, D.C. 20460

Dear Mr. Thomas:

I have reviewed your recent letter with the appropriate Agency directors. The majority of the new amendments to the Safe Drinking Water Act deal primarily with public water supplies. Therefore, I am designating the Department of Health to be the lead Agency in implementing the new provisions to the Act. I believe that the Department's existing regulations are sufficient to conduct the wellhead protection program.

In particular, the Division of Engineering in the Department is responsible for the public water supply program in our State. I request that you contact Bruno Kirsch, Jr., P.E., Division Director to work with your Agency on the new provisions.

I am committed to maintaining the high quality of drinking water in Arkansas; however, it is essential that we receive sufficient funding to ensure the successful implementation of these amendments.

Sincerely,

Bill Clinton

Bill Clinton

BC:vm

APPENDIX B

WHPA DELINEATION BOUNDARY RATIONALE

WHPA DELINEATION BOUNDARY RATIONALE

Based on an analysis of hydrogeologic information for the aquifers of the State, a radius of 1/4 mile around each public water supply well was selected as the generic delineation boundary for the Arkansas Wellhead Protection Plan. This same methodology will be used for the delineation of assessment areas for wells in the SWAP. The rationale for the choice of the 1/4 mile radius is presented in the following paragraphs.

It is a goal of the ADH, in implementing a WHP program, to establish a zone around each well which will generally provide a comfortable degree of protection/warning if contaminant controls and monitoring are implemented within the boundary area. In a groundwater contamination incident sufficient time will be needed to determine the extent of the problem, determine the appropriate actions needed (e.g.; secure new source, install treatment equipment, etc.), secure funding, design and construct the needed facilities. A boundary, which establishes a 5-year time of travel (TOT), is considered the minimum acceptable time frame satisfactory for that purpose.

In determining that the 1/4-mile radius generally provides at least a 5-year TOT around each well the distribution of PWS wells across the various hydrogeologic environments in the state were considered. WHPAs were calculated for selected PWS wells using site specific methods of delineation.

Arkansas is very diverse in terms of geology and hydrology, but can be generally divided into two major regions; 1) Gulf Coastal Plain and 2) Mountains. The population base served by PWSs in the mountainous region, which consists of the Ouachita and Ozark Mountains, generally depends upon surface water as a source of supply rather than groundwater. The Ozark Mountains are generally a Karst area where shallow groundwater is highly vulnerable to contamination. However most community PWSs in this area (which do not depend on surface water sources) depend on deep wells (e.g.; 1,000+ feet) which tap confined aquifers (i.e.; Gunter and Roubidoux).

The great majority of the PWS wells in the State occur in the Gulf Coastal Plain region. A few of the PWS wells withdraw groundwater from alluvial and terrace deposits which are extensive throughout this area, but most are supplied by older, confined aquifers under artesian conditions. One aquifer, the Sparta Sand, supplies more water for PWS wells in the State than all other aquifers combined.

Average groundwater travel times for the 1/4 mile WHPA boundary in the major Gulf Coastal Plain aquifers were calculated on the basis of hydraulic conductivity values provided by the USGS, hydraulic gradients taken from USGS potentiometric maps (selected from areas having high average values), and estimated porosity values. The results are shown in the following table:

AQUIFER	K (ft/day)	POROSITY	GRADIENT	VELOCITY (ft/day)	TRAVEL TIME (years)
Sparta	45	0.30	0.0022	0.33	11.0
Alluvium	300	0.30	0.0002	0.19	19.1
Cockfield	40	0.25	0.0022	0.29	12.4
Carrizo	15	0.30	0.0022	0.11	32.8
Wilcox	35	0.30	0.0022	0.25	14.1

The hydraulic conductivity values in this table were derived from pump tests on wells screened in the more productive zones of the aquifers. Hydraulic gradient information is not generally available on aquifers other than the Alluvium and Sparta. Because of the similarities between the confined Gulf Coastal Plains aquifers, a high value was selected for the Sparta and applied to all of the aquifers except the Alluvium for which independent values were available.

The calculated travel times are probably very conservative. Although localized hydraulic gradients may exceed the value shown in the table, the gradients were selected to generally exceed the value expected across the state.

In addition to considering groundwater travel times for the 1/4-mile boundary area, a fixed radius based upon a 5-year TOT was calculated for each community PWS well with current data in Union County for comparative purposes. This county was chosen because all the community PWS wells are completed into the Sparta Sand, which is the major source of drinking water in the State, and because a recent investigation by USGS provided current data on pumping rates and screened intervals. The calculated fixed radius defines an area on the ground surface overlying that portion of the aquifer which would contain the volume of water pumped by the well during a five year period, neglecting the effect of the local hydraulic gradient. Of the 47 active community PWS wells in the county, complete data were obtained on 45, resulting in the following summary: (Refer to the attached table for individual results.)

5-YEAR CALCULATED FIXED RADIUS (ft)	NUMBER OF WELLS
more than 1320	8
1320 - 1000	2
999 - 800	3
799 - 600	7
599 - 400	15
less than 400	10

The mean radius found for a 5-year TOT was 736. These figures may be somewhat conservative because a porosity of 0.25 was used in the calculation (rather than the 0.30 used for the earlier flow velocity calculations) and it was assumed that the aquifer was no thicker than the screened interval.

All of the wells that exceeded the 1/4-mile radius belong to the City of El Dorado and have pumping rates that are exceptionally high when compared to most PWS wells in the State. It is probable that only a few major pumping centers, such as El Dorado, Magnolia, and Pine Bluff, would have WHPAs larger than 1/4 mile when calculated in this manner.

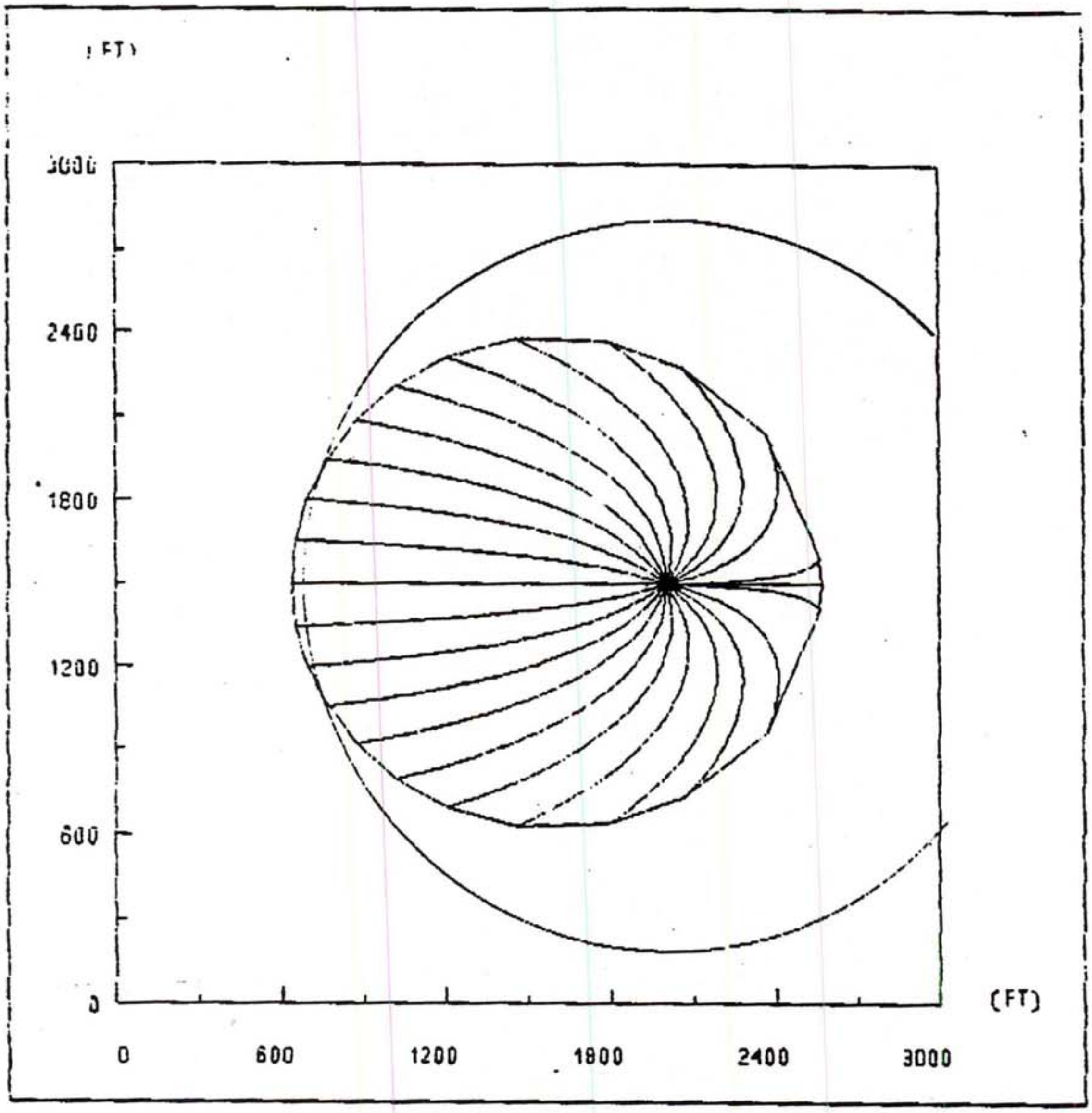
As a further check on the appropriateness of using a 1/4-mile radius, analytical models were run on four of the PWS wells in Union County. The model used, MWCAP, is part of the EPA's WHPA Code which was designed for use in delineating WHPAs on a site-specific basis. These computer runs were somewhat generalized in that a county average hydraulic gradient of 0.0022 was used for each of the wells and, for convenience of comparison, the flow direction is toward the east in each case. However, aquifer thickness and the well pumping rate are individually specified.

The generalized WHPAs delineated with MWCAP all fall within the 1/4-mile radius, except for a very small portion of the delineated area around the Smackover well. There was an attempt to choose a wide range of circumstances for these examples. The Smackover well is more representative of the larger WHPAs, while the Faircrest example is probably more typical of most wells in Union County. Because the hydraulic gradients in Union County are locally high due to a county-wide cone of depression from over pumping of the Sparta Sand, WHPAs delineated in this manner would be expected to be smaller over most of the rest of the State.

These comparative analyses indicate that the choice of a 1/4-mile fixed radius, as the WHPA boundary is appropriate for protection of PWS wells in general within the State.

PWS	**SCREEN LENGTH** (ft)	**1989 AVERAGE DAILY USE** (gpd)	**5-YEAR CALCULATED FIXED RADIUS** (ft)
Batts Lapile WA	74	25561	328
	30	25561	514
Calion	50	66082	641
	70	0	----
Crabapple Point	--	1250	----
	--	2500	----
El Dorado	70	878071	1974
	105	878071	1612
	100	878071	1651
	115	17797	219
	115	57053	393
	100	878071	1651
	70	844488	1936
	80	680163	1625
	80	680163	1625
	100	680163	1454
Faircrest WA	41	52149	629
	60	52149	450
Felsenthal WA	56	4500	158
	37	4500	194
Huttig	80	179029	834
	60	13000	259
Hwy 82 WA	20	14000	466
Johnson Township WA	60	100000	720
Junction City	52	39076	483
	55	39076	469

PWS	SCREEN LENGTH (ft)	1989 AVERAGE DAILY USE (gpd)	5-YEAR CALCULATED FIXED RADIUS (ft)
Lawson Urbana WA	25	47702	770
	20	47702	860
Marysville	30	53083	741
Mount Holly	40	21145	405
	58	17864	309
New Hope WA	70	39353	418
	40	39353	553
New London WA	51	30837	433
	50	30837	438
Norphlet	53	50527	544
	41	50527	619
Old Union WA	100	88419	524
Parkers Chapel WA	42	62857	682
	50	106848	815
Smackover	60	0	----
	50	161093	1000
	40	0	----
	40	161093	1118
Strong	70	29096	359
	40	8762	261
	30	0	----
	25	6134	276
	40	44693	589
	50	44000	523
Wesson Newell WA	40	39256	552

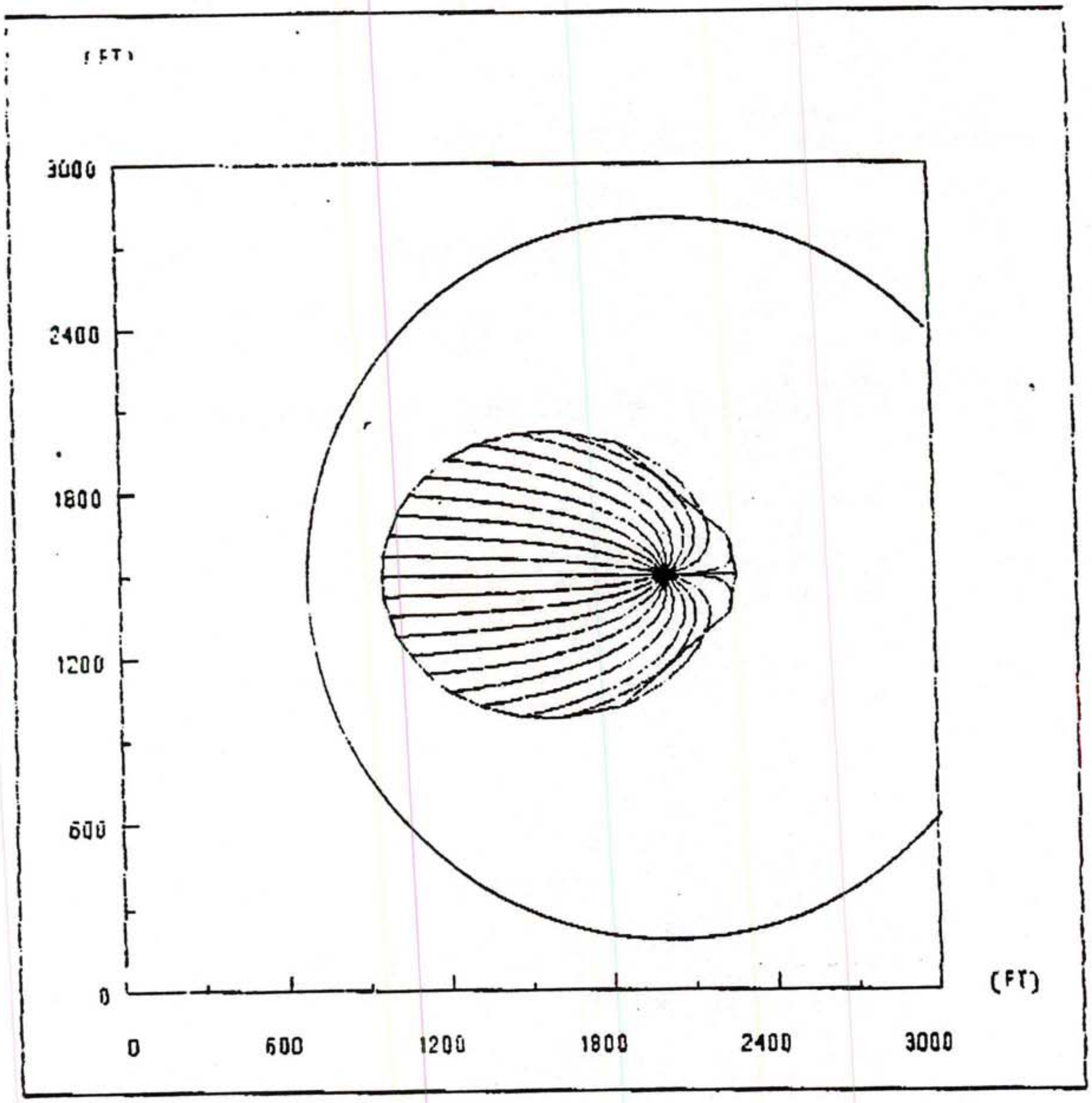


SMACKOVER PWS WELL

5-YEAR TIME OF TRAVEL CAPTURE ZONE

As delineated by MWCAP

Larger circle has 1/4 mile radius

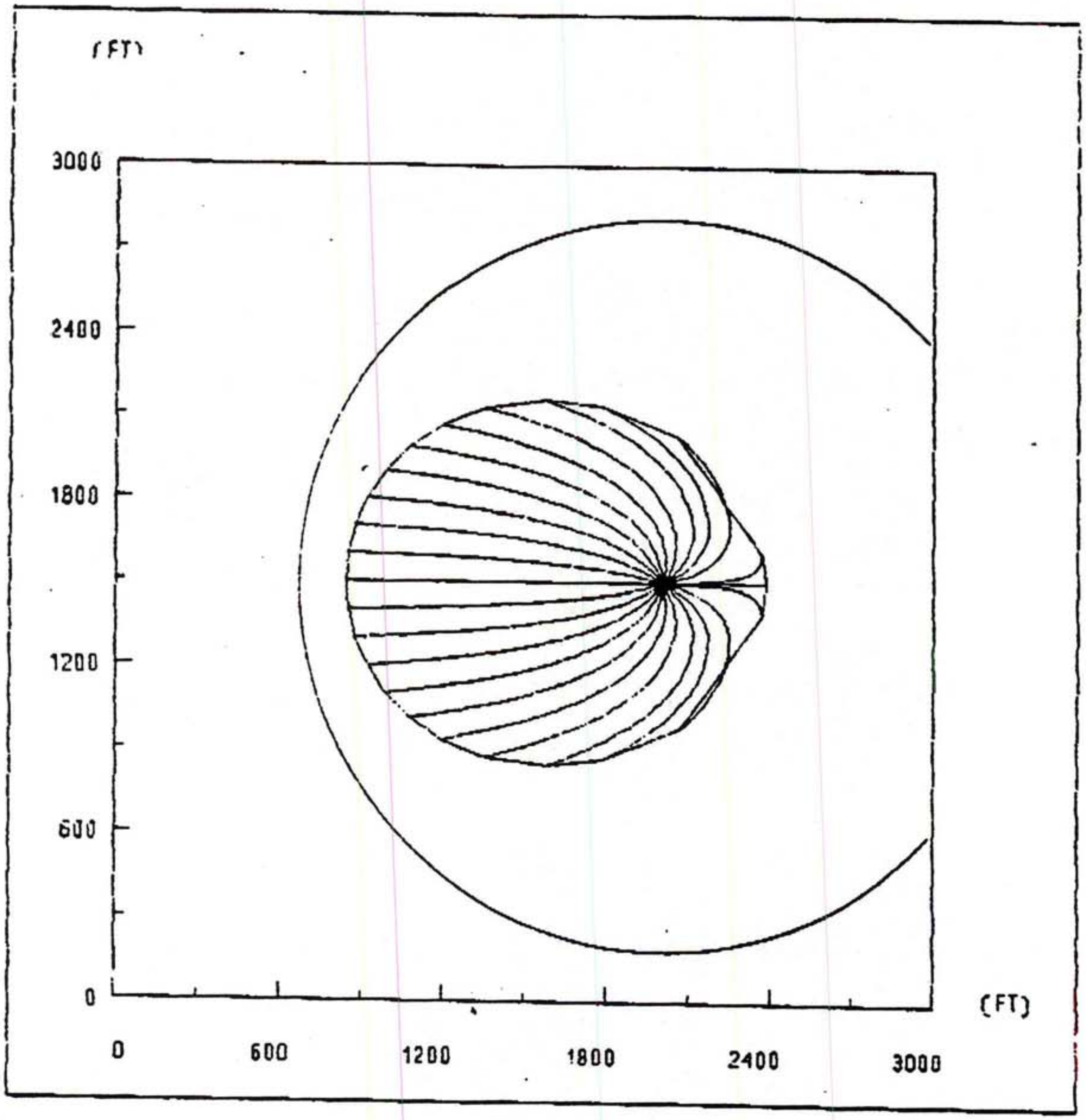


FAIRCREST PWS WELL

5-YEAR TIME OF TRAVEL CAPTURE ZONE

As delineated by MWCAP

Larger circle has 1/4 mile radius

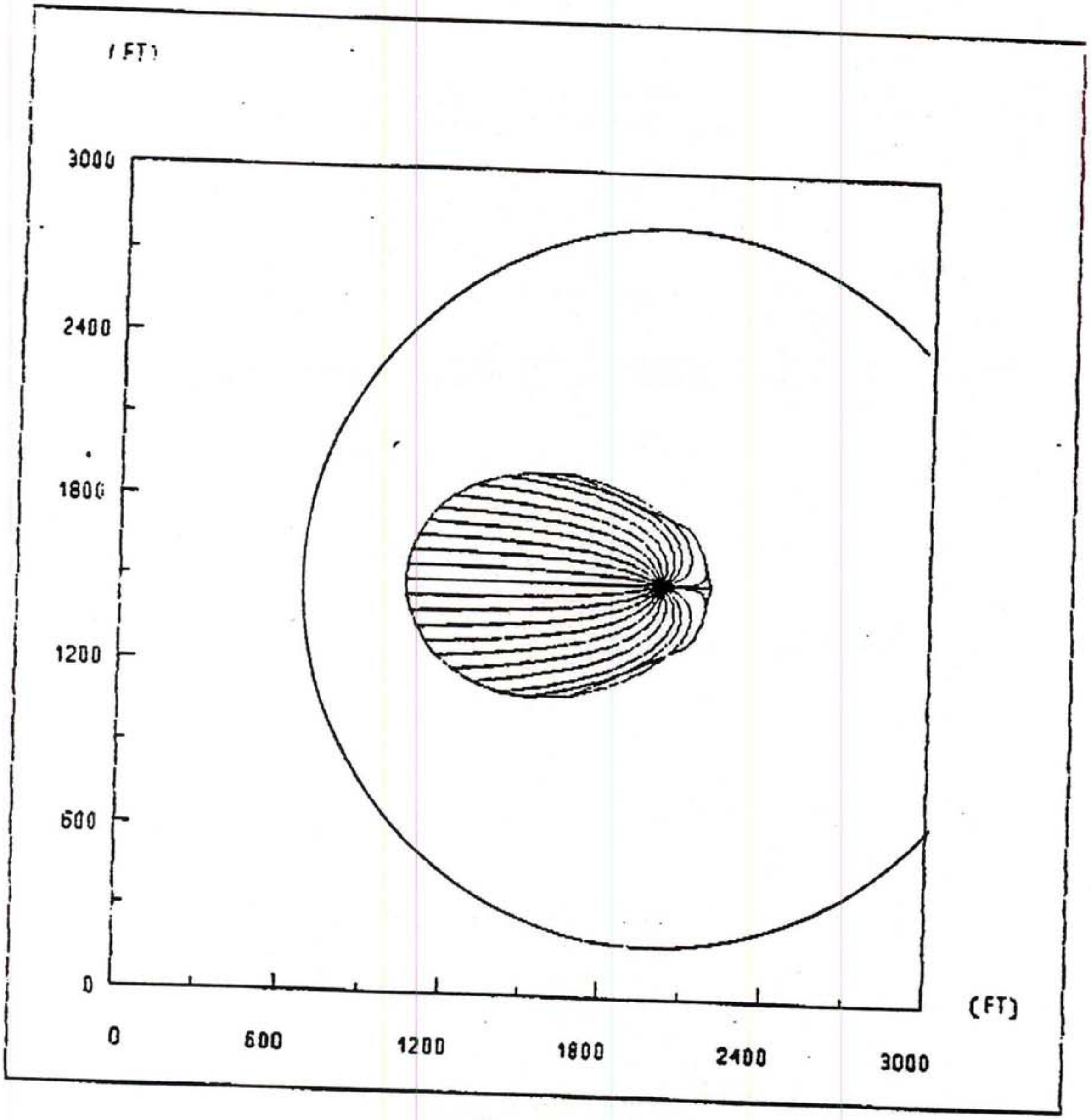


LAWSON - URBANA PWS WELL

5-YEAR TIME OF TRAVEL CAPTURE ZONE

As delineated by MWCAP

Larger circle has 1/4 mile radius



OLD UNION PWS WELL

5-YEAR TIME OF TRAVEL CAPTURE ZONE

As delineated by MWCAP

Larger circle has 1/4 mile radius

APPENDIX C

NOTICE OF PUBLIC HEARING

Notice of Public Hearing

ARKANSAS DEPARTMENT OF HEALTH

A public hearing will be held May 30 at 9:00 a.m. in the Auditorium of the Arkansas Department of Health to allow interested parties to comment on the proposed State Wellhead Protection Program.

Copies of the program summary and purpose will be available for public inspection at the Arkansas Department of Health Building, 4815 West Markham, Little Rock, AR 72205-3867.

The public may submit written comments to the Director of the Arkansas Department of Health or the Department's Division of Engineering no later than 8:00 a.m. on June 16, 1989.

This Notice of Public Hearing was published in both the Arkansas Democrat and the Arkansas Gazette for seven consecutive days beginning on April 29, 1989 in conformance with the ADH's Administrative Proceedures for Rules/Regulations.

Summary of Proposed
Arkansas Wellhead Protection Program

Authority

Under Section 1428 of the Federal Safe Drinking Water Act Amendments of 1986, each State shall submit to the EPA Administrator "a State program to protect wellhead areas within their jurisdiction from contaminants which may have any adverse affect on the health of persons. In a letter to Lee M. Thomas, then Administrator of the USEPA, Governor Bill Clinton designated the Department of Health to be the lead Agency in implementing the new amendments to the Safe Drinking Water Act. In particular, the Governor advised the Administrator to work with the Department's Division of Engineering.

Purpose

The purpose in establishing this program is two-fold. First, it will fulfill the wellhead protection requirements of the Safe Drinking Water Act Amendments of 1986. Secondly, it will provide a means of enhancing the current drinking water source protection component of the State's Public Water Supply Supervision program. This will in turn provide greater protection of a major state resource and the health and safety of the general public.

Program Content

The State Wellhead Protection Program will be implemented as a part of the current public water supply program. The major component of the wellhead program will be the establishment/delineation of a wellhead protection area around each public water supply well or wellfield in the State.

The wellhead protection area will be subdivided into two zones: primary and secondary.

> Primary Zone - The current state Rules and Regulations pertaining to Public Water Systems require that a horizontal distance (measured radially) of not less than 100 feet be maintained between any public water supply well and any possible source of contamination. This is a minimum distance which can be increased where local conditions dictate. This protected zone will be the primary wellhead zone and activities within this zone will continue to be regulated by the Department.
>
> Secondary Zone - A second wellhead zone, concentric to the primary zone, will extend a radial distance of 1/4 mile around each wellhead. New and existing activities within this secondary zone, which are not otherwise subject to review and regulation by a State Agency, will be controlled through local regulatory powers. It is envisoned that local controls will be enacted on a voluntary basis with technical assistance and guidance being provided by the Department.

Should adequate State program resources become available, the wellhead delineation areas will be refined using site specific hydrologic and geologic data and more sophisticated delineation methods.

Two key points to keep in mind are that (1) no new state regulations are envisioned at this time and (2) enactment of local land use controls for protecting wellheads from potential contaminants will be in the hands of the local authorities and will be encouraged, but not mandated.

APPENDIX D

SUMMARY

PUBLIC WATER SUPPLY SUPERVISION PROGRAM

ARKANSAS DEPARTMENT OF HEALTH

PUBLIC WATER SYSTEM SUPERVISION PROGRAM

April 2, 1990

The Arkansas Department of Health's Division of Engineering is responsible for the Public Water System Supervision Program in Arkansas. This program consists of multiple elements including compliance monitoring, enforcement, technical assistance, training, & public education. The Division is responsible for administering the Federal Safe Drinking Water Act (SDWA) in Arkansas, as well as enforcing the State "Rules & Regulations Pertaining to Public Water Systems".

The program staff includes fourteen Engineers, eight Environmental Specialists, fourteen and one half Laboratory staff (Chemists, Microbiologists, and Technicians), and eleven clerical and support personnel.

Over $1,500,000 is spent annually to monitor the water quality in over 700 community public water systems, and over 1200 non-community public water systems. The program includes the following activities:

1) Conducting inspections and sanitary surveys of community PWS's. The surveys include examination of the source, treatment facilities, and distribution, pumping and storage facilities for compliance with regulations and for the presence of sanitary defects.

2) Collecting and analyzing chemical, microbiological, and radiochemical samples to determine compliance with the SDWA primary drinking water standards.

a) Over 50,000 bacteriological samples are collected by the PWS's each year and analyzed by the ADH laboratories.

b) Division staff collect over 500 samples each year which are analyzed by the ADH labs for inorganic contaminants.

c) Division staff collect over 800 samples each year which are analyzed by the ADH labs for Trihalomethanes (THM's).

d) Water system personnel collect over 1200 samples which are analyzed by the ADH labs for Fluoride.

e) Division staff collect over 300 samples which are analyzed by ADH laboratories for radiochemical contaminants.

f) Division staff collect over 800 samples which are analyzed by the ADH labs for Volatile Organic Chemicals (VOC's) and the Unregulated Compounds (URC's).

g) Division staff collect over 100 samples annually which are analyzed for specific pesticides and herbicides by the ADH labs.

3) Reviewing analyses reports from each of the above analyses to verify compliance with the SDWA primary drinking water standards. Compliance with secondary standards (non-health related) is also checked, and technical assistance provided if necessary.

4) Investigating water quality complaints. The Division's staff of engineers and environmental specialists are frequently contacted by the public to answer questions or to investigate water quality problems. Problems related to the public water system are handled by the Engineering Section, while those problems that are plumbing related are referred to the Division's Area Plumbing Inspector.

5) Providing technical assistance to public water systems and consulting engineers. The Division's staff have a tremendous amount of experience in solving treatment plant problems, pumping problems, pressure problems, and public education problems which every water system may encounter from time to time.

6) Examining and certifying Water Works Operators. The Division conducts almost 1000 Water Works Operator examinations each year, provides over 1500 hours of training to new and current operators, and licenses over 1100 active Water Works Operators.

7) Taking enforcement action as necessary against persistant violators of SDWA primary drinking water standards.

APPENDIX E

RULES AND REGULATIONS
PERTAINING TO PUBLIC WATER SYSTEMS

RULES AND REGULATIONS

PERTAINING

TO

PUBLIC WATER SYSTEMS

ARKANSAS DEPARTMENT OF HEALTH

LITTLE ROCK, ARKANSAS

TABLE OF CONTENTS

RULES AND REGULATIONS PERTAINING TO PUBLIC WATER SYSTEMS

SECTION I. AUTHORITY

The following Rules and Regulations Pertaining to Public Water Systems are duly adopted and promulgated by the Arkansas State Board of Health pursuant to the authority expressly conferred by the Laws of the State of Arkansas including, without limitation, Act 96 of 1913, as amended (Arkansas Codes Anotated 20-7-109).

SECTION II. PURPOSE

These Rules and Regulations are adopted for the purpose of ensuring that all persons in the State of Arkansas receiving water from a public water system are provided with ample quantities of safe, palatable water which is in full compliance with the National Primary Drinking Water Standards.

SECTION III. DEFINITIONS

For the purpose of these Regulations, the following terms are defined:

A. Public Water System: All sources and their surroundings from which water is derived for drinking or domestic purposes by the public, including sources for bottled water, and all structures, conduits and appurtenances in connection therewith by which water for such use is obtained, treated, conditioned, stored and delivered to consumers.

B. Distribution System: All systems of conduits and their appurtenances by which water is distributed to consumers.

C. Water Treatment Plant: A group or assemblage of processes, devices, and structures used for treating or conditioning water for public drinking or domestic purposes.

D. Owner: Any person, firm, corporation, institution or governmental agency owning or operating any water system, distribution system or water treatment plant.

E. Contaminant: Any physical, chemical, biological, or radiological substance or matter in water.

F. Maximum Contaminant Level: The maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system; except in the case of turbidity and other specific contaminants where the maximum permissible level is measured at the point of entry to the distribution system. Contaminants added to the water under circumstances controlled by the user, except for those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition. [1]

G. National Primary Drinking Water Regulations: The current, effective drinking water regulations promulgated by the United States Government.

H. Community Water System: A public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

I. Non-Community Water System: A public water system that serves at least 15 service connections or 25 persons per day which is not a community water system .

J. Ground Water: Naturally occurring water occupying the zone of saturation in the ground below the surface of the earth.

K. Surface Water: Water that flows over or rests upon the surface of the earth. The term surface water includes rivers, lakes, impoundments, reservoirs and springs in addition to other man-made and naturally occurring bodies of water on the surface of the earth. Thermal springs with minimum water temperatures greater than 120 degress Farenheit are not considered surface water.

Surface water shall not include those springs for which a comprehensive hydrogeologic and microbiologic study has been performed by the owner which indicates a lack of surface water influence, and which has been accepted by the Department and the Regional Office of the U.S. Environmental Protection Agency, unless additional information refutes the original reports conclusions.

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[1] NOTE: It is not the intent of these Regulations to include individual service pipes from the property side of the water meter to buildings and plumbing within or in connection with buildings served, since this is covered in the State Plumbing Code.

L. Cross-Connection: A physical connection between a public water supply and either an unsafe or a questionable quality water or any toxic or objectionable material.

M. Surface Water Influenced Ground Water: A ground water with significant occurrence of insects or other macroorganisms, algae, or large diameter pathogens such as Giardia lamblia, or which is subject to significant changes in water quality which are determined to be in direct relationship with the climatological or surface water conditions.

N. Non-Transient Non-Community Water System: A Non-Community Water System which serves at least 25 of the same individuals at least 180 days (or portions thereof) per year, or a Public Water System which is utilized as a source for bottled water.

O. Public Water Supply Reservoir: A lake or reservoir, not owned by the United States of America, which is utilized as a source, directly or indirectly, either permanently, temporarily, or as a standby, for a public water system.

P. Operator of Record: That person, not including elected officials performing their duties of office, whose primary responsibility is the highest level of management and/or operation of the water system, and compliance with the relevant state and federal drinking water regulations.

SECTION IV. APPLICABILITY

These Rules and Regulations apply to all public water systems in the State of Arkansas, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year, including federally owned or maintained public water systems. These Rules and Regulations shall apply to all public water systems utilized as a source for bottled water without regard to population served.

SECTION V. WATER QUALITY

A. The quality of the water made available must conform to the National Primary Drinking Water Regulations. The quality of the water may be required, by the Arkansas Department of Health, to conform to the National Secondary Drinking Water Regulations.

B. The quality of new or additional sources of supply must be approved by the Arkansas Department of Health before being made available for public use.

SECTION VI. ALTERATIONS OR CHANGES REQUIRED

A. Authority to issue orders.

The Arkansas Department of Health may, in order to protect the public health and to ensure compliance with these and other applicable regulations, issue orders to public water systems requiring any one or more of the following actions.

1) The securing of a new source.

2) The modification of treatment facilities.

3) The addition of treatment facilities.

4) The securing of new or additional testing equipment.

5) The modification or expansion of monitoring procedures.

B. Provision of Emergency Water Supply.

Upon determination by the Director of the Arkansas Department of Health that a public health emergency exists, the Arkansas Department of Health may order a public water system to provide water to another public water system for the duration of the emergency, provided that the receiving public water system agrees to pay a reasonable rate for the water provided. The Department of Health must make a formal determination that the supplying system has excess capacity, and that the supplying system will not be harmed by the Order.

C. Compliance with Arkansas Department of Health Orders.

The person, firm, corporation, institution, governmental agency, or municipality owning a public water system, shall, at its own expense, comply with such orders in a reasonable length of time. Approval of any proposed change or new construction, by the Arkansas Department of Health, is required prior to initiating the change or the new construction.

SECTION VII. OPERATION

Every owner must operate the water supply, including water treatment plant and distribution system, so as to meet the standards set forth in the National Primary Drinking Water Regulations and take every reasonable precaution to protect the water from contamination. Every owner of a surface water system must operate the treatment facility within the operating criteria specified at the time of approval by the Arkansas Department of Health, or as specified in writing to the owner by the Arkansas Department of Health at any time following the approval. (See also Section XXI.)

A. Monitoring.

1. For purposes of determining compliance with the National Drinking Water Regulations, the Arkansas Department of Health Laboratory will be used unless otherwise approved by the Arkansas Department of Health.

2. The Arkansas Department of Health may, by using a published policy, signed by the Director of the Department, and approved by the U.S. Environmental Protection Agency, utilize any discretion allowed in the National Primary Drinking Water Regulations for monitoring requirements or for Maximum Contaminant Level or Treatment Technique compliance.

B. Records.

The owner shall make such suitable analyses and keep such records of operation as required by the Arkansas Department of Health. True and accurate reports of such analyses and operational records for each month shall be submitted to the Arkansas Department of Health by the tenth day of the following month. (See also Section XVII.)

C. Responsibility.

Every owner shall be responsible for compliance with these Regulations and shall submit samples of water to the Arkansas Department of Health Laboratory whenever requested by the Arkansas Department of Health.

D. License.

All persons holding positions in responsible charge of every community water system shall be duly licensed and certified under the provisions of Act 333 of 1957, as amended (A.C.A. 17-44-101 et seq), and such Rules and Regulations as may be adopted under the provisions of Act 333 of 1957, as amended. All persons holding positions in responsible charge of every non-community water system conducting any treatment for the removal of any contaminant from the water supply, exclusive of disinfection only of a well supply, shall be duly licensed and certified under the provisions of Act 333 of 1957, as amended, and such Rules and Regulations as may be adopted under the provisions of Act 333 of 1957, as amended.

E. Cross-Connection Program.

The owner shall institute a routine cross-connection program to locate and eliminate cross-connections. The program shall include routine inspections of commercial and industrial establishments and the routine maintenance of a listing of locations of cross-connection control devices. By January 1, 1996, each program shall include the mandatory testing of backflow prevention devices by certified testers, on a frequency approved by the Arkansas Department of Health.

F. Approved Chemicals, Materials, Equipment, and Processes.

1. All chemicals added to the water and all materials in contact with in-process or treated water shall be certified as being in compliance with ANSI/NSF Standards 60 and 61, as applicable, and as specified in the "Arkansas Department of Health Policy on Certification of Drinking Water Additives". Certification shall be made by an independent agency meeting the criteria specified in the "Arkansas Department of Health Policy on Certification of Drinking Water Additives". Self-certification by the manufacturer will not be accepted.

2. All unit processes, equipment, chemicals and appurtenances shall be in accordance with the applicable AWWA standards, and approved by the Arkansas Department of Health.

3. For treatment facilities utilized for treating water solely for bottled water, at its discretion, the Department may allow certification with the equivalent U.S. Food and Drug Administration food contact or food additive standard in lieu of certification with the appropriate ANSI/NSF 60/61 and AWWA standards.

G. Emergency Planning.

Each community public water system shall have a written emergency plan. The emergency plan shall include, at a minimum, names and telephone numbers of responsible utility personnel, procedures to be followed in the event of loss of source, treatment, storage, or distribution facilities, and procedures to be followed in the event of a loss of distribution system pressure or a known or suspected introduction of contaminants into the distribution system.

H. Long Range Planning.

Each community public water system shall have a written long range plan. The long range plan shall address, at a minimum, projected needs for source, treatment, storage and distribution for a planning period of at least ten years.

I. New Systems.

Prior to the startup of a new public water system or specified extensions or modifications of existing systems, the Owner shall notify the Department of Health that the system is in full compliance with the approved plans, specifications, and special conditions imposed by the Department, and obtain written approval from the Department to initiate use of the new system or modifications. The Department shall issue written approval or disapproval within two working days of the receipt of the certification. If the Department fails to issue an approval or disapproval within two working days following receipt of the certification by the Department, use of the project may be initiated. The Department may grant verbal interim approvals in emergency or critical situations.

SECTION VIII. GROUND WATER SUPPLIES

A. Location.

1. Surface Drainage

Every well must be located on a site having good surface drainage, at a higher elevation than, and at a safe distance from any barnyard, privy, soil pipe, any pipe through which sewage may back up or overflow or from any other possible source of pollution and in such a manner as to prevent the contamination of the water by either underground seepage or channels, lakes, ponds and surface drainage.

2. Proximity to Sources of Contamination

The horizontal distance from any such possible source of contamination such as privies, septic tanks, sewers, sub-surface pits, sub-surface sewage disposal fields, and barnyards must not be less than 100 feet. This distance shall be used only where a sanitary survey performed by the Arkansas Department of Health indicates it to be safe, and greater distances shall be required where local conditions necessitate. Chemical storage or disposal facilities shall not be located within 100 feet of the well without written approval of the Arkansas Department of Health.

3. Proposed Well Sites

The location of each proposed well must be approved in writing by the Arkansas Department of Health prior to commencing construction.

4. Location Below Grade Prohibited

No wellhead, well casing or well pump (except submersible pumps) shall be located in any pit, room or spaces extending below ground directly over the well.

5. Ownership of Restricted Wellhead Protection Zone

The owners of water supplies utilizing a well source shall own and effectively control a restricted wellhead protection zone around the well at 100 feet in radius. Deviation may be approved by the Arkansas Department of Health for a portion of the wellhead protection zone when that portion is owned by another governmental entity and protective easements prohibit the conveyance, use, or storage of potential contaminants within the easement.

B. Well Construction.

All public water wells, whether community or non-community, shall be constructed in accordance with AWWA Standard A100-90 or the latest revision thereof and approved by the Arkansas Department of Health. A copy of the well construction log shall be filed with the Arkansas Department of Health.

1. Casing.

Every well must have an outside water tight casing extending below the ground surface to such a depth as may be necessary, depending upon the character of the underground formations, to exclude the entrance or undesirable water and sub-surface contamination or as determined by the Arkansas Department of Health. The outer casing should be seated securely into an impervious formation whenever possible, otherwise the casing should extend as far as practical below the water table. The casing, when it extends into a pump room, shall project above the pump room floor, and safely above maximum flood elevation.

The annular space between the excavation line and the outside of the casing shall be filled with impervious cement grout in such a manner as to prevent surface water or shallow ground water from running directly down the outside of the casing. The required depth of the grout seal will be determined by the Arkansas Department of Health after a review of the geological formation.

2. Surface Protection.

Every well must be protected at the surface by a water tight slab or platform extending a minimum of two feet in all directions from the well and sloped to provide drainage away from the well.

3. Wellhead and Pump.

The discharge tee of the pump, together with the valves, shall be above the pump room floor. Any pump placed immediately over the well casing must have a water tight metal base to form a cover for the well. The base plate of the pump shall be recessed on the under side to permit the casing to extend into it at least one inch above the level of the concrete foundation. All air-relief vent openings must be at least 24 inches above the floor and must be screened and protected against the possibility of contaminating material entering the vent. Each wellhead shall be provided with a raw water sample tap and the means for measuring drawdown.

4. Abandonment of Wells.

Abandoned wells must be completely filled with clean, selected materials to protect the water bearing formations against possible contamination. At least the top 20 feet must consist of impervious cement grout. The record of abandonment must be filed with the Arkansas Department of Health.

C. Water Quality

The raw water at the wellhead shall not contain organic, inorganic or radiochemical contaminants which would not be removed or reduced to acceptable levels by a reasonable method of water treatment.

SECTION IX. SURFACE WATER SUPPLIES

A. Raw Water Quality.

The water at the intake, based on the monthly arithmetical average number of coliform organisms, shall not exceed 5,000 per 100 ml. in any month; nor exceed this number in more than 20 percent of the samples examined during any month; nor exceed 20,000 per 100 ml. in more than 5 percent of such samples.

The water at the intake shall not contain organic, inorganic, or radiochemical contaminants which would not be removed or reduced to acceptable levels by a reasonable method of water treatment.

B. Watershed and Reservoir Sanitation.

Protective distances stated in this section are minimum distances that may be used only under ideal circumstances. Greater protection will be required in most cases; the extent of protective area will be determined by a field inspection of the proposed site by the staff of the Department.

1. Recreational Use

Artificial lakes and all other bodies of water serving as reservoirs for city or other public water supplies shall not be used for recreational or other purposes in a manner whereby the water supply might become contaminated and thus become a potential hazard to public health. (Also see ACA 14-234-405 and ACA 14-251-106.)

2. Water Intake Structures

Intake structures shall be located and designed such that the best possible water quality can be obtained. Multi-level intake ports shall be provided.

Buoys shall be located in the water supply reservoir at a minimum distance of 300 feet from the intake and the use of the water within the zone shall be restricted to water supply (restricted intake zone). Greater distances may be required when deemed necessary by the Arkansas Department of Health.

3. Ownership of Restricted Zones

a. River Sources

1. The owners of water systems utilizing river intakes shall own and effectively control a restricted buffer zone around the water intake. The minimum restricted buffer zone shall include all land from the river bank to a line 300 feet back, if within a one fourth mile radius of the intake. The maximum extent of this zone will be determined by the Arkansas Department of Health on an individual basis after a sanitary survey of the intake site has been made.

2. The Department may reduce the downstream protected zone if a weir or other

physical barrier precludes downstream water from backing up to the intake.

b. Public Water Supply Reservoirs

The owners of water systems shall own and effectively control a restricted buffer zone around the reservoir. The restricted buffer zone shall include all of the land bounded by a fixed line which is at least 300 feet horizontally from the shore line when the reservoir is at the maximum high water level contour as established by the Arkansas Department of Health. Use of the restricted buffer zone will be determined by the Arkansas Department of Health.

c. Other Reservoir Sources

In the case of large multi-purpose reservoirs developed by the federal government, the water system owner shall effectively control a restricted buffer zone on land around the water intake structure. The extent of this restricted buffer zone will be determined on an individual basis by the Arkansas Department of Health after a sanitary survey of the proposed intake site has been made. All possible sources of contamination are prohibited within this restricted buffer zone.

d. Spring Sources

The owners of water supplies utilizing spring sources shall own and effectively control a restricted buffer zone around the spring. The minimum restricted buffer zone shall be all property with a 300 foot radius of the spring enclosure. The maximum extent of this buffer zone will be determined by the Arkansas Department of Health on an individual basis after a sanitary survey has been made of the spring site.

e. Deviations from the Restricted Buffer Zone

Deviations from the miminum restricted buffer zone may be approved by the Arkansas Department of Health for a portion of the restricted buffer zone when that portion is owned by another governmental entity and protective easements to prohibit the conveyance, use, or storage of potential contaminants within the easement are granted to the public water system.

4. Pollution of the Watershed

a. Objectionable Substances

No sewage, garbage, dead animals, refuse, industrial wastes or other objectionable substances shall be deposited in the reservoir, or in the restricted zones of any surface water source or surface water influenced ground water source.

None of the above substances may be deposited, discharged, or disposed of within the watershed of the water source without the written approval of Arkansas Department of Health.

b. Domestic Animals

Horses, cows, sheep, goats, swine, fowl, or other domestic animals are prohibited in the restricted zones. Domestic animal lots and pens located on the watershed of a water supply shall be maintained in a manner acceptable to the Arkansas Department of Health.

c. Human Habitation

Residences, dwellings, houses, cottages, camps, cabins, tents, trailers, club houses, or other places where people reside, congregate, or are employed are prohibited in the restricted buffer zone around the reservoir; provided, however, that the water utility may, upon approval by the Arkansas Department of Health, construct such structures in the restricted buffer zone that are necessary for the protection of the reservoir. All sewage disposal facilities located on the watershed of the reservoir shall be constructed and maintained in accordance with the requirements of the Arkansas Department of Health.

d. Picnicking and Camping

Camping is prohibited in the restricted buffer zone of the water supply. Picnicking is prohibited in the restricted intake zone.

e. Swimming, Bathing, Skiing

Swimming, bathing, or skiing in the restricted intake zone of the water supply, or other zones as specified by the Arkansas Department of Health, is prohibited.

C. Filtration Required.

1. Filtration of all surface water sources and surface water influenced groundwater sources, by a method approved by the Arkansas Department of Health, is required.

2. The Arkansas Department of Health may, by using a published policy, signed by the Director of the Department and approved by the U.S. Environmental Protection Agency, utilize discretion allowed in the National Primary Drinking Water Regulations to allow an alternate MCL for turbidity.

D. Determination of Level of Treatment Required.

1. The Arkansas Department of Health shall:

a. Set the level of removal/inactivation for enteric cysts and viruses (logarithmic removal rates) required for each surface water source and each surface water influenced groundwater source.

b. Determine treatment plant efficiency for removal of enteric cysts and viruses.

c. Determine the contact time associated with each treatment plant, based on information submitted by the owner or established by the staff of the Arkansas Department of Health, for assigning the level of inactivation of enteric cysts and viruses provided by the disinfection system.

d. Determine if each ground water source utilized by a public water system is surface water influenced.

SECTION X. WATER TREATMENT PLANTS

A. Location.

Plants shall be located on sites having good drainage and not subject to flooding. They shall also be located so that no conduit, basin or other structure containing or conducting water in the process of treatment can possibly be affected by leakage from any sewer, drain or other source of contamination.

B. Chemical Feed and Dosing.

Adequate quantities of suitable chemicals shall be provided as required for the approved treatment processes. All chemical feed machines shall be kept in good repair and accurately adjusted so that proper and efficient dosage of chemicals can be maintained at all times. Proper safety equipment shall be provided, and safety procedures followed, where chemicals are used or stored.

C. Mixing and Flocculation.

Facilities shall be designed and operated to insure adequate mixing of chemicals with the untreated water and to maximize particle formation. All mixing devices shall be maintained in good repair so as to provide efficient mixing of the chemicals.

D. Sedimentation Basins.

Sedimentation basins shall be designed and operated so as to maximize particulate removal. Sedimentation basins shall be cleaned as often as necessary so as to reduce algal growth and minimize taste and odors in the settled water.

E. Filters.

Filters shall be designed and operated so as to maximize contaminant removal. Filters shall be inspected periodically and kept in good operating condition. All valves, controls and regulators shall be maintained in good working order. The rate of backwash shall be sufficient to rid the filter of all accumulations. Filter to waste facilities are required.

F. Disinfection Equipment.

All disinfection equipment shall be maintained in good working condition. All leaks shall be corrected immediately. Ammonia or other suitable leak indicators shall be kept on hand at all times and shall be used for the determination of leaks. Disinfection equipment shall be kept clean and free from deposits so as to not impede the feed or regulating devices. Adequate heating, safety equipment, spare parts, and ventilation facilities shall be provided.

G. Laboratory.

Adequate laboratory facilities suitable for the control of the treatment processes involved shall be provided and shall be certified by the Arkansas Department of Health, if necessary.

H. Plant Maintenance.

All treatment plants shall be kept and maintained in a clean and sanitary manner. All accumulations of trash, chemical bags, cans, etc., shall be removed from the premises daily. Surrounding grounds shall be maintained in a suitable manner.

XI. POTABLE WATER STORAGE TANKS

A. Location.

Potable water storage tanks shall be located above ground water level unless otherwise approved in writing by the Arkansas Department of Health. The location must be such that surface water and underground drainage will be away from the structure. They shall not be placed in close proximity to any sewer, privy, septic tank, absorption field or other source of pollution from which either surface or underground drainage might flow toward the storage tank. The minimum distances from any sources of pollution shall be in accordance with Section VIII. A. Any sewer located within 100 feet of a storage tank should be constructed of cast iron or other durable material with water-tight mechanical joints.

B. Drainage.

All potable water storage tanks shall be protected against flooding. The ground surface shall be sloped to drain or divert surface water away from the storage tank and shall be so graded that no surface water will pool within the vicinity of the storage tank. Floors of passageways, galleries or compartments adjacent to any potable water storage tank shall have free drainage to the surface of the ground or into a drainage pit equipped with proper drainage pumps of ample capacity which are properly maintained.

C. Overflows.

Overflow pipes shall discharge freely at least 12 inches above ground or flood level or into an open basin from a point not less than 12 inches above the top of spill line of the basin. They shall be protected against backflow. The overflow outlet shall be turned downward or to the side and protected to prevent the entrance of rain, dust, birds, insects, rodents, or other contaminating material.

D. Design and Operation.

1. Sufficient useable storage shall be provided with consideration given to average daily demand, peak hourly demand, power outages, and fire flows, if applicable. Particular care shall be taken to insure that construction joints are water tight and free of any material likely to deteriorate or fail

due to weathering. Storage tanks shall be kept free from cracks. All inlet and outlet pipes shall be properly supported and shall be provided with a flexible joint, or equal, to prevent cracking the pipe if unequal settlement should occur. Wall castings shall be provided with suitable collars to insure water tight connections.

2. All potable water storage tanks shall be designed, inspected, repaired, and painted in accordance with the applicable AWWA standards. A routine maintenance program, including regular cleaning and painting, shall be applied to all potable water storage tanks. All leaks shall be promptly repaired.

E. Covers.

Suitable and substantial covers shall be provided for all potable water storage tanks. They shall be water tight and of some permanent material and shall be constructed so as to provide drainage away from the cover and to prevent the entrance of contamination. The surface of covers shall not be used for any purpose in connection with which contamination material is likely to be produced.

F. Manholes.

Manhole openings shall be fitted with raised water tight walls projecting at least 4 inches above the surrounding surface, with a solid water tight cover with edges projecting downward at least 2 inches around the outside frame, or be fitted with a gasketed weathertight cover. The manhole covers shall be provided with a sturdy locking device and should be kept locked at all times except when actually in use.

G. Vents and Other Openings.

Any necessary vents or opening through covers of storage tanks for water-level control gauges or other purposes shall be constructed so as to prevent the entrance of dust, rain, bird, insects and any other material which might include contamination. Any such opening shall be provided with a pipe sleeve or other device making a water tight junction with the storage tank cover and extending without openings to at least 12 inches above the surface of the cover with a stuffing box at the top. No such vents or openings shall be provided near sources of dust, smoke and the like nor where surface water might splash into them. Vents must be protected with a 24-mesh screen.

H. Cleaning and Disinfection.

Potable water storage tanks shall be cleaned as often as necessary. They shall be effectively disinfected before being placed into service in accordance with the "American Water Works Association Standard for Disinfection of Water Storage Facilities" (AWWA C652-92 or the latest revision thereof). Before the storage tank is placed in service, two consecutive series of samples which are not collected on the same day must show that the water is bacteriologically safe for drinking purposes.

SECTION XII. DISINFECTION REQUIRED

Disinfection of all public water supplies by a method approved by the Arkansas Department of Health must be provided. Disinfection must include adequate contact holding time prior to pumping into the distribution and storage system. An adequate residual of the disinfectant must be carried to all points throughout the distribution system.

SECTION XIII. BOOSTER PUMP STATIONS

Booster pump stations shall be located on sites having good surface drainage and not subject to flooding. When the pump suction lines are connected to the distribution system, they must be automatically controlled so as not to reduce the suction line pressure to less than 20 lbs. per square inch. The suction line on any booster pump shall be so located and constructed to prevent contamination of the water supply.

SECTION XIV. DISTRIBUTION SYSTEM

All public water supply distribution systems shall be tested and constructed using materials and construction methods in accordance with the applicable AWWA standards and approved by the Arkansas Department of Health.

A. Sanitary Hazards.

The operating routine shall include necessary protective measures to detect and remove or destroy any contaminant of concern or regulation which might enter the distribution system. Every precaution must be taken against the possibility of sewage contamination of the water in the distribution system. Water mains and sanitary sewers shall be constructed as far apart as practicable, and shall be separated by undisturbed and compacted earth. A minimum horizontal distance of ten feet should be maintained between water lines and sewer lines or other sources of contamination. Water lines and sewers shall not be laid in the same trench except on the written approval of the Arkansas Department of Health. Water mains necessarily in close proximity to sewers must be placed so that the bottom of the water line will be at least 18 inches above the top of the sewer line at its highest point and must be partially protected by being entirely surrounded by at least 18 inches of carefully compacted clay backfill or other similar barriers as approved by the Arkansas Department of Health.

B. System Design.

1. General

The distribution system shall be properly arranged and of ample capacity to insure a supply of water to all parts of the system to meet any reasonable demand, including fire, if applicable, without producing a condition of negative pressure in any part of the system. A minimum pressure of 20 pounds per square inch shall be maintained, except under emergency conditions such as a fire flow or main break. Pipes shall have sufficient structural strength and shall be properly supported and reinforced where necessary to guard against structural failures and resulting sanitary hazards. All drains, such as hydrant drips or valve pits, shall discharge onto the ground surface where possible, or into dry pits or gravel pockets, but not into any sewer.

2. Location Records

An accurate up-to-date record shall be kept of the location of every item in the distribution system with all mains, valves and other underground structures carefully referenced to reasonably permanent aboveground objects in order that the underground structure may be properly located. Such records should show all pipes carrying domestic sewage or toxic industrial wastes located within 10 feet of any element of the distribution system.

3. Depth of Mains

All water pipes must be located at sufficient depth to protect the pipe from the direct effect of traffic and at least below maximum frost depth of the locality, or be otherwise protected.

4. Valves

Valves shall be located at frequent intervals along all water mains and at such points to permit closing off of any section of a water main for repairs or testing without affecting water service to any extended area. All valves shall be tested for leakage and operation by routine inspection at frequent intervals. Leaky stuffing boxes shall be properly and promptly repaired.

5. Blowoff Drainage

Blowoffs shall be so located that the distribution system may be properly flushed, and so that danger of contamination of the water line by backflow will be eliminated. No blowoff shall be connected to any sewer or storm drain, submerged in any surface water or installed in any manner that will permit backsiphonage into the distribution system. The discharge of the blowoff shall be located above natural grade, and be screened, capped, or plugged.

C. Water Main Construction.

Construction shall be carried out so as to insure a water distribution system free from leaks, thoroughly supported to prevent settlement or breakage of pipes and thoroughly sterilized to remove all possibility of infection or contamination. Particular care must be taken to guard against the entrance of sewage into the trench during or after construction. Any sewage matter which might be found in the trench shall be carefully removed and the location sterilized with a suitable chlorine compound spread over the area. Ample provision must be made to remove all ground or surface water from the trenches and no such water shall be allowed to enter the pipe. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times. They shall be carefully inspected and thoroughly cleaned before laying. After laying and before completion of backfill, lines shall be tested in accordance with the applicable AWWA specifications for the pipe material being used.

D. Used Pipe.

The use of secondhand or used pipe is prohibited unless it was previously used for the distribution of potable water, or approved by the Arkansas Department of Health.

E. Disinfection of Pipe.

Before being placed in service, all new water distribution systems, extensions to existing systems, any valved section of such extension or any replacement of the water distribution system shall be properly disinfected. Prior to disinfection, all dirt shall be removed by thorough flushing. All valves and appurtenances affected shall be operated while the pipeline is filled with the disinfecting agent. Following disinfection, all treated water shall be thoroughly flushed from the pipeline and bacteriological samples shall be taken to determine the efficiency of the disinfection procedure. Before the system or line is placed in service, two consecutive series of samples which are not collected on the same day must show that the water is bacteriologically safe for drinking purposes. Disinfection shall conform with American Water Works Association, "Standard Specifications for Disinfecting Water Mains," C651-92, or the latest revision thereof.

F. Plumbing Inspection and Sewage Disposal Required.

1. No public water system shall provide service to a new building or residence in an unsewered area until the customer provides written documentation that the Department Of Health has approved plans for construction of a sewage disposal facility for the building or residence, or that no disposal system approval is required by the Department of Health for the building.

2. No public water system shall provide new service to any building or residence until the customer provides written documentation that the service line and building plumbing were inspected by the system's certified plumbing inspector, and found to be in substantial compliance with the State Plumbing Code (Rules and Regulations Governing Construction, Installation, and Inspection of Plumbing and Drainage).

   a) If the system has no certified plumbing inspector, the written documentation shall be obtained from the Department of Health's Area Plumbing Inspector or a certified inspector designated by the Area Inspector.

   b) Temporary service for construction purposes, in unsewered areas, may be provided only after compliance with Section XIV. F. 1, above.

SECTION XV. RETURN OF COOLING WATER

The return of heating or cooling water to a potable water storage reservoir or distribution system is prohibited.

SECTION XVI. CROSS CONNECTIONS

Any physical connection is prohibited whereby a public water system whether community or non-community, is connected to an unsafe or questionable water supply system either inside or outside of any building or buildings.

A. Prohibited Services.

Domestic water shall not be supplied to any device, equipment, or service connection which may permit the contamination of the water supply by back-siphonage or backflow. Provision of water service to any service connection found to contain a cross-connection shall immediately be terminated, unless a backflow prevention device of a type approved by the Arkansas Department of Health is installed between the cross-connection and the public water system.

SECTION XVII. NOTIFICATION

A. Notification of Arkansas Department of Health.

1. The owner shall report to the Arkansas Department of Health within the 48 hour time limit prescribed by the Arkansas Department of Health the failure to comply with any primary drinking water regulation including failure to comply with monitoring requirements. The owner is not required to report analytical results to the Arkansas Department of Health in cases where the analysis was performed by the Arkansas Department of Health Laboratory.

2. The owner shall report to the Arkansas Department of Health within four hours of the discovery and evaluation of any emergency condition located in the water system which affects the ability of the water system to deliver adequate quantities of safe water to its customers. Examples of such emergencies include loss of pressure in the distribution system, failure of the source or treatment facility or parts thereof, voluntary or mandatory water conservation efforts, or the known or suspected introduction of any contaminant into the water system.

3. The owner shall report to the Arkansas Department of Health, within two working days, of any change of the Operator of Record for the water system. The owner shall report both the name of the former Operator of Record, and the new Operator of Record.

B. Notification of the Public.

1. The owner shall, as directed in writing by the Arkansas Department of Health or as required by the National Primary Drinking Water Regulations, notify the public of its failure to comply with the National Primary Drinking Water Regulations, and/or its failure to comply with these regulations. Public notification shall be given using the wording directed by the Arkansas Department of Health. The public notification shall be given in a timely manner as directed by the Arkansas Department of Health.

2. In lieu of applying specific National Primary Drinking Water Regulations public notification requirements to bottled water, the Division of

Engineering shall notify water bottler and the appropriate state regulatory program when the Department has determined that there has been a failure of the bottled water source to comply with the monitoring, Maximum Contaminant Level, or Treatment Technique requirements of the National Primary Drinking Water Regulations, as applied to NonTransient NonCommunity Public Water Systems.

SECTION XVIII. APPROVED LABORATORIES

The Arkansas Department of Health Laboratory shall conduct analyses for the purpose of determining compliance with the National Primary Drinking Water Regulations. Routine examinations on a daily, weekly, or monthly basis may be conducted in a public water system plant laboratory certified by the Arkansas Department of Health.

SECTION XIX. VARIANCES AND EXEMPTIONS

A review of chemical and physical analyses for community water systems in the State of Arkansas indicates that a program of variances and exemptions is not needed by the State. If the need arises, the Arkansas Department of Health is authorized to implement a program of variances and exemptions consistent with the requirements of the National Primary Drinking Water Regulations.

SECTION XX. PRELIMINARY REPORTS

Before detailed plans and specifications for construction of major improvements are prepared, the owner or his authorized agent shall submit to the Arkansas Department of Health a preliminary report containing data and information sufficient for the complete understanding of the proposed work. The "Recommended Standards for Waterworks" by the Great Lakes - Upper Mississippi River Board of State Sanitary Engineers (Ten States Standards) is recommended as a guide. An inspection by Arkansas Department of Health staff of all proposed surface water and all groundwater source locations shall be conducted as part of the review of the preliminary report.

SECTION XXI. SUBMISSION OF PLANS AND SPECIFICATIONS

A. Alterations.

The owner or his authorized agent shall submit two complete sets of engineering plans and specifications to, and receive written approval of, the Arkansas Department of Health, before constructing or entering into a contract to construct a water supply, source of supply, water purification plant and/or distribution system, or any alterations thereto. Thereafter such engineering plans and specifications must be adhered to unless deviations are submitted to, and receive written approval of, the Arkansas Department of Health. The Arkansas Department of Health may, upon approval of a written agreement between the owner and the Arkansas Department of Health, delegate plan review responsibility for minor distribution improvements to the owner.

B. Extensions to Existing Distribution Systems.

If the engineering plans are solely for the extension to an existing distribution system, only such information as is necessary for a clear understanding of the proposed extension will be required. This information must, in general, conform to the requirements for a complete system.

C. All construction plans and specifications for the construction of new systems or extensions, expansions or modifications of existing systems submitted to the Department for review shall be in full compliance with all Plan Review Policy Statements issued by the Department and signed by the Director of the Department of Health.

SECTION XXII. ENGINEERS REPORT

A. Design Data.

A report, written by the designing or consulting engineer, shall be presented with all engineering plans and shall give all data upon which the design is based, or which is required for the complete understanding of the engineering plans.

B. Surface Water Supply.

If a surface supply is proposed, the nature and extent of the watershed with special reference to its sanitary condition and anticipated maximum and minimum water yield shall be fully and explicitly discussed, together with proposed methods and regulations for the prevention of accidental or other pollution. A small scale map of the watershed, showing the roads and number and character of the buildings, shall be included in the report. Other features which should be discussed in the report are storage, capacity, average depth, general nature and area of the storage reservoir, probable water quality of the source, and proposed treatment processes. Treatment must be based on a thorough study of raw water quality.

C. Ground Water Supply.

If a well supply is proposed, the number, depth, size and construction, method of pumping, type of strainer, geological formations through which wells will be drilled, and probable yield of the wells shall be given. Treatment must be provided based upon a thorough study of raw water quality. If collecting galleries are to be used, describe their construction. A map shall be submitted showing the location of all buildings, privies, sewers, underground conduits or other possible sources of contamination within 1320 feet of the proposed wells, galleries or gravity conduits.

D. Unsupplied Area.

Should there be areas in the municipality or districts which, on account of topography or other reasons, cannot be supplied with water, a definite statement to this effect must be made and the probable future methods of supplying water to the area should be discussed.

E. Estimate of Cost.

An estimate of the cost for the construction of the water supply, source of supply, water treatment plant and/or distribution system shall accompany all engineering plans. The estimate shall include quantities of the necessary materials.

F. Plan Review Fee.

In accordance with Act 469 of 1965, as amended (ACA 20-7-123 et seq), a review fee of one percent (1%) of the estimated cost shall be submitted with the engineering plans and specifications. The maximum fee is five hundred dollars ($500.00). A minimum fee of $50.00 is required. Unless the maximum fee is paid, a detailed cost estimate must accompany the engineering plans and specifications. No fee is required for preliminary engineering reports.

SECTION XXIII. RIGHT OF ACCESS

The owners of public water systems shall permit reasonable access to personnel of the Arkansas Department of Health for the purpose of inspection of facilities and records, or collection of samples. Access shall be permitted whether or not there is any question that the system is in compliance with applicable legal requirements.

SECTION XXIV. ADMINISTRATIVE PENALTY AUTHORITY

The Arkansas Department of Health shall have the authority to assess administrative penalties against any public water system for failure to comply with any portion of these regulations, provided that such penalties and procedures are in accordance with Arkansas Statutes.

SECTION XV. SEVERABILITY

If any provision of these Rules and Regulations, or the application thereof to any person or circumstances is held invalid, such provisions or applications of these Rules and Regulations which can give effect without the invalid provisions or applications, and to this end the provisions hereto are declared to be severable.

SECTION XXVI. REPEAL

All Regulations and parts of Regulations in conflict herewith are hereby repealed.

CERTIFICATION

This will certify that the foregoing Rules and Regulations Pertaining to Public Water Systems were adopted by the Arkansas Board of Health at a regular session held in Little Rock, Arkansas, on the twenty-sixth day of January, A.D. nineteen hundred and ninety-five.

Secretary of the Board of Health
Director, Arkansas Department of Health

Dated at Little Rock, Arkansas, this 22th day of March, A.D. nineteen hundred and ninety-five.

The preceeding Rules & Regulations have been filed in my office and are hereby adopted on the 24 day of March, 1995.

Governor

ARKANSAS REGISTER

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SHARON PRIEST
SECRETARY OF STATE
STATE OF ARKANSAS
BY

Transmittal Sheet

Sharon Priest
Secretary of State
State Capitol Room 017
Little Rock, AR 72201-1094

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Name of Agency HEALTH DEPARTMENT

Department DIVISION OF ENGINEERING

Contact Person HAROLD R. SEIFERT, P.E.

Statutory Authority for Promulgating Rules A.C.A. 20-7-109

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	Adopted by State Agency	1-26-95

CERTIFICATION OF AUTHORIZED OFFICER

I Hereby Certify That The Attached Rules Were Adopted In Compliance with Act 434 of 1967 As Amended.

George A Hayes
Signature

GENERAL COUNSEL
Title

4-3-95
Date

APPENDIX F

RULES AND REGULATIONS PERTAINING TO GENERAL SANITATION

RULES AND REGULATIONS

PERTAINING TO

GENERAL SANITATION

ARKANSAS DEPARTMENT OF HEALTH

LITTLE ROCK

ARKANSAS DEPARTMENT OF HEALTH
LITTLE ROCK
RULES AND REGULATIONS PERTAINING TO
GENERAL SANITATION
WITHIN THE STATE OF ARKANSAS

AUTHORITY

The following Rules and Regulations Pertaining to General Sanitation are duly adopted and promulgated by the Arkansas Board of Health pursuant to the authority expressly conferred by the laws of the State of Arkansas including, without limitation, Act 96 of 1913 (ACA 20-7-109).

PURPOSE: To protect the environment and the health of the citizens of Arkansas by establishing acceptable criteria for various public health concerns.

Definitions:

Child Care Facilities A home, business, or institution that, for a fee, regularly cares for more than ten children.

Department The Arkansas Department of Health or its Authorized Agent.

Discharge Includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying or dumping.

Ground Water Subsurface water that occurs in soil and geologic formations.

Health Authority means the Director, State Department of Health or his authorized representative.

Industrial/Manufacturing Wastes Liquid or solid wastes resulting from processes employed in industrial and/or commercial establishments whether combined or uncombined with human wastes.

Individual Sewage Disposal and/or Treatment System A single system of treatment tanks and/or disposal facilities used for the treatment of domestic sewage serving only a single dwelling, office building or institution.

Marine Sanitation Device Any equipment for installation aboard a vessel and which is designed to receive, retain, treat or discharge sewage and any process to treat such sewage.

Portable Toilet Any equipment used to temporarily receive and retain human excreta prior to its delivery to a sewage treatment facility.

Public Health Nuisance Any condition which is created, maintained or continued in a way that is detrimental to public health.

Public Toilet Facility A restroom or toilet facility provided for the use of employees, patrons, visitors and/or the general public.

Septage The settled scum and sludge from a septic tank or sewage handling facility.

Sewage Any liquid wastes containing animal or vegetable matter in suspension or solution, including liquid wastes from toilets, kitchen sinks, lavatories, washing machines, dishwashers, garbage grinders and other plumbing fixtures.

Surface Water Water occuring on top of soil and geologic formations. This includes, but is not limited to, lakes, rivers, streams, creeks, bayous, ponds and reserviors.

Vector Arthropods or other invertebrates which transmit infection by inoculation into or through the skin or mucous membrane by biting, or by depositing infected materials on the skin, food or other objects. The vector may be infected itself or may act only as a passive or mechanical carrier of the infective agent.

SECTION I. PUBLIC HEALTH NUISANCE

It is prohibited for any person, firm, partnership, corporation, organization, association, municipality, county or governmental agency to create, permit, maintain or continue any public health nuisance.

SECTION II. GROUNDWATER POLLUTION

The pollution of groundwater is prohibited. No sewage, septage, food, grease, garbage, rubbish, drainage from buildings, filth, poisonous or deletrious substance or the effluent from any sewage treatment or disposal device is to be discharged or disposed of by means or manner that jeopardizes ground water quality. All subsurface disposal sites and techniques must comply with all State and Federal laws and regulations.

Abandoned water wells must be completely filled with clean, selected materials. These materials must be thoroughly tamped in place and the last (top) ten feet must consist of cement grout or other impervious material.

SECTION III. SURFACE WATER POLLUTION

The pollution of surface waters is prohibited. All discharges from sewage treatment facilities, factories,, industrial sites, processing centers, disposal sites or other unspecified operations must be in compliance with all State and Federal laws and regulations.

SECTION IV. TREATMENT AND DISPOSAL OF HUMAN WASTE

A. METHOD OF DISPOSAL. It is not lawful to discharge or dispose of human waste by any means or manner that violates any State or Federal law or regulation. All human excreta must be deposited in sanitary sewers, sewage treatment facilities, septic tank systems or other systems or devices adequate to meet the needs of the people being served. The discharge of either treated or untreated sewage into road ditches or right-of-ways is prohibited.

B. SUBMISSION OF PLANS. Detailed plans and specifications for the collection, treatment, and/or disposal facilities for all wastes of a domestic nature, containing a predominance of human excreta and exclusive of industrial or manufacturing wastes, shall be submitted to the Department. Plans for public sewer systems must be submitted to the Engineering Division of the Department for review. The plans for individual sewage disposal or treatment systems must be submitted to the Sanitarian Services Division of the Department or its authorized agent. All individual sewage disposal or treatment systems must be planned, designed, and constructed in accordance with the Department's Rules and Regulations Pertaining to Sewage Disposal Systems, Installers and Designated Representatives (ACA 14-236-101 thru 14-236-117). A permit for construction must be obtained prior to the construction, installation, modification or repair of an individual sewage disposal or treatment system.

C. CONNECTION TO PUBLIC SEWER REQUIRED. Connection to a public sewer system is required of all homes and businesses located within 300 feet and having adequate access. No privies, septic tank systems, individual sewage treatment systems or other receptacles for human excreta are to be constructed, maintained or used on premises connected to a public sewer system. Plumbing fixtures must be installed and maintained in accordance with the Arkansas State Plumbing Code.

D. OPERATION & MAINTENANCE OF INDIVIDUAL SEWAGE DISPOSAL AND/OR TREATMENT SYSTEMS. All individual Sewage Disposal and/or Treatment Systems must be operated and maintained in accordance with Department Rules and Regulations Pertaining to Individual Sewage Disposal Systems, Installers and Designated Representatives (ACA 14-236-101 thru 14-236-117). Property owners are responsible for the proper operation and maintenance of all sewage disposal, treatment or handling facilities located on their property. Discharges from sewage disposal or treatment facilities are prohibited unless specifically permitted by the Department or the Arkansas Department of Pollution Control & Ecology. All off-property discharges must be disinfected and meet current discharge standards. Property owners with off-property discharges must contact the Arkansas Department of Pollution Control and Ecology to obtain a National Pollutant Elimination System (NPDES) Permit.

E. SAFE LOCATION REQUIRED. All facilities used for the collection, treatment, disposal or handling of human excreta must be located on a suitable, well drained site and at a safe distance from any source of water supply. Both public and private water supplies must be protected from the possibility of surface or subsurface contamination. In order to meet this problem in a practical manner, these minimum distances are provided:

1. All facilites used for the collection, treatment and disposal of human excreta must be at least 100 feet from any domestic water well.

2. All facilities used for the collection, treatment and disposal of human excreta must be at least 300 feet from the high water mark of a water supply lake or water supply intake.

These distances are to be used only where ideal conditions are present. Greater distances will be required where local conditions demand. Requests for water well waivers must be submitted to the Department or its Authorized Agent.

F. DISPOSAL OF SEPTAGE. The settled contents of septic tanks and sludge from sewage treatment facilities must be disposed of in a manner approved by the Department or its Authorized Agent. The preferred method of disposal is into a public sewage treatment facility. This is the only method of disposal acceptable for holding tank contents. All persons, firms, corporations, or governmental agencies engaged in pumping or cleaning septic tanks or private owned sewage treatment facilities must be licensed by the Department (ACA 17-38-101 thru 17-38-105). The disposal or discharge of septage or holding tank wastes at an unapproved site or in a manner not approved by the Department is prohibited.

G. MARINE SANITATION DEVICE. The collection, treatment, handling or disposal of marine toilet wastes in any manner or method that violates State or Federal law or regulation is prohibited. All marine sanitation devices on craft operating on navigable rivers or water ways must be licensed by the United States Coast Guard or other appropriate federal agency. All marine sanitation devices on craft operating in lakes, or reservoirs either natural or impounded, must be of a no discharge design. The discharge of marine toilet wastes containing human excreta into lakes or reservoirs, either natural or impounded is prohibited.

H. PORTABLE TOILETS. Portable toilets are considered as sewage holding tanks or devices and are subject to Department's Regulations Pertaining to Septic Tank Cleaning Operations (ACA 17-38-101 thru 17-38-105).

1. Use required. Portable toilets must be provided, in adequate numbers, for all construction sites, work area, recreation areas, gatherings and other outdoor activities and events where 25 or more people are present for more than 4 hours and permanent toilets are not available. At least one portable toilet must be provided for every 100 persons or fraction thereof.

2. Maintenance. Portable toilets must be kept clean, properly ventilated and in good repair. The holding chamber must be pumped and recharged with a disinfectant solution on a regular basis to keep the unit operating as designed. Each portable toilet must have on display the owner's name, phone number and record of the last service date.

3. Licensing. All persons, firms, corporations, and governmental agencies engaged in the rental, leasing or maintenance of portable toilets must be a licensed septic tank cleaner (ACA 17-38-101 thru 17-38-105).

4. Waste Disposal. All wastes removed from portable toilets must be disposed of in a manner consistent with State and Federal guidelines and requirements. The discharge of portable toilet waste at an unapproved site or in a manner not approved by the Department is prohibited.

I. WELLS OR CISTERNS. The use of wells or cisterns for the disposal of sewage or any wastes containing human excreta is prohibited.

J. IRRIGATION, FERTILIZATION AND SOIL CONDITIONING. Neither human excreta nor any effluent or sludge from any type of sewage treatment facilitiy is to be used for irrigation, fertilization or soil conditioning unless approved by the Department or the Arkansas Department of Pollution Control and Ecology.

K. INSECT AND ANIMAL PROOF. All containers or receptables for human excreta or wastes must be constructed, maintained and used in a manner that excludes flies or other insects and animals.

L. ABANDONMENT OF SEPTIC TANKS. Septic tanks no longer in use must be pumped out by a licensed septic tank cleaner and filled with clean soil at the time of abandonment or connection of the residence or building to some other sewage treatment or disposal system.

SECTION V. GARBAGE, FOOD, GREASE, TRASH, REFUSE, DEAD ANIMALS, MANURE AND TOXIC SUBSTANCE DISPOSAL

A. It is prohibited to dispose of garbage, litter, food, grease, trash, refuse, dead animals or manure in any method or manner that violates State or Federal law or regulation.

B. Garbage, litter, trash, refuse, dead animals, manure and toxic substances must be disposed of in accordance with Arkansas Department of Pollution Control and Ecology regulations.

C. Food grease must be disposed of by a method and manner approved by the Deparment. All persons, firms, corporations or governmental agencies engaged in pumping grease traps, must hold a valid septic tank cleaning license issued by the Department.

D. STORAGE OF RESIDENTIAL GARBAGE. Residential garbage must be stored, until collection or disposal, in watertight containers. These containers must be provided with close fitting, insect proof covers. Garbage storage containers must be adequately maintained by the owner.

SECTION VI. PUBLIC TOILET FACILITES

MINIMUM STANDARDS. Public toilet facilities must be provided and maintained in accordance with the Arkansas State Plumbing Code, kept clean, adequately lighted, properly ventilated and in good repair.

Lavatories must be provided in all toilet rooms and supplied with an adequate supply of both hot and cold running water. The lavatory must be provided with a mixing valve or combination faucet to deliver the hot and cold running water.

Each lavatory must be provided with an adequate supply of hand cleaning soap or detergent and an adequate supply of sanitary towels or an approved hand drying device. Where disposable towels are used, an adequete waste receptacle must be located near the hand-washing facility. The use of a common towel is prohibited.

SECTION VII. CHILD CARE FACILITIES

All child care facilities must be operated in a clean sanitary manner and in compliance with all State and Federal laws, regulations and permitting requirements.

SECTION VIII. KEEPING OF ANIMALS

No person, firm, corporation or governmental agency is to keep or shelter fowls or animals in a manner that creates or maintains a public health nuisance.

All commercial animal and fowl operations must operate according to Livestock & Poultry Commission regulations.

SECTION IX. DRINKING WATER FOUNTAINS

A. Drinking fountains must dispense water at an angle, and the orifice must be protected by a mouth guard.

B. The lower edge of the orifice must be at an elevation not less than 3/4 inch above the flood level rim of the receptacle.

C. Drinking fountains attached to a lavoratory, sink, toilet or other dual purpose fixture are prohibited.

D. All drinking fountains must meet the requirements in the Arkansas State Plumbing Code.

E. The use of a common drinking cup is prohibited.

SECTION X. VECTOR AND RODENT CONTROL

A. MOSQUITO CONTROL. "No person, firm, corporation, or governmental agency is to allow conditions conducive to the breeding of mosquitoes in area where mosquito populations may cuase a public health nuisance.

B. FLY CONTROL. No person, firm, corporation or governmental agency is to allow conditions conducive to fly breeding on any property they own or lease.

C. RODENT CONTROL

   1. No person, firm, corporation or governmental agency is to allow conditions conducive to the feeding, breeding or harborage of rodents on any property they either own or lease. The keeping of rodents under sanitary conditions in connection with scientific research, commercial production or as pets is not prohibited.

   2. All exterior openings to buildings, both public and private, must be rodent proof. Manholes or other sewer access points must be maintained in a rodent proof condition.

3. All articles and materials stored outside of buildings must be a minimum of six inches off the ground or in a manner approved by the Department or its authorized agent. This does not apply to discarded items awaiting immediate removal.

D. PESTICIDE USE. It is prohibited to apply or use any pesticide, poison or chemical intended for pest control in any manner that violates label directions or intended use. All pesticide, poison, and chemical containers must be disposed of by an acceptable method and at an approved site.

SECTION XI. PENALTY

Every firm, person, or corporation violating any of the provisions of this chapter, or any of the orders, rules, or regulations made and promulgated in pursuance hereof, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punished by a fine of not less than one hundred dollars ($100) nor more than five hundred dollars ($500) or by imprisonment not exceeding one (1) month, or both. Each day of violation shall constitue a separate offense (ACA 20-7-101).

SECTION XII. SEVERABILITY

If any provision of these Rules and Regulations, or the application thereof to any person or circumstances is held invalid, such invalidity shall not affect other provisions or applications of these Rules and Regulations which can give effect without the invalid provisions or appplications, and to this end the provisions hereto are declared to be severable.

SECTION XIII. REPEALING CLAUSE

All Regulations and parts of Regulations in conflict herewith are hereby repealed.

SECTION XIV. CERTIFICATION

This will certify that the foregoing Rules and Regulations Pertaining to General Sanitation were adopted by the Arkansas Board of Health at a regular session of said Board held in Little Rock, Arkansas, on the 25th day of July, 1991.

M. Joycelyn Elders

M. Joycelyn Elders, M.D.
Director
Arkansas Department of Health

Dated at Little Rock, Arkansas 8-19-91

The foregoing Rules and Regulations, copy having been filed in my office, are hereby approved this 1st day of September, 1991.

Bill Clinton

Bill Clinton
Governor

APPENDIX G

GLOSSARY OF ACRONYMS

GLOSSARY OF ACRONYMS

ADH	-- Arkansas Department of Health
AWHPP	-- Arkansas Wellhead Protection Program
DOE	-- Division of Engineering (ADH)
DPC&E	-- Arkansas Department of Pollution Control & Ecology
EPA (USEPA)	-- Environmental Protection Agency
GIS	-- Geographic Information System
O&GC	-- Arkansas Oil & Gas Commission
PWS	-- Public Water System
PWSSP	-- Public Water Supply Supervision Program
SDWA	-- Safe Drinking Water Act
TOT	-- Time of Travel
USGS	-- United States Geological Survey
WHP	-- Wellhead Protection

Appendix B Arkansas Wellhead Protection Program

Addendum 1 With Supporting Documentation

(Note: Documents are on file at EPA Region 6)

Appendix C -- Index to Likely Sources of Contamination and Associated Contaminants

INTRODUCTION

The 1996 Amendments to the Safe Drinking Water Act recognized the critical role played by source water protection in ensuring high quality drinking water. Previously, the federal regulations focused on sampling and enforcement to identify and correct damage from contamination. Whereas the Act itself focused the quality of the delivered water, the Amendments emphasize the importance of protecting the source water.

Under the amendments to the Act, States must create Source Water Protection Programs. The programs must include an individual Source Water Assessment for each community water system regulated by the State. These assessments will determine whether an individual drinking water source is susceptible to contamination.

The benefits from source water protection are best understood by examining the cost of correcting damage from contamination. The value of protective activities are often recognized only after a community has to treat or remediate contamination in their source waters. Therefore, water systems should play an increasingly visible role in assessing their source water quality and developing source water protection plans.

To help water suppliers assess the quality of their source water we are providing a modified index developed by EPA. EPA created this index to help identify likely sources of contamination and the contaminants which may be associated with them. The index consists of two parts. The first part contains an alphabetical list of contaminants found in source waters in the United States and the sources that may produce them. The second part identifies sources of contaminants that are commonly found in watersheds in the United States, organized by general categories, such as commercial or industrial sources. Listed next to each source is an alphabetical inventory of contaminants that are likely to be used, generated by, disposed of, or stored at that source.

The index can serve as a field guide for people interested in watershed protection. For example, water supply operators may identify businesses when surveying their watershed, and be uncertain what contaminants those businesses may store, use, or generate. They can use the index to look up the industry or business and find a list of the contaminants associated with it. Conversely, if certain contaminants are detected in the watershed, the user can look up the contaminant in the index and find the industry or industries likely to be the source(s) of the problem.

List of Contaminants Found in Source Waters
&
The Sources that May Produce Them

Table **Pages**

APPENDIX C

List of Contaminants Found in Source Waters
&
The Sources that May Produce Them

Table **Pages**

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Inorganic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Antimony	0.006	0.006	**Commercial / Industrial**	Electrical / Electronic Manufacturing, Metal Plating / Finishing / Fabricating, Synthetics / Plastics Production
Arsenic	0.05	None	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Photo Processing / Printing, RV / Mini Storage, Research Laboratories, Retail Operations, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Golf Courses and Parks, Landfills / Dumps, Public Buildings and Civic Organizations, Schools, Utility Stations
Asbestos	7 million fibers per Liter	7 million fibers per Liter	**Commercial / Industrial**	Construction / Demolition

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Inorganic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Barium	2	2	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Office Building / Complex, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Production, Underground Storage Tanks, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Landfills / Dumps, Public Buildings and Civic Organizations, RV / Mini Storage, Schools, Utility Stations
Beryllium Powder	0.004	0.004	**Commercial / Industrial**	Research Laboratories
			Residential / Municipal	Public Buildings and Civic Organizations, Schools

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Inorganic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Cadmium	0.005	0.005	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Boat Repair / Refinishing, Chemical / Petroleum Processing, Construction / Demolition, Drinking Water Treatment, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Military Installations, Office Building / Complex, Photo Processing / Printing, Medical / Vet Offices, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Underground Storage Tanks Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Landfills / Dumps, Public Buildings and Civic Organizations, Schools, Utility Stations, Wastewater
Chromium	0.1	0.1	**Commercial / Industrial**	Metal Plating / Finishing / Fabricating

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Inorganic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Copper	TT[3]	1.3	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
Cyanide	0.2	0.2	**Commercial / Industrial**	Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers
			Residential / Municipal	Drinking Water Treatment, Public Buildings and Civic Organizations, Schools, RV / Mini Storage, Utility Stations
Fluoride	4	4	**Commercial / Industrial**	Construction / Demolition

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Lead	TT	0.015	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Boat Repair / Refinishing, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Mines / Gravel Pits, Office Building / Complex, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Underground Storage Tanks, Wholesale Distribution Activities, Wood Preserving / Treating, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Drinking Water Treatment, Golf Courses and Parks, Landfills / Dumps, Public Buildings and Civic Organizations, Schools, Utility Stations, Wastewater

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Inorganic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Mercury	0.002	0.002	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Boat Repair / Refinishing, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Office Building / Complex, Photo Processing / Printing, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Landfills / Dumps, Public Buildings and Civic Organizations, RV / Mini Storage, Schools, Utility Stations, Wastewater
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
Nitrate	10	10	**Commercial / Industrial**	Boat Repair / Refinishing, Historic Waste Dumps / Landfills
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Landfills / Dumps, Septic Systems Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Crops - Irrigated + Non-irrigated, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Nitrite	1	1	**Commercial / Industrial**	Boat Repair / Refinishing, Historic Waste Dumps / Landfills

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Inorganic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Landfills / Dumps, Septic Systems, Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads, Crops - Irrigated + Non-irrigated
Selenium	0.05	0.05	**Commercial / Industrial**	Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Furniture Repair / Manufacturing, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Mines / Gravel Pits, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Landfills / Dumps, Public Buildings and Civic Organizations, Schools, Wastewater
Thallium	0.002	0.0005	**Commercial / Industrial**	Electrical / Electronic Manufacturing, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Research Laboratories

(Notes)
[1]MCL - Maximum Contaminant Level; HAL - Health Advisory Limit
[2]MCLG - Maximum Contaminant Level Goal
[3]TT- Treatment Technique
[4] No more than 5.0% of samples should detect total coliforms in one month. Every system that detects total coliform must be analyzed for fecal coliforms.

- **BOLD** Denotes contaminant is on the Drinking Water Contaminant Candidate List

APPENDIX C

List of Contaminants Found in Source Waters
&
The Sources that May Produce Them

Table **Pages**

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Microbiological Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Coliform	5.0%[4]	Zero	**Commercial / Industrial**	Boat Repair / Refinishing
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Housing, Septic Systems, Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Lagoons and Liquid Waste, Rural Homesteads
Giardia Lamblia	zero	TT[3]	**Commercial / Industrial**	Boat Repair / Refinishing
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Housing, Septic Systems, Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Lagoons and Liquid Waste, Rural Homesteads,
Legionella	zero	TT	**All**	Surface Water
Viruses	TT	N/A	**Commercial / Industrial**	Boat Repair / Refinishing
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Housing, Septic Systems, Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Lagoons and Liquid Waste Rural Homesteads

Notes:

[1]MCL - Maximum Contaminant Level; HAL - Health Advisory Limit
[2]MCLG - Maximum Contaminant Level Goal
[3]TT- Treatment Technique

- **BOLD** Denotes contaminant is on the Drinking Water Contaminant Candidate List

APPENDIX C

List of Contaminants Found in Source Waters
&
The Sources that May Produce Them

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Organic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Alachlor	0.002	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Historic Waste Dumps / Landfills, Injection Wells
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Landfills / Dumps, Septic Systems Wells
			Agricultural / Rural	Injection Wells, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Atrazine	0.003	0.003	**Commercial / Industrial**	Chemical / Petroleum Processing, Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Office Building / Complex, Railroad Yards
			Residential / Municipal	Apartments and Condominiums, Drinking Water Treatment, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Schools, Septic Systems, Utility Stations, Wells
			Agricultural / Rural	Injection Wells, Lagoons and Liquid Waste, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Organic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Benzene	0.005	zero	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Boat Repair / Refinishing, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Office Building / Complex, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetic / Plastics Production, Synthetics / Plastics Producers, Underground Storage Tanks, Wholesale Distribution Activities, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Drinking Water Treatment, Golf Courses and Parks, Landfills / Dumps, Public Buildings and Civic Organizations, Utility Stations, Schools
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
Benzo(a)pyrene	0.0002	zero	**Commercial / Industrial**	Fleet / Trucking / Bus Terminals
Carbofuran	0.04	0.04	**Commercial / Industrial**	Chemical / Petroleum Processing, Historic Waste Dumps / Landfills, Injection Wells
			Residential / Municipal	Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads,

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Organic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Carbon Tetrachloride	0.005	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Public Buildings and Civic Organizations, Schools
Chlordane	0.002	zero	**Agricultural / Rural**	Pesticide / Fertilizer / Petroleum Storage Sites
Chlorobenzene	0.1	0.1	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Military Installations, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers
			Residential / Municipal	Golf Courses and Parks, Public Buildings and Civic Organizations, Schools, Utility Stations
2,4-D	0.07	0.07	**Commercial / Industrial**	Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals, Machine Shops, Retail Operations, Office Building / Complex
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Pesticide / Fertilizer / Petroleum Storage Sites
			Residential / Municipal	Golf Courses and Parks, Public Buildings and Civic Organizations, RV / Mini Storage, Schools, Utility Stations
Dalapon	0.2	0.2	**Commercial / Industrial**	Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Railroad Yards

Contaminant Name	**MCL or HAL**[1]	**MCLG**[2] **(if applicable)**	Source	
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Housing, Injection Wells, Septic Systems, Transportation Corridors, Utility Stations, Wells, Golf Courses and Parks
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Injection Wells, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Di(2-ethylhexyl) adipate	0.4	0.4	**Commercial / Industrial**	Chemical / Petroleum Processing, Hardware / Lumber / Parts Stores, Metal Plating / Finishing / Fabricating, Synthetics / Plastics Producers
Di(2-ethylhexyl) phthalate	.006	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Photo Processing / Printing, Synthetics / Plastics Producers
			Residential / Municipal	Public Buildings and Civic Organizations
Dibromochloropropane	0.0002	zero	**Agricultural / Rural**	Pesticide / Fertilizer / Petroleum Storage Sites
1,2-Dibromoethane or Ethylene Dibromide (EDB)	0.00005	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Photo Processing / Printing
			Residential / Municipal	Public Buildings and Civic Organizations
1,4-Dichlorobenzene or P-Dichlorobenzene	0.075	0.075	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals, Hardware / Lumber / Parts Stores, Machine Shops, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Synthetics / Plastics Producers, Underground Storage Tanks
			Residential / Municipal	Public Buildings and Civic Organizations, Schools Utility Stations

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Organic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
1,2-Dichlorobenzene or O-Dichlorobenzene	0.6	0.6	**Commercial / Industrial**	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Home Manufacturing, Military Installations, Photo Processing / Printing, Synthetic / Plastics Production, Office Building / Complex
1,2-Dichloroethane or Ethylene Dichloride	0.005	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Furniture Repair / Manufacturing, Machine Shops, Medical / Vet Offices, Military Installations, Office Building / Complex, Photo Processing / Printing, Synthetic / Plastics Production, Research Laboratories, Retail Operations
			Residential / Municipal	Public Buildings and Civic Organizations, Schools, Wood / Pulp / Paper Processing, Utility Stations
1,1-Dichloroethylene or Vinylidene Chloride	0.007	0.007	**Commercial / Industrial**	Chemical / Petroleum Processing, Machine Shops, Photo Processing / Printing, Research Laboratories
cis 1,2 - Dichloroethylene	0.07	0.07	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Gas Stations, Historic Waste Dumps / Landfills, Home Manufacturing, Injection Wells, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Military Installations, Motor Pools, Photo Processing / Printing, Synthetic / Plastics Production, Railroad Yards, Research Laboratories, Wood Preserving / Treating

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Injection Wells, Landfills / Dumps, Utility Stations, Wastewater
			Agricultural / Rural	Injection Wells, Rural Homesteads
trans 1,2 - Dichloroethylene			**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Gas Stations, Historic Waste Dumps / Landfills, Home Manufacturing, Injection Wells, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Military Installations, Motor Pools, Photo Processing / Printing, Synthetic / Plastics Production, Railroad Yards, Research Laboratories, Wood Preserving / Treating
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Injection Wells, Landfills / Dumps, Utility Stations, Wastewater
			Agricultural / Rural	Injection Wells

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Dichloromethane or Methylene Chloride	0.005	zero	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Funeral Services / Graveyards, Fleet / Trucking / Bus Terminals, Food Processing, Gas Stations, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Motor Pools, Office Building / Complex, Photo Processing / Printing, Railroad Yard / Maintenance / Fueling Areas, Research Laboratories, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Public Buildings and Civic Organizations, Schools
Dinoseb	0.007	0.007	**Agricultural / Rural**	Crops - Irrigated + Non-irrigated
Dioxin	0.00000003	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Wood / Pulp / Paper Processing
Diquat	0.1	0.1	**Commercial / Industrial**	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Junk / Scrap / Salvage Yards, Injection Wells, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Landfills / Dumps, Schools, Septic Systems, Wells, Camp Grounds / RV Parks, Golf Courses and Parks
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Injection Wells, Lagoons and Liquid Waste, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Endothall	0.1	0.1	**Residential / Municipal**	Injection Wells, Public Buildings and Civic Organizations, Schools

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Organic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Endrin	0.002	0.002	**Commercial / Industrial**	Chemical / Petroleum Processing, Research Laboratories
			Residential / Municipal	Public Buildings and Civic Organizations, RV / Mini Storage, Schools
Ethylbenzene	0.7	0.7	**Commercial / Industrial**	Cement / Concrete Plants, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Office Building / Complex, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas)
Glyphosate	0.7	0.7	**Commercial / Industrial**	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Schools, Septic Systems, Wells
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Injection Wells, Lagoons and Liquid Waste, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Heptachlor (and Epoxide)	0.0004 (0.0002)	zero	**Commercial / Industrial**	Fleet / Trucking / Bus Terminals, Photo Processing / Printing
			Residential / Municipal	Wells
Hexachlorobenzene	0.001	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Machine Shops, Military Installations, Photo Processing / Printing, Synthetics / Plastics Producers
Hexachlorocyclopentadiene	0.05	0.05	**Commercial / Industrial**	Chemical / Petroleum Processing

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Organic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Lindane	0.0002	0.0002	**Commercial / Industrial**	Construction / Demolition, Fleet / Trucking / Bus Terminals, Photo Processing / Printing
			Residential / Municipal	Landfills / Dumps, Public Buildings and Civic Organizations
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
Methoxychlor	0.04	0.04	**Commercial / Industrial**	Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals, Medical / Vet Offices, Military Installations, Photo Processing / Printing
			Residential / Municipal	Golf Courses and Parks, Public Buildings and Civic Organizations, RV / Mini Storage
Oxamyl (Vydate)	0.2	0.2	**Commercial / Industrial**	Chemical / Petroleum Processing, Historic Waste Dumps / Landfills, Injection Wells
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Lagoons and Liquid Waste, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Pentachlorophenol	0.001	zero	**Commercial / Industrial**	Fleet / Trucking / Bus Terminals, Food Processing, Machine Shops, Metal Plating / Finishing / Fabricating, Synthetics / Plastics Producers
Picloram	0.5	0.5	**Commercial / Industrial**	Historic Waste Dumps / Landfills, Injection Wells
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Transportation Corridors, Utility Stations, Wells,
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Injection Wells, Lagoons and Liquid Waste, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Organic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Polychlorinated Biphenyls	.0005	zero	**Commercial / Industrial**	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Research Laboratories, Wood / Pulp / Paper Processing
			Residential / Municipal	Drinking Water Treatment
Propylene Dichloride or 1,2-Dichloropropane	0.005	zero	**Commercial / Industrial**	Fleet / Trucking / Bus Terminals, Photo Processing / Printing
Simazine	0.004	0.004	**Commercial / Industrial**	Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Transportation Corridors, Utility Stations Wells
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Lagoons and Liquid Waste, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Styrene	0.1	0.1	**Commercial / Industrial**	Cement / Concrete Plants, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Home Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Retail Operations, Synthetics / Plastics Producers, Wholesale Distribution Activities, Wood / Pulp / Paper Processing

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Tetrachloroethylene or Perchlorethylene (Perk)	0.005	zero	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Drinking Water Treatment, Dry Cleaners / Dry Cleaning, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals Food Processing, Gas Stations, Hardware / Lumber / Parts Stores, Historic Waste Dumps / Landfills, Home Manufacturing, Injection Wells, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Mines / Gravel Pits, Motor Pools, Office Building / Complex, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Injection Wells, Public Buildings and Civic Organizations, Schools, Utility Stations, Wastewater

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Toluene	1	1	**Commercial / Industrial**	Cement / Concrete Plants, Chemical / Petroleum Processing, Drinking Water Treatment, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Research Laboratories, Synthetics / Plastics Producers, Retail Operations, Office Building / Complex, Photo Processing / Printing, Wood / Pulp / Paper Processing
			Residential / Municipal	Public Buildings and Civic Organizations, Schools, Utility Stations
Total Trihalomethanes	0.1	None	**Residential / Municipal**	Drinking Water Treatment
Toxaphene	0.003	zero	**Commercial / Industrial**	Fleet / Trucking / Bus Terminals
2,4,5-TP (Silvex)	0.05	0.05	**Commercial / Industrial**	Medical / Vet Offices
			Agricultural / Rural	Pesticide / Fertilizer / Petroleum Storage Sites
1,2,4-Trichlorobenzene	0.07	0.07	**Commercial / Industrial**	Chemical / Petroleum Processing
1,1,2-Trichloroethane	0.005	0.003	**Commercial / Industrial**	Dry Cleaners / Dry Cleaning, Electrical / Electronic Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Photo Processing / Printing

Contaminant Name	**MCL or HAL[1]**	**MCLG[2] (if applicable)**	Source	
1,1,1-Trichloroethane or Methyl Chloroform	0.2	0.2	**Commercial / Industrial**	Body Shops/Repair Shops, Chemical / Petroleum Processing, Dry Cleaners / Dry Cleaning, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Mines / Gravel Pits, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Retail Operations, Wholesale Distribution Activities, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Construction / Demolition Areas, Drinking Water Treatment, Landfills / Dumps, Naturally Occurring, Public Buildings and Civic Organizations, Schools
Trichloroethylene or TCE	0.005	zero	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Historic Waste Dumps / Landfills, Home Manufacturing, Injection Wells, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Military Installations, Motor Pools, Office Building / Complex, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Synthetics / Plastics Producers, Underground Storage Tanks, Wood / Pulp / Paper Processing

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Injection Wells, Public Buildings and Civic Organizations, Schools, Utility Stations
Vinyl Chloride	0.002	zero	**Commercial / Industrial**	Boat Repair / Refinishing, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Fleet / Trucking / Bus Terminals, Research Laboratories, Retail Operations, Synthetic / Plastics Production
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks Housing, Public Buildings and Civic Organizations, Septic Systems, Waste Transfer / Recycling Wastewater
			Agricultural / Rural	Confined Animal Feeding Operations Lagoons and Liquid Waste, Rural Homesteads
Xylene (Mixed Isomers)	10	10	**Commercial / Industrial**	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Production, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Public Buildings and Civic Organizations, Schools, Utility Stations,

Notes:
[1]MCL - Maximum Contaminant Level; HAL - Health Advisory Limit [2]MCLG - Maximum Contaminant Level Goal

- **BOLD** Denotes contaminant is on the Drinking Water Contaminant Candidate List

APPENDIX C

List of Contaminants Found in Source Waters
&
The Sources that May Produce Them

Table **Pages**

NATIONAL PRIMARY DRINKING WATER REGULATIONS
Other Contaminants

Contaminant Name	**MCL or HAL[1]**	**MCLG[2] (if applicable)**	Source	
Beta particles and photon emitters*	Beta: 4 millirems per year;	none	**Commercial / Industrial**	Medical / Vet Offices, Military Installations, Naturally Occurring
Gross Alpha particle activity	15 pCi/L per year;	none	same as above	same as above
Radium 226 & Radium 228 (combined)	5 pCi/L per year	none	same as above	same as above
Turbidity	TT[3]	N/A	**Commercial / Industrial**	Construction / Demolition, Home Manufacturing, Mines / Gravel Pits
			Residential / Municipal	Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Transportation Corridors
			Agricultural / Rural	Crops - Irrigated + Non-irrigated, Managed Forests

Notes:

[1]MCL - Maximum Contaminant Level; HAL - Health Advisory Limit
[2]MCLG - Maximum Contaminant Level Goal
[3]TT- Treatment Technique

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APPENDIX C

List of Contaminants Found in Source Waters
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Table **Pages**

OTHER CONTAMINANTS OF CONCERN
Inorganic Contaminants

Contaminant Name	**MCL or HAL**[1]	**MCLG**[2] **(if applicable)**	Source	
Ammonia			Residential / Municipal	Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Mines / Gravel Pits, Office Building / Complex, Photo Processing / Printing, Retail Operations, Wood / Pulp / Paper Processing, Synthetic / Plastics Production
			Residential / Municipal	Landfills / Dumps
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
Ammoniacal Copper Arsenate			Commercial / Industrial	Boat Repair / Refinishing, Construction / Demolition, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Railroad Yards, Wood Preserving / Treating, Wood / Pulp / Paper Processing
Ammonium Persulfate			Commercial / Industrial	Automobile Body Shops / Repair Shops, Electrical / Electronic Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating
Boric Acid			Commercial / Industrial	Electrical / Electronic Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Synthetic / Plastics Production
			Residential / Municipal	Utility Stations
Bromine			Commercial / Industrial	Injection Wells
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Rural Homesteads

OTHER CONTAMINANTS OF CONCERN
Inorganic Contaminants

Contaminant Name	**MCL or HAL[1]**	**MCLG[2] (if applicable)**	Source	
Calcium Fluoride			Commercial / Industrial	Electrical / Electronic Manufacturing
Calcium Hypochlorate			Commercial / Industrial	Injection Wells
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Rural Homesteads
Chlorine			Commercial / Industrial	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Injection Wells, Machine Shops, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Railroad Yards / Maintenance / Fueling Areas, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Apartments and Condominiums, Housing, Injection Wells, Landfills / Dumps, Public Buildings and Civic Organizations, Schools, Utility Stations
			Agricultural / Rural	Injection Wells, Rural Homesteads
Chlorine Dioxide			Commercial / Industrial	Chemical / Petroleum Processing, Wood / Pulp / Paper Processing
Chromated Copper Arsenic			Commercial / Industrial	Boat Repair / Refinishing, Construction / Demolition, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Railroad Yards, Wood Preserving / Treating, Wood / Pulp / Paper Processing
Chromic Acid			Commercial / Industrial	Wood / Pulp / Paper Processing

OTHER CONTAMINANTS OF CONCERN
Inorganic Contaminants

Contaminant Name	**MCL or HAL[1]**	**MCLG[2] (if applicable)**	Source	
Hydrochloric Acid or Muriatic Acid			Commercial / Industrial	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Injection Wells, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Mines / Gravel Pits, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Apartments and Condominiums, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Rural Homesteads
Hydrogen Peroxide			Commercial / Industrial	Chemical / Petroleum Processing
Iodine			Commercial / Industrial	Injection Wells, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Rural Homesteads
Nickel	0.01	0.01	Commercial / Industrial	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Synthetics / Plastics Producers

OTHER CONTAMINANTS OF CONCERN
Inorganic Contaminants

Contaminant Name	**MCL or HAL[1]**	**MCLG[2] (if applicable)**	Source	
Nitric Acid			Commercial / Industrial	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Junk / Scrap / Salvage Yards, Machine Shops, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Agricultural / Rural	Confined Animal Feeding Operations
Peroxide			Commercial / Industrial	Dry Cleaners / Dry Cleaning, Historic Waste Dumps / Landfills, Injection Wells, Synthetic / Plastics Production
			Residential / Municipal	Injection Wells, Landfills / Dumps, Septic Systems, Wells
Phosphates			Commercial / Industrial	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Schools, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads

OTHER CONTAMINANTS OF CONCERN
Inorganic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Phosphoric Acid Ortho-			Commercial / Industrial	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing Machine Shops, Metal Plating / Finishing / Fabricating, Mines / Gravel Pits, Office Building / Complex, Photo Processing / Printing, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Drinking Water Treatment
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
Phosphorus			Commercial / Industrial	Pesticide / Fertilizer / Petroleum Storage Sites
Potassium Alum (dodecahydrate)			Commercial / Industrial	Medical / Vet Offices, Research Laboratories
Potassium Bromide			Commercial / Industrial	Medical / Vet Offices, Research Laboratories
Sodium			Residential / Municipal	Transportation Corridors, Utility Stations
Sodium Carbonate			Commercial / Industrial	Injection Wells, Medical / Vet Offices Research Laboratories
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Rural Homesteads
Sodium Chloride			Commercial / Industrial	Transportation Corridors, Utility Stations

OTHER CONTAMINANTS OF CONCERN
Inorganic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Sodium Cyanide			Commercial / Industrial	Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Furniture Repair / Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Synthetic / Plastics Production, Research Laboratories, Retail Operations
			Residential / Municipal	Public Buildings and Civic Organizations, Schools, Utility Stations
Sodium Hypochlorate			Commercial / Industrial	Injection Wells
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Rural Homesteads
Sodium Sulfite			Commercial / Industrial	Medical / Vet Offices, Research Laboratories
Sulfuric Acid			Commercial / Industrial	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Drinking Water Treatment, Landfills / Dumps, Public Buildings and Civic Organizations, Research Laboratories, Retail Operations, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing

OTHER CONTAMINANTS OF CONCERN
Inorganic Contaminants

Contaminant Name	**MCL or HAL[1]**	**MCLG[2] (if applicable)**	Source	
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
Thiosulfates			Commercial / Industrial	Medical / Vet Offices, Research Laboratories
Tin			Commercial / Industrial	Automobile Body Shops / Repair Shops, Furniture Repair / Manufacturing, Historic Waste Dumps / Landfills, Injection Wells, Machine Shops, Metal Plating / Finishing / Fabricating, Mines / Gravel Pits, Junk / Scrap / Salvage Yards
			Residential / Municipal	Landfills / Dumps, Injection Wells, Utility Stations, Wastewater, Wells
Zinc (Fume or Dust)			Commercial / Industrial	Chemical / Petroleum Processing, Construction / Demolition, Electrical / Electronic Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, Synthetic / Plastics Production

Notes:
[1]MCL - Maximum Contaminant Level; HAL - Health Advisory Limit [2]MCLG - Maximum Contaminant Level Goal

- **BOLD:** Denotes contaminant is on the Drinking Water Contaminant Candidate List. Contaminant Candidate List are contaminants under consideration for federal regulation or guideline development.

APPENDIX C

List of Contaminants Found in Source Waters
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OTHER CONTAMINANTS OF CONCERN
Microbiological Contaminants

Contaminant Name	**MCL or HAL[1]**	**MCLG[2] (if applicable)**	Source	
Cryptosporidium			Commercial / Industrial	Boat Repair / Refinishing
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Housing, Septic Systems, Waste Transfer / Recycling, Wastewater
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Lagoons and Liquid Waste, Rural Homesteads

Notes:

[1]MCL - Maximum Contaminant Level; HAL - Health Advisory Limit
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OTHER CONTAMINANTS OF CONCERN
Organic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Acetone			Commercial / Industrial	Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Retail Operations, Synthetic / Plastics Production, Wood / Pulp / Paper Processing
			Agricultural / Rural	Crops - Irrigated + Non-irrigated
			Residential / Municipal	Public Buildings and Civic Organizations, Schools, Utility Stations
Acetylene			Commercial / Industrial	Metal Plating / Finishing / Fabricating
Acrylamide			Commercial / Industrial	Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals, Medical / Vet Offices, Photo Processing / Printing
			Residential / Municipal	Public Buildings and Civic Organizations, Schools
Amyl Acetate			Commercial / Industrial	Dry Cleaners / Dry Cleaning, Electrical / Electronic Manufacturing
Benomyl			Commercial / Industrial	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Office Building / Complex, Research Laboratories
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Landfills / Dumps, Schools, Septic Systems, Wells
			Agricultural / Rural	Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads

OTHER CONTAMINANTS OF CONCERN
Organic Contaminants

Contaminant Name	**MCL or HAL**[1]	**MCLG**[2] **(if applicable)**	Source	
Chloroform			Commercial / Industrial	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Photo Processing / Printing, RV / Mini Storage, Synthetics / Plastics Producers, Research Laboratories, Wood / Pulp / Paper Processing
			Residential / Municipal	Public Buildings and Civic Organizations Schools, Utility Stations, Wastewater
Chlorpyrifos			Commercial / Industrial	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Landfills / Dumps, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing, Injection Wells, Schools, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Copper Quinolate			Commercial / Industrial	Boat Repair / Refinishing, Construction / Demolition, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Railroad Yards, Wood Preserving / Treating, Wood / Pulp / Paper Processing
Creosote			Commercial / Industrial	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals, Machine Shops, Wood Preserving / Treating
			Residential / Municipal	Schools, Utility Stations

OTHER CONTAMINANTS OF CONCERN
Organic Contaminants

Contaminant Name	**MCL or HAL[1]**	**MCLG[2] (if applicable)**	Source	
Cyanuric Acid			Commercial / Industrial	Injection Wells
			Residential / Municipal	Apartments and Condominiums, Housing, Injection Wells, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Rural Homesteads
Epichlorohydrin			Commercial / Industrial	Chemical / Petroleum Processing, Fleet / Trucking / Bus Terminals
Epoxy			Commercial / Industrial	Boat Repair / Refinishing, Construction / Demolition, Furniture Repair / Manufacturing, Wood Preserving / Treating, Wood / Pulp / Paper Processing, Historic Waste Dumps / Landfills, Home Manufacturing, Junk / Scrap / Salvage Yards
			Residential / Municipal	Apartments and Condominiums, Housing, Landfills / Dumps
Ethane			Commercial / Industrial	Chemical / Petroleum Processing
Ethylene			Commercial / Industrial	Chemical / Petroleum Processing
Ethylene Glycol			Commercial / Industrial	Automobile Body Shops / Repair Shops, Cement / Concrete Plants, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Hardware / Lumber / Parts Stores, Junk / Scrap / Salvage Yards, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Airports (Maintenance / Fueling Areas), Landfills / Dumps

OTHER CONTAMINANTS OF CONCERN
Organic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Flourocarbon 113 (Freon) or 112-trichloro-122-trifluoroethane			Commercial / Industrial	Dry Cleaners / Dry Cleaning, Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers
			Residential / Municipal	Airports (Maintenance / Fueling Areas)
			Agricultural / Rural	Confined Animal Feeding Operations
Formaldehyde (K157)			Commercial / Industrial	Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Home Manufacturing, Machine Shops, Medical / Vet Offices, Wood Preserving / Treating, Wood / Pulp / Paper Processing, Metal Plating / Finishing / Fabricating, Office Building / Complex, Synthetics / Plastics Producers, Photo Processing / Printing, Research Laboratories
			Residential / Municipal	Public Buildings and Civic Organizations, RV / Mini Storage, Schools, Utility Stations
Hexachlorophene			Commercial / Industrial	Electrical / Electronic Manufacturing
Hydrogen Cyanide			Commercial / Industrial	Machine Shops, Metal Plating / Finishing / Fabricating
Hydroquinone			Commercial / Industrial	Chemical / Petroleum Processing, Photo Processing / Printing, Synthetics / Plastics Producers
Isopropanol			Commercial / Industrial	Boat Repair / Refinishing, Injection Wells, Office Building / Complex, Junk / Scrap / Salvage Yards

OTHER CONTAMINANTS OF CONCERN
Organic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Schools, Housing, Injection Wells, Landfills / Dumps, Septic Systems, Wastewater, Wells
				Injection Wells, Rural Homesteads
Isopropyl Alcohol (Manufacturing Strong-acid Process)			Commercial / Industrial	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Machine Shops, Metal Plating / Finishing / Fabricating, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers, Wood / Pulp / Paper Processing
			Residential / Municipal	Drinking Water Treatment
Kerosene			Commercial / Industrial	Chemical / Petroleum Processing, Synthetics / Plastics Producers
Methane			Residential / Municipal	Landfills / Dumps, Septic Systems
			Agricultural / Rural	Lagoons and Liquid Waste
Methanol			Commercial / Industrial	Cement / Concrete Plants, Chemical / Petroleum Processing, Construction / Demolition, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Hardware / Lumber / Parts Stores, Home Manufacturing, Injection Wells, Machine Shops, Medical / Vet Offices, Metal Plating / Finishing / Fabricating, Military Installations, Office Building / Complex, Photo Processing / Printing, Research Laboratories, Synthetics / Plastics Producers, Retail Operations, Wood / Pulp / Paper Processing
			Residential / Municipal	Injection Wells, Public Buildings and Civic Organizations, Schools, Utility Stations

OTHER CONTAMINANTS OF CONCERN
Organic Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
Nitrosamine			Commercial / Industrial	Funeral Services / Graveyards, Historic Waste Dumps / Landfills, Injection Wells, Junk / Scrap / Salvage Yards, Office Building / Complex
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Golf Courses and Parks, Housing Injection Wells, Landfills / Dumps, Schools, Septic Systems, Wells
			Agricultural / Rural	Injection Wells, Managed Forests, Pesticide / Fertilizer / Petroleum Storage Sites, Rural Homesteads
Polyurethane			Commercial / Industrial	Boat Repair / Refinishing, Construction / Demolition, Furniture Repair / Manufacturing, Hardware / Lumber / Parts Stores, Home Manufacturing, Railroad Yards, Wood Preserving / Treating, Wood / Pulp / Paper Processing
Strychnine			Commercial / Industrial	Machine Shops
			Residential / Municipal	Public Buildings and Civic Organizations, Schools
			Commercial / Industrial	Pesticide / Fertilizer / Petroleum Storage Sites
1,1,2,2-Tetrachloroethane			Commercial / Industrial	Automobile Body Shops / Repair Shops, Chemical / Petroleum Processing, Construction / Demolition, Fleet / Trucking / Bus Terminals, Furniture Repair / Manufacturing, Gas Stations, Junk / Scrap / Salvage Yards, Metal Plating / Finishing / Fabricating, Motor Pools, Photo Processing / Printing, Synthetics / Plastics Producers

OTHER CONTAMINANTS OF CONCERN
Organic Contaminants

Contaminant Name	**MCL or HAL[1]**	**MCLG[2] (if applicable)**	Source	
Toluenediisocyanate (Mixed Isomers)			Commercial / Industrial	Chemical / Petroleum Processing, Dry Goods Manufacturing, Electrical / Electronic Manufacturing, Fleet / Trucking / Bus Terminals, Food Processing, Machine Shops, Photo Processing / Printing Research, Laboratories, Synthetics / Plastics Producers
			Residential / Municipal	Public Buildings and Civic Organizations, Schools

Notes:

[1]MCL - Maximum Contaminant Level; HAL - Health Advisory Limit
[2]MCLG - Maximum Contaminant Level Goal

BOLD Denotes contaminant is on the Drinking Water Contaminant Candidate List. Contaminant Candidate List is contaminants under consideration for federal regulation or guideline development.

APPENDIX C

List of Contaminants Found in Source Waters
&
The Sources that May Produce Them

Table **Pages**

NATIONAL SECONDARY DRINKING WATER REGULATIONS
Secondary Contaminants

Contaminant Name	**MCL or HAL[1]**	**MCLG[2] (if applicable)**	Source	
Aluminum (Fume or Dust)	0.05 to 0.2		Commercial / Industrial	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Hardware / Lumber / Parts Stores, Machine Shops, Metal Plating / Finishing / Fabricating, Photo Processing / Printing
Chloride	250		Commercial / Industrial	Construction / Demolition
Fluoride	2.0		Commercial / Industrial	Automobile Body Shops / Repair Shops, Injection Wells, Machine Shops, Metal Plating / Finishing / Fabricating
			Residential / Municipal	Drinking Water Treatment, Injection Wells, Wastewater, Wells
Iron	0.3		Commercial / Industrial	Historic Waste Dumps / Landfills, Junk / Scrap / Salvage Yards, Naturally Occurring
			Residential / Municipal	Naturally Occurring
			Agricultural / Rural	Naturally Occurring
Manganese	0.05		Commercial / Industrial	Historic Waste Dumps / Landfills, Junk / Scrap / Salvage Yards, Naturally Occurring
			Residential / Municipal	Naturally Occurring
Silver	0.1		Commercial / Industrial	Medical / Vet Offices, Naturally Occurring
			Residential / Municipal	Naturally Occurring
			Agricultural / Rural	Naturally Occurring
Sulfate	500	250	Commercial / Industrial	Chemical / Petroleum Processing, Electrical / Electronic Manufacturing, Historic Waste Dumps / Landfills, Metal Plating / Finishing / Fabricating, Mines / Gravel Pits, Wood Preserving / Treating, Injection Wells, Junk / Scrap / Salvage Yards

NATIONAL SECONDARY DRINKING WATER REGULATIONS
Secondary Contaminants

Contaminant Name	MCL or HAL[1]	MCLG[2] (if applicable)	Source	
			Residential / Municipal	Apartments and Condominiums, Camp Grounds / RV Parks, Injection Wells, Septic Systems, Wastewater, Wells
			Agricultural / Rural	Auction Lots / Boarding Stables, Confined Animal Feeding Operations, Injection Wells, Lagoons and Liquid Waste, Rural Homesteads

Notes:
[1]MCL - Maximum Contaminant Level; HAL - Health Advisory Limit [2]MCLG - Maximum Contaminant Level Goal

- Secondary drinking water contaminants are unenforceable federal guidelines regarding taste, odor, color and other non-aesthetic effects of drinking water.

Sources of Contaminants Commonly Found in Watersheds or Recharge Zones

Table **Pages**

APPENDIX C

Sources of Contaminants Commonly Found in Watersheds or Recharge Zones

Commercial / Industrial

Source	Contaminant*
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**, Fluoride, **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)**
Boat Repair/Refinishing	Ammoniacal Copper Arsenate, **Benzene**, **Cadmium**, Chromated Copper Arsenic, **Coliform**, Copper Quinolate, Cryptosporidium, Epoxy, ***Giardia Lamblia***, Isopropanol, **Lead**, **Mercury**, **Nitrate**, **Nitrite**, Polyurethane, **Vinyl Chloride**, Viruses
Cement/Concrete Plants	Acetone, **Barium**, **Benzene**, **Dichloromethane or Methylene Chloride**, **Ethylbenzene**, Ethylene Glycol, **Lead**, Methanol, **Styrene**, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, **Xylene (Mixed Isomers)**
Chemical/Petroleum Processing	Acetone, **Acrylamide**, **Arsenic**, **Atrazine**, **Alachlor**, Aluminum (Fume or Dust), Ammonia, **Barium**, **Benzene**, **Cadmium**, **Carbofuran**, **Carbon Tetrachloride**, Chlorine, Chlorine Dioxide, **Chlorobenzene**, Chloroform, **Copper**, Creosote, **Cyanide**, Captan, **2,4-D**, **1,2-Dibromoethane or Ethylene Dibromide (EDB)**, 1,2-Dichlorobenzene or O-Dichlorobenzene, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **1,1-Dichloroethylene or Vinylidene Chloride**, cis 1,2 Dichloroethylene, **Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) adipate**, **Di(2-ethylhexyl) phthalate**, **1,2-Dichloroethane or Ethylene Dichloride**, **Dioxin**, **Endrin**, **Epichlorohydrin**, Ethane, Ethylenzene, Ethylene, Ethylene Glycol, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, **Hexachlorobenzene**, **Hexachlorocyclopentadiene**, Hydrochloric Acid or Muriatic Acid, Hydroquinone, Hydrogen Peroxide, Isopropyl Alcohol (Manufacturing, Strong-Acid Process), Kerosene, **Lead**, **Mercury**, Methanol, **Methoxychlor**, Naphthalene or K156, **Nickel**, Nitric Acid, Oxamyl (Vydate), **Polychlorinated Biphenyls**, Phosphoric Acid Ortho-, **Selenium**, Sodium Cyanide, **Styrene**, Sulfate, Sulfuric Acid, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluenediisocyanate (Mixed Isomers), **1,2,4-Trichlorobenzene**, **1,1,1-Trichloroethane or Methyl Chloroform**, **Trichloroethylene or TCE**, **Vinyl Chloride**, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)

Commercial / Industrial

Source	Contaminant*
Construction/Demolition	Acetone, **Arsenic**, **Asbestos**, Ammonia, Ammoniacal Copper Arsenate, **Benzene**, **Cadmium**, Chloride, Chromated Copper Arsenic, **Copper**, Copper Quinolate, **Cyanide**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, Epoxy, Fluorides, Formaldehyde or K157, **Lead**, Lindane, Methanol, **Nickel**, Polyurethane, Phosphoric Acid Ortho-, **Selenium**, Sodium **Cyanide**, Sulfuric Acid, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, Turbidity, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)
Dry Cleaners/Dry Cleaning	Amyl Acetate, Flourocarbon 113 (Freon), Peroxide, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, 1,1,2-Trichloroethane
Dry Goods Manufacturing	Acetone, Ammonia, **Barium**, **Benzene**, **Cadmium**, Chlorine, **Copper**, **Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthalate**, Formaldehyde or K157, Hydrochloric Acid or Muriatic Acid, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, Methanol, **1,1,1-Trichloroethane or Methyl Chloroform** Nitric Acid, **Polychlorinated Biphenyls**, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Disocyanate (Mixed Isomers), Trichloroethylene or TCE, **Xylene (Mixed Isomers)**
Electrical/Electronic Manufacturing	Acetone, Aluminum (Fume or Dust), Ammonia, Ammonium Persulfate, Amyl Acetate, **Antimony**, **Arsenic**, **Barium**, **Benzene**, Boric Acid, **Cadmium**, Chlorine, **Chlorobenzene**, Chloroform, **Copper**, **Cyanide**, Calcium Fluoride, **Carbon Tetrachloride**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthalate**, **Ethylbenzene**, Ethylene Glycol, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, Hexachlorophene, Hydrochloric Acid or Muriatic Acid, Isopropyl Alcohol (Manufacturing, Strong-Acid Process), **Lead**, **Mercury**, Methanol, Naphthalene or K156, **Nickel**, Nitric Acid, **Polychlorinated Biphenyls**, Phosphoric Ac id Ortho-, **Selenium**, **Styrene**, Sulfate, Sulfuric Acid, Sodium Cyanide, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, 1,1,2-Trichloroethane, Trichloroethylene or TCE, **Thallium**, **Toluene**, Toluene Disocyanate, (Mixed Isomers), **Vinyl Chloride**, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)

Commercial / Industrial

Source	Contaminant*
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) phthalate**, **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 Disocyanate (Mixed Isomers), **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**
Food Processing	**Arsenic**, Ammonia, **Benzene**, **Cadmium**, Chlorine, Chloroform, **Copper**, **Carbon Tetrachloride**, **Dichloromethane or Methylene Chloride**, Formaldehyde or K157, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Methanol, Nitric Acid, **Picloram**, Phosphoric Acid Ortho-, Sulfuric Acid, Sodium Cyanide, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Disocyanate (Mixed Isomers), **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Xylene (Mixed Isomers)**
Funeral Services/Graveyards	**Atrazine**, Benomyl, Chlorpyrifos, Diazinon, **Diquat**, **Glyphosate**, **Dichloromethane or Methylene Chloride**, Nitrosamine, Phosphates
Furniture Repair/Manufacturing	Ammoniacal Copper Arsenate, **Barium**, Chromated Copper Arsenic, Copper Quinolate, **1,2-Dichloroethane or Ethylene Dichloride**, **Dichloromethane or Methylene Chloride**, Epoxy, **Ethylbenzene**, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, **Lead**, **Mercury**, **Nickel**, Polyurethane, Phosphoric Acid Ortho-, **Selenium**, Sodium Cyanide, 1,1,2,2-Tetrachloroethane, Trichloroethylene or TCE, Tin
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

SOURCES OF CONTAMINANTS COMMONLY FOUND IN WATERSHEDS OR RECHARGE ZONES

Commercial / Industrial

Source	Contaminant*
Hardware/Lumber/Parts Stores	Acetone, Aluminum (Fume or Dust), Ammonia, Ammoniacal Copper Arsenate, **Barium**, **Benzene**, **Cadmium**, Captan, Chlorine, **Chlorobenzene**, Chloroform, Chromated Copper Arsenic, **Copper**, Copper Quinolate, **Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl)adipate**, **Di(2-ethylhexyl) phthalate**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **Ethylbenzene**, Ethylene Glycol, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Methanol, **Nickel**, Nitric Acid, Polyurethane, Phosphoric Acid Ortho-, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Toluene**, **Xylene (Mixed Isomers)**
Historic Waste Dumps/Landfills	**Atrazine**, **Alachlor**, Benomyl, Chlorpyrifos, **Carbofuran**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Diquat**, **Dalapon**, Diazinon, Epoxy, **Glyphosate**, **Dichloromethane or Methylene Chloride**, Manganese, **Nitrate**, **Nitrite**, Nitrosamine, Oxamyl (Vydate), Peroxide, Phosphates, **Picloram**, Sulfate, **Simazine**, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE, Tin
Home Manufacturing	Acetone, **Arsenic**, Ammonia, Ammoniacal Copper Arsenate, **Barium**, **Benzene**, **Cadmium**, Chlorine, **Chlorobenzene**, Chloroform, Chromated Copper Arsenic, **Copper**, Copper Quinolate, **Carbon Tetrachloride**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthalate**, Epoxy, **Ethylbenzene**, Formaldehydeor K157, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Methanol, Naphthalene or K156, **Nickel**, Nitric Acid, Polyurethane, Phosphoric Acid Ortho-, **Selenium**, **Styrene**, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, 1,1,2,2-Tetrachloroethane, **Toluene**, Turbidity, **Xylene (Mixed Isomers)**
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**, Fluoride, **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

Commercial / Industrial

Source	Contaminant*
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, **Nickel**, 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) phthalate**, **Ethylbenzene**, Ethylene Glycol, Fluoride, 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)
Medical/Vet Offices	Acetone, **Arsenic**, **Acrylamide**, **Barium**, **Benzene**, **Cadmium**, Chloroform, **Copper**, **Cyanide**, **Carbon Tetrachloride**, **Dichloromethane or Methylene Chloride**, **1,2-Dichloroethane or Ethylene Dichloride**, Ethylene Glycol, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, Glutaldehyde, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Methanol, **Methoxychlor**, **1,1,1-Trichloroethane or Methyl Chloroform**, **Nickel**, Potassium Alum (dodecahydrate), Potassium Bromide, Radionuclides, **Selenium**, Silver, Sulfuric Acid, Sodium Carbonate, Sodium Cyanide, Sodium Sulfite, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **2,4,5-TP (Silvex)**, **Thallium**, Thiosulfates, **Toluene**, **Xylene (Mixed Isomers)**

Commercial / Industrial

Source	Contaminant*
Metal Plating/Finishing/Fabricating	Acetone, **Antimony**, Acetylene, Aluminum (Fume or Dust), Ammonia, Ammonium Persulfate, **Arsenic**, **Barium**, **Benzene**, Boric Acid, **Cadmium**, **Carbon Tetrachloride**, Chlorine, **Chlorobenzene**, Chloroform, **Chromium**, **Copper**, **Cyanide**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) adipate**, **Ethylbenzene**, Ethylene Glycol, Fluoride, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, Hydrochloric Acid or Muriatic Acid, Hydrogen Cyanide, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, **Mercury**, Manganese, Methanol, Naphthalene or K156, **Nickel**, Nitric Acid, **Polychlorinated Biphenyls**, **Pentachlorophenol**, Phosphoric Acid Ortho-, **Selenium**, **Styrene**, Sulfate, Sulfuric Acid, Sodium Cyanide, **Tetrachloroethylene or Perchlorethylene (Perk)**, 1,1,2,2 Tetrachloroethane, **Thallium**, Tin, **Toluene**, **1,1,1-Trichloroethane or Methyl Chloroform**, 1,1,2-Trichloroethane, Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)
Military Installations	**Arsenic**, **Barium**, **Benzene**, **Cadmium**, **Chlorobenzene**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Hexachlorobenzene**, **Lead**, **Mercury**, Methanol, **Methoxychlor**, **1,1,1-Trichloroethane or Methyl Chloroform**, Radionuclides, **Selenium**, **Tetrachloroethylene or Perchlorethylene (Perk)**, 1,1,2,2 Tetrachloroethane, **Toluene**, Trichloroethylene or TCE
Mines/Gravel Pits	Ammonia, Hydrochloric Acid or Muriatic Acid, **Lead**, Naphthalene or K156, Phosphoric Acid Ortho-, **Selenium**, Sulfate, **Tetrachloroethylene or Perchlorethylene (Perk)**, Tin, **1,1,1-Trichloroethane or Methyl Chloroform**, Turbidity
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

Commercial / Industrial

Source	Contaminant*
Office Building/Complex	Acetone, **Atrazine**, Ammonia, **Barium**, Benomyl, **Benzene**, **Cadmium**, Chlorine, Chlorpyrifos, **Copper**, **2,4-D**, Diazinon, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **Dichloromethane or Methylene Chloride**, **Diquat**, **1,2-Dichloroethane or Ethylene Dichloride**, **Ethylbenzene**, Ethylene Glycol, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, **Mercury**, Methanol, Nitric Acid, Nitrosamine, Phosphates, Phosphoric Acid Ortho-, **Selenium**, Sulfuric Acid, **Simazine**, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Toluene**, **Vinyl Chloride**, **Xylene (Mixed Isomers)**
Photo Processing/Printing	Acetone, **Acrylamide**, Aluminum (Fume or Dust), Ammonia, **Arsenic**, **Barium**, **Benzene**, **Cadmium**, **Carbon Tetrachloride**, Chlorine, **Chlorobenzene**, Chloroform, **Copper**, **Cyanide**, **1,1-Dichloroethylene or Vinylidene Chloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthalate**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **1,2-Dibromoethane or Ethylene Dibromide (EDB)**, Ethylene Glycol, Freon 113 or CFC 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, **Heptachlor (and Epoxide)**, **Hexachlorobenzene**, Hydrochloric Acid or Muriatic Acid, Hydroquinone, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, Lindane, **Mercury**, Methanol, **Methoxychlor**, **Nickel**, Nitric Acid, Phosphoric Acid Ortho-, Propylene Dichloride or **1,2-Dichloropropane**, **Selenium**, Sodium Cyanide, **Styrene**, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, 1,1,2,2-Tetrachloroethane, **Toluene**, Toluene Disocyanate (Mixed Isomers), 1,1,2-Trichloroethane, Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)

Commercial / Industrial

Source	Contaminant*
Synthetic / Plastics Production	Acetone, **Antimony**, Ammonia, **Arsenic**, **Barium**, **Benzene**, Boric Acid, **Cadmium**, Captan, **Carbon Tetrachloride**, Chlorine, **Chlorobenzene**, Chloroform, **Copper**, **Cyanide**, **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) adipate**, **Di(2-ethylhexyl) phthalate**, **Ethylbenzene**, Ethylene Glycol, Freon 113 or CFC 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, **Hexachlorobenzene**, Hydrochloric Acid or Muriatic Acid, Hydroquinone, Isopropyl Alcohol (Manufacturing, Strong-Acid Process), Kerosene, **Lead**, **Mercury**, Methanol, Methyl Chloroform or 1,1,1-Trichloroethane, **Nickel**, Nitric Acid, **Pentachlorophenol**, Peroxide, Phosphoric Acid Ortho-, **Selenium**, Sodium Cyanide, **Styrene**, Sulfuric Acid, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Disocyanate (Mixed Isomers), Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)
RV/Mini Storage	**Arsenic**, **Barium**, Chloroform, **Cyanide**, **2,4-D**, **Endrin**, Formaldehyde or K157, **Lead**, **Methoxychlor**
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)**
Research Laboratories	Acetone, **Arsenic**, **Barium**, Benomyl, **Benzene**, **Beryllium Powder**, **Cadmium**, **Carbon Tetrachloride**, Chlorine, **Chlorobenzene**, Chloroform, **Cyanide**, **1,2-Dichloroethane or Ethylene Dichloride**, **1,1-Dichloroethylene or Vinylidene Chloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Endrin**, Freon 113 or CFC 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, Formaldehyde or K157, Glutaldehyde, Hydrochloric Acid or Muriatic Acid, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, **Mercury**, Methanol, **Polychlorinated Biphenyls**, Potassium Alum (dodecahydrate), Potassium Bromide, **Selenium**, Sulfuric Acid, Sodium Carbonate, Sodium Cyanide, Sodium Sulfite, Tetrachloroethane-1,1,2,2 , **Tetrachloroethylene or Perchlorethylene (Perk)**, **Thallium**, Thiosulfates, **Toluene**, Toluene Disocyanate (Mixed Isomers), **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**

Commercial / Industrial

Source	Contaminant*
Retail Operations	Acetone, Ammonia, **Arsenic**, **Barium**, **Benzene**, **Cadmium**, Chlorine, **2,4-D**, **1,2-Dichloroethane or Ethylene Dichloride**, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Methanol, Naphthalene or K156, Nitric Acid, Phosphoric Acid Ortho-, **Styrene**, Sulfuric Acid, Sodium Cyanide, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, **1,1,1-Trichloroethane or Methyl Chloroform**, **Vinyl Chloride**
Underground Storage Tanks	**Arsenic**, **Barium**, **Benzene**, **Cadmium**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **Lead**, Trichloroethylene or TCE
Wholesale Distribution Activities	**Benzene**, **Lead**, **Styrene**, **1,1,1-Trichloroethane or Methyl Chloroform**
Wood Preserving/Treating	Ammoniacal Copper Arsenate, Chromated Copper Arsenic, Creosote, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene,** Epoxy, Formaldehyde or K157, **Lead**, Naphthalene or K156, Polyurethane, Sulfate
Wood/Pulp/Paper Processing	Acetone, Ammonia, **Arsenic**, Ammoniacal Copper Arsenate, **Barium**, **Benzene**, **Cadmium**, Chlorine, Chlorine Dioxide, **Carbon Tetrachloride**, Chloroform, Chromated Copper Arsenic, Chromic Acid, **Copper**, Copper Quinolate, **Dichloromethane or Methylene Chloride**, **Dioxin**, **1,2-Dichloroethane or Ethylene Dichloride**, Epoxy, **Ethylbenzene**, Ethylene Glycol, Formaldehyde, K157, Hydrochloric Acid or Muriatic Acid, Isopropyl Alcohol (Manufacturing Strong-Acid Process), **Lead**, **Mercury**, Methanol, Nitric Acid, **Polychlorinated Biphenyls**, Polyurethane, Phosphoric Acid Ortho-, **Selenium**, **Styrene**, Sulfuric Acid, Gas, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE, **Toluene**, **1,1,1-Trichloroethane or Methyl Chloroform**, **Xylene (Mixed Isomers)**

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

APPENDIX C

Sources of Contaminants Commonly Found
in Watersheds or Recharge Zones

Table **Pages**

SOURCES OF CONTAMINANTS COMMONLY FOUND IN WATERSHEDS OR RECHARGE ZONES

Residential / Municipal

Source	Contaminant*
Airports (Maintenance/Fueling Areas)	**Arsenic**, **Barium**, **Benzene**, **Cadmium**, Chlorine, **Carbon Tetrachloride**, cis 1,2-Dichloroethylene, **Dichloromethane or Methylene Chloride**, **Ethylbenzene**, Ethylene Glycol, Freon 113 or 1,1,2-trichloro-1,2,2-trifluoroethane, Hydrochloric Acid or Muriatic Acid, **Lead**, **Mercury**, Sulfuric Acid, **Selenium**, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, Urea or Carbamide, **Xylene (Mixed Isomers)**
Apartments and Condominiums	**Atrazine**, **Alachlor**, Benomyl, Bromine, Chlorpyrifos, **Coliform**, Cryptosporidium, Cyanuric Acid, Calcium Hypochlorate, Chlorine, **Diquat**, **Dalapon**, Diazinon, Epoxy, ***Giardia Lamblia***, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, **Nitrate**, **Nitrite**, Nitrosamine, Oxamyl (Vydate), Phosphates, **Picloram**, Sulfate, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, **Vinyl Chloride**, Viruses
Camp Grounds/RV Parks	Benomyl, Chlorpyrifos, **Coliform**, Cryptosporidium, **Diquat**, **Dalapon**, Diazinon, ***Giardia Lamblia***, **Glyphosate**, Isopropanol, **Nitrate**, **Nitrite**, Nitrosamine, Phosphates, **Picloram**, Sulfate, **Simazine**, Turbidity, **Vinyl Chloride**, Viruses
Drinking Water Treatment	**Atrazine**, **Benzene**, **Cadmium**, **Cyanide**, Fluoride, 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**
Golf Courses and Parks	**Arsenic**, **Atrazine**, Benomyl, **Benzene**, **Chlorobenzene**, Chlorpyrifos, **Carbofuran**, **2,4-D**, **Diquat**, **Dalapon**, Diazinon, **Glyphosate**, **Lead**, **Methoxychlor**, **Nitrate**, **Nitrite**, Nitrosamine, Phosphates, **Picloram**, **Simazine**, Turbidity
Housing	**Atrazine**, **Alachlor**, Benomyl, Bromine, Chlorpyrifos, **Coliform**, Cryptosporidium, Cyanuric Acid, Calcium Hypochlorate, **Carbofuran**, Chlorine, **Diquat**, **Dalapon**, Diazinon, Epoxy, ***Giardia Lamblia***, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, **Dichloromethane or Methylene Chloride**, **Nitrate**, **Nitrite**, Nitrosamine, Oxamyl (Vydate), Phosphates, **Picloram**, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, Tetrachloroethane-1,1,2,2 , Trichloroethylene or TCE, Turbidity, **Vinyl Chloride**, Viruses
Injection Wells	**Atrazine**, **Alachlor**, Benomyl, Bromine, Chlorpyrifos, Cyanuric Acid, Calcium Hypochlorate, Chlorine, **Carbofuran**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Diquat**, **Dalapon**, Diazinon, Fluoride, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, Methanol, Nitrosamine, Oxamyl (Vydate), Peroxide, Phosphates, **Picloram**, Sulfate, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Tin, Trichloroethylene or TCE

Residential / Municipal

Source	Contaminant*
Landfills/Dumps	**Arsenic**, **Atrazine**, **Alachlor**, Ammonia, **Barium**, Benomyl, **Benzene**, **Cadmium**, Chlorine, Chlorpyrifos, **Carbofuran**, cis 1,2 Dichloroethylene, **Diquat**, Diazinon, Epoxy, Ethylene Glycol, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Isopropanol, **Lead**, Lindane, **Mercury**, Methane, **1,1,1-Trichloroethane or Methyl Chloroform**, **Dichloromethane or Methylene Chloride**, **Nitrate**, **Nitrite**, Nitrosamine, Oxamyl (Vydate), Peroxide, Phosphates, **Picloram**, **Selenium**, Sulfuric Acid, **Simazine**, 1,1,2,2-Tetrachloroethane, Tin, Trichloroethylene or TCE
Public Buildings and Civic Organizations	Acetone, **Arsenic**, **Acrylamide**, **Barium**, **Benzene**, **Beryllium Powder**, **Cadmium**, **Carbon Tetrachloride**, Chlorine, **Chlorobenzene**, Chloroform, **Cyanide**, 2,4-D, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **Dichloromethane or Methylene Chloride**, **Di(2-ethylhexyl) phthalate**, **1,2-Dichloroethane or Ethylene Dichloride**, **Endothall**, **Endrin**, **1,2-Dibromoethane or Ethylene Dibromide (EDB)**, Formaldehyde or K157, **Lead**, Lindane, **Mercury**, Methanol, **Methoxychlor**, Naphthalene or K156, **Selenium**, Sodium Cyanide, Strychnine, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Disocyanate (Mixed Isomers), **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Vinyl Chloride**, **Xylene (Mixed Isomers)**
Schools	Acetone, **Arsenic**, **Atrazine**, **Acrylamide**, **Barium**, Benomyl, **Benzene**, **Beryllium Powder**, **Cadmium**, Chlorine, **Chlorobenzene**, Chloroform, Chlorpyrifos, Creosote, **Cyanide**, **Carbon Tetrachloride**, **2,4-D**, Dichloride, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **Dichloromethane or Methylene Chloride**, **Diquat**, Diazinon, 1,2-Dichloroethane or Ethylene, **Endothall**, **Endrin**, Formaldehyde or K157, **Glyphosate**, Isopropanol, **Lead**, **Mercury**, Methanol, **1,1,1-Trichloroethane or Methyl Chloroform**, Naphthalene or K156, Nitrosamine, Phosphates, **Selenium**, Strychnine, Sodium Cyanide, **Tetrachloroethylene or Perchlorethylene (Perk)**, **Toluene**, Toluene Diisocyanate (Mixed Isomers), Trichloroethylene or TCE, **Xylene (Mixed Isomers)**
Septic Systems	**Atrazine**, **Alachlor**, Benomyl, Bromine, Calcium Hypochlorate, **Carbofuran**, Chlorpyrifos, **Coliform**, Cryptosporidium, Cyanuric Acid, **Diquat**, **Dalapon**, Diazinon, ***Giardia Lamblia***, **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

SOURCES OF CONTAMINANTS COMMONLY FOUND IN WATERSHEDS OR RECHARGE ZONES

Residential / Municipal

Source	**Contaminant***
Utility Stations	Acetone, **Arsenic**, **Atrazine**, **Barium**, **Benzene**, Boric Acid, **Cadmium**, Chlorine, **Chlorobenzene**, Chloroform, Creosote, **Cyanide**, **2,4-D**, **Dalapon**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **1,2-Dichloroethane or Ethylene Dichloride**, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, Formaldehyde or K157, **Lead**, **Mercury**, Methanol, **Picloram**, **Simazine**, Sodium, Sodium Chloride, Sodium Cyanide, Tin, **Toluene**, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE, **Xylene (Mixed Isomers)**
Waste Transfer /Recycling	**Coliform**, Cryptosporidium, ***Giardia Lamblia***, **Nitrate**, **Nitrite**, **Vinyl Chloride**, Viruses
Wastewater	**Cadmium**, Chloroform, **Coliform**, Cryptosporidium, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, Fluoride, ***Giardia Lamblia***, 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, Fluoride, **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

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

APPENDIX C

Sources of Contaminants Commonly Found
in Watersheds or Recharge Zones

Table **Pages**

SOURCES OF CONTAMINANTS COMMONLY FOUND IN WATERSHEDS OR RECHARGE ZONES

Agricultural / Rural

Source	Contaminant*
Auction Lots/Boarding Stables	**Coliform**, Cryptosporidium, ***Giardia Lamblia***, **Nitrate**, **Nitrite**, Sulfate
Confined Animal Feeding Operations	**Coliform**, Cryptosporidium, Freon 113 or 1,1,2-Trichloro-1,2,2-trifluoroethane, ***Giardia Lamblia***, **Nitrate**, Nitric Acid, **Nitrite**, Sulfate, **Vinyl Chloride**, Viruses
Crops - Irrigated + Non-irrigated	Acetone, Ammonia, **Benzene**, **2,4-D**, **Dalapon**, **Dinoseb**, **Diquat**, **Glyphosate**, Lindane, **Lead**, **Nitrate**, **Nitrite**, Phosphoric Acid Ortho-, **Picloram**, **Simazine**, Sulfuric Acid, Turbidity
Injection Wells	**Atrazine**, **Alachlor**, Benomyl, Bromine, Calcium Hypochlorate, **Carbofuran**, Chlorpyrifos, Cyanuric Acid, Chlorine, **Dalapon**, Diazinon, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Dichloromethane or Methylene Chloride**, **Diquat**, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, Methanol, Nitrosamine, **Oxamyl (Vydate)**, Peroxide, Phosphates, **Picloram**, Sulfate, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, 1,1,2,2-Tetrachloroethane, **Tetrachloroethylene or Perchlorethylene (Perk)**, Trichloroethylene or TCE, Tin
Lagoons and Liquid Waste	**Atrazine**, **Alachlor**, **Coliform**, Cryptosporidium, **Carbofuran**, **Diquat**, **Dalapon**, ***Giardia Lamblia***, **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)
Rural Homesteads	**Atrazine**, **Alachlor**, Benomyl, Bromine, Calcium Hypochlorate, **Carbofuran**, Chlorine, Chlorpyrifos, **Coliform**, Cryptosporidium, Cyanuric Acid, **cis 1,2-Dichloroethylene**, **trans 1,2-Dichloroethylene, Diquat**, **Dalapon**, Diazinon, ***Giardia Lamblia***, **Glyphosate**, Hydrochloric Acid or Muriatic Acid, Iodine, Isopropanol, **Nitrate**, **Nitrite**, Nitrosamine, **Oxamyl (Vydate)**, Phosphates, **Picloram**, Sulfate, **Simazine**, Sodium Carbonate, Sodium Hypochlorate, **Vinyl Chloride**, Viruses

SOURCES OF CONTAMINANTS COMMONLY FOUND IN WATERSHEDS OR RECHARGE ZONES

Agricultural / Rural

Source	Contaminant*
Naturally Occurring	Acetone, **Arsenic**, **Barium**, **Benzene**, **Cadmium**, Calcium, Chlorine, **Chlorobenzene**, Chloroform, **Cyanide**, **Carbon Tetrachloride**, **1,2-Dichlorobenzene or O-Dichlorobenzene**, **1,4-Dichlorobenzene or P-Dichlorobenzene**, **Di(2-ethylhexyl) phthalate**, **1,2-Dichloroethane or Ethylene Dichloride**, Dichloromethane or Methylene Chloride, **Ethylbenzene**, Formaldehyde or K157, **Hexachlorobenzene**, **Hexachlorocyclopentadiene**, Iron, **Lead**, **Lindane**, Manganese, **Mercury**, Methanol, , Nitric Acid, Radionuclides, **Selenium**, Silver, Sulfuric Acid, **Tetrachloroethylene or Perchlorethylene (Perk)**, 1,1,2,2-Tetrachloroethane, **Toluene**, Toluene Diisocyanate (Mixed Isomers), **1,1,1-Trichloroethane or Methyl Chloroform**, Trichloroethylene or TCE, **Xylene (Mixed Isomers)**, Zinc (Fume or Dust)

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

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The list of sources and contaminants is comprehensive, but may not be exhaustive. The index compiles information from several documents, databases, and web pages into one document. These resources used in developing the list include:

- The Cadmus Group, Inc. "Standard Industrial Code - Contaminant Database" prepared under Contract 68-C4-0011, Work Assignment 27, for United States Environmental Protection Agency, Office of Ground Water and Drinking Water, Sept. 30, 1996.

- Conservation Technology Informations Center. "Groundwater and Surface Water: Understanding the Interaction." West Lafayette, IN: Conservation Technology Information Center.

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- Oregon Department of Environmental Quality. Table 3-2 in “Oregon Wellhead Protection Program Guidance Manual.” Retrieved from the World Wide Web: http://waterquality.deq.state.or/us/wq/WhpGuide/contents.htm#content.

- Sittig, Marshall. 1985. Handbook of Toxic and Hazardous Chemicals and Carcinogens, 2nd edition (Park Ridge, NJ:Noyes Publication).

- United States Environmental Protection Agency, Office of Research and Development, Office of Water. 1993. "Wellhead Protection: A Guide for Small Communities." EPA/625/R-93/002.

- United States Environmental Protection Agency, Office of Water. 1990. "A Review of Sources of Groundwater Contamination from Light Industry." EPA/440/6-90-005.

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- Witten, Jon and Scott Horsely. United States Environmental Protection Agency and American Planning Association. "A Guide to Wellhead Protection." PAS Number 457/458.

- United States Environmental Protection Agency, Office of Water. "A Consumer's Guide to the Nation's Drinking Water." EPA/815-K-97-002.

- United States Environmental Protection Agency, Region 5, and Agricultural and Biological Engineering, Purdue University. Retrieved from the World Wide Web: http:// www.epa.gov/grtlakes/seahome/groundwater/src/quality2.html. Version 1.0, updated May 8. 1998.

- United States Environmental Protection Agency. 1993. IRIS (Integrated Risk Information System). Retrieved from the World Wide Web: http://rtk.net/T866

Appendix D Technical and Citizens Advisory Committees

Technical and Citizens Advisory Committees were formed early in the SWAP process. A deliberate effort was made to have diversity in representation but foster continuity within committee members. This diversity and continuity would act as our catalyst to obtain our goal of an acceptable SWAP. Initially the committees met separately (see meeting dates for each committee below) but as the statutory plan submission date neared it became evident that both committees would have to meet together to agree upon and finalize certain aspects and approaches within the draft SWAP.

During the course of the advisory committee meetings it was interesting to note how both committees worked to obtain the same goals through different pathways. It was anticipated that the TAC would utilize scientific and work related experiences in setting and obtaining some objectives. It was surprising in some instances the CAC became more technical and scientific in their approach than the TAC. When both committees met together it was often times difficult to determine who was on which committee.

During this process there were some initial disagreements* (diversity) and both committees had to compromise* (continuity) but in the end both committees agreed and developed a SWAP that can be the basis for future programs.

Meeting Dates:

Technical Advisory Committee	Citizens Advisory Committee
February 10, 1998	March 26, 1998
May 29, 1998	June 25, 1998
July 30, 1998	August 6, 1998
September 3, 1998	September 11, 1998

Joint Technical and Citizens Advisory Committee
October 8, 1998
January 21, 1999

A list of the Technical and Citizens Advisory Committee members are contained on the following page(s).

*See appendix E – Issues and Responses

Organization Name	Title	First	Last Name	Committee
ARKANSAS CANOE CLUB	MR.	WALTER	FELTON	CAC
ARKANSAS CATTLEMAN'S ASSOCIATION	MR.	JIM	CLOWER	CAC
ARKANSAS COOPERATIVE EXTENSION SERVICE	MR.	STAN	CHAPMAN	TAC
ARKANSAS COOPERATIVE EXTENSION SERVICE	MR.	MIKE	DANIELS	TAC
ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY	MR.	TONY	HILL	TAC
ARKANSAS DEPARTMENT OF HEALTH	MS.	GINGER	TATOM	TAC & CAC
ARKANSAS DEPARTMENT OF HEALTH	MR.	ROBERT	CORDOVA	TAC & CAC
ARKANSAS DEPARTMENT OF HEALTH	MR.	LYLE	GODFREY	TAC & CAC
ARKANSAS DEPARTMENT OF HEALTH	MS.	KAREN	HOWARD	TAC & CAC
ARKANSAS DEPARTMENT OF HEALTH	MR.	TONY	RAMICK	TAC & CAC
ARKANSAS DEPARTMENT OF HEALTH - AIDS/STD	MR.	BOB	MILLER	CAC
ARKANSAS DEPARTMENT OF HEALTH, OFFICE OF COMMUNICATIONS	MS.	ANN	WRIGHT	TAC & CAC
ARKANSAS DEPARTMENT OF POLLUTION CONTROL & ECOLOGY	MR.	RANDALL	MATHIS	TAC
ARKANSAS DEPARTMENT OF POLLUTION CONTROL & ECOLOGY	MR.	CHUCK	BENNETT	TAC
ARKANSAS DEPARTMENT OF POLLUTION CONTROL & ECOLOGY	MR.	TOM	HUETTER	TAC
ARKANSAS DEPARTMENT OF POLLUTION CONTROL & ECOLOGY - WET	MR.	GREG	PATTERSON	CAC
ARKANSAS ENVIRONMENTAL EDUCATION ASSOCIATION	MS.	BECKY	HORTON	CAC
ARKANSAS FORESTRY ASSOCIATION	MR.	CHRIS	BARNEYCASTL	CAC
ARKANSAS FORESTRY COMMISSION	MR.	JOHN	SHANNON	TAC
ARKANSAS GAME & FISH COMMISSION	MR.	STEVE	WILSON	TAC
ARKANSAS GEOLOGICAL COMMISSION	MR.	BILL	PRIOR	TAC
ARKANSAS HIGHWAY & TRANSPORTATION DEPARTMENT -	MS.	BRENDA	PRICE	TAC
ARKANSAS HOME BUILDERS ASSOCIATION	MR.	BRUCE	BLACKALL	CAC
ARKANSAS MUNICIPAL LEAGUE	MR.	JOHN	WOODRUFF	CAC
ARKANSAS MUNICIPAL LEAGUE	MR.	DON	ZIMMERMAN	CAC
ARKANSAS NATURE CONSERVANCY	MS.	NANCY	DELAMAR	CAC
ARKANSAS OIL & GAS COMMISSION			CHAIRMAN	TAC
ARKANSAS PARKS AND TOURISM	MR.	JIM	ALFORD	TAC
ARKANSAS POULTRY FEDERATION	MR.	DON	ALLEN	CAC
ARKANSAS RURAL WATER ASSOCIATION	MR.	ARTHUR	GUNN	TAC
ARKANSAS RURAL WATER ASSOCIATION	MR.	DENNIS	STERNBERG	TAC

ARKANSAS SOIL & WATER CONSERVATION COMMISSION	MS.	LINDA	HANSON	TAC
ARKANSAS SOIL & WATER CONSERVATION COMMISSION	MR.	BOB	MORGAN	TAC
ARKANSAS SOIL & WATER CONSERVATION COMMISSION	MR.	RANDY	YOUNG	TAC
ARKANSAS STATE PLANT BOARD	MR.	CHARLES	ARMSTRONG	TAC
ARKANSAS STATE PLANT BOARD	MR.	DON	ALEXANDER	TAC
ARKANSAS STREAM TEAM	MR.	STEVE	FILIPEK	CAC
ARKANSAS WATER & WASTERWATER MANAGERS ASSOCIATION	MR.	GARY	MILLS	TAC
ARKANSAS WATER AND WASTEWATER MANAGERS ASSOCIATION	MR.	JIM	HARVEY	TAC
ARKANSAS WATER RESOURCES CENTER	MR.	RALPH	DAVIS	TAC & CAC
ARKANSAS WATER RESOURCES CENTER	MR.	KENNETH	STEELE	TAC & CAC
ARKANSAS WATER WORKS & WATER ENVIRONMENT ASSOCIATION	MR.	SCOTT	BOGGS	TAC
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ARKANSAS WILDLIFE FEDERATION	MR.	HOWARD	ROBINSON	CAC
ASSOCIATED MILK PRODUCERS, INC.		GENERAL	MANAGER	CAC
BEAVER WATER DISTRICT	MR.	ALAN	FORTENBERR	TAC
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CITIZEN'S FOR CLEAN WATER, INC.	MR.	JOHN	STRONG	CAC
COUNTY JUDGES ASSOCIATION OF ARKANSAS	MR.	DAVID	MORRIS	CAC
DIVISION OF VOLUNTEERISM	MR.	LES	BRUNSON	CAC
DIVISION OF VOLUNTEERISM	MS.	BECKY	KOSSOVER	CAC
EL DORADO WATER UTILITIES COMMISSION	MR.	ED	JOHNSON	CAC
ENTERGY - ARKANSAS	MR.	TED	SMETHERS	CAC
ENTERGY SERVICES, INC.	MS.	FIRDINA	HYMAN	CAC
FARM SERVICES AGENCY	MS.	LINDA	NEWKIRK	CAC
FARM SERVICES AGENCY	MR.	WAYNE	PERRYMAN	CAC
FORT SMITH WATERWORKS	MR.	RANDY	EASLEY	CAC
FTN & ASSOCIATES	MR.	KEN	THORNTON	CAC
GREENBRIAR HIGH SCHOOL - EAST PROGRAM	MR.	TIM	STEPHENSON	CAC
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LITTLE ROCK MUNICIPAL WATERWORKS	MR.	GARY	HUM	TAC
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MAGNOLIA WATERWORKS	MR.	DAVID	GARRETT	CAC
ONCOLOGY - ST. VINCENT'S INFIRMARY	MS.	SANDY	SMITH	CAC
OZARK SOCIETY	MR.	STEWART	NOLAND	CAC
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US CORPS OF ENGINEERS - VICKSBURG DISTRICT	MR.	MAC	MONTGOMERY	TAC
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USCOE - TULSA DISTRICT	MR.	DAVID	COMBS	TAC
USCOE - VICKSBURG DISTRICT	MR.	MICHAEL	SEAL	TAC
USDA - NRCS	MR.	JIM	CAUDLE	TAC
USDA - NRCS	MR.	DANNY	GOODWIN	TAC
USFS - FOREST SERVICE OZARK NATIONAL FOREST	MS.	CONNIE	NEFF	TAC
USFS - OUACHITA NATIONAL FOREST	MR.	AL	NEWMAN	TAC

Appendix E -- Issues and Responses

Issues and Responses
from the Arkansas
Source Water Assessment Program
Advisory Committee Meetings

1. ISSUE: Deep-water impoundments need to have their dynamics looked at, especially water movement, sediments, and etc. – The proposed radius concept presented may not be adequate for some of the larger Corp reservoirs, especially during stratification periods. The Corp has data available documenting the dynamics for some of the larger reservoirs in Arkansas.

   RESPONSE: We intend to use a phased approached in our assessment process. Initially, we plan to delineate source waters on the basis explained in our proposed delineation procedures. We feel that we will need to limit the delineation areas to a manageable size to be assured that we can meet the statutory deadlines with the limited resources that are available. If specific information can be provided on individual reservoirs we will review our stance on this issue. We certainly feel that after the statutory deadlines have been met, that we be able to expand upon our assessments on a case by case basis and as prioritized by our initial efforts as an ongoing program.

2. ISSUE: What measures will be taken to determine if data is good, bad, or ludicrous?

   RESPONSE: We realize this is a problem. We will make every effort to use the best available data. Some ground-truthing will be done and we hope to utilize water system personnel to local and / or verify PSOC locations. This will be an ongoing project and we will continually upgrade and validate the information.

3. ISSUE: Would we consider intersection of a Highway and a contributory stream a PSOC?

   RESPONSE: Yes. Spills on highways and railroads are a major concern. Currently we have a notification process set up with the OES. When a spill that has the potential to affect a water source occurs the OES contacts the Arkansas Department of Health and we in turn notify any potentially affected system. We do plan to evaluate such conditions in our susceptibility analysis.

4. ISSUE: If a well is deep and cased to the Roubidoux, could we look at it and not bother with doing an assessment?

   RESPONSE: No. All sources will need to be assessed. However, the detail of the assessment may need to vary based on the situation, such as geology. Certainly, a well cased and grouted through confining formations, will not be as vulnerable as one that has direct communication with the surface, such as one in karst geology. In the case of the Roubidoux formation, it is overlain by karst geology in Arkansas. Past experience has not shown that it is susceptible to contamination if the well is cased and grouted deep enough. Additionally, the velocity of water movement in the Roubidoux is extremely slow. Therefore contamination incidents where the formation outcrops would seem to be lessened by this fact and therefore the vulnerability lessened.

5. ISSUE: What about if the recharge area is outside the state- both ground and surface?

   RESPONSE: The Guidance states that we are responsible for the recharge areas with in the state. We can not cross State boundaries; therefore we will have to coordinate with the applicable surrounding state agencies to gain the information needed.

6. ISSUE: Are we going to look at just what can exceed an MCL or health advisory or are we going to look at possible precursors?

   RESPONSE: We have not fully decided, and will be looking at that in the susceptibility analysis phase of the program development.

7. ISSUE: Is this just going to be a database effort, or will there be ground – truthing?

   RESPONSE: With the time and money allotted, we will not be able to do a lot of ground truthing, but hope to get assistance from systems in verifying data. There is a lot of data available from a wide variety of sources. Data will be used from one source to verify data from other sources. Data that will match will be considered primary.

8. ISSUE: How did we come up with the delineations for surface water sources.

   RESPONSE: We looked at available data for time of travel in streams based on both low flow conditions and median flow conditions. We considered selecting a procedure that would utilize a time of travel of two or three days. We also considered the size of the majority of reservoirs in Arkansas. We selected the five-mile radius concept because most of the reservoir sources will result in the delineation of the entire watershed on this basis. We also felt that for the stream and large reservoirs it would be too resource intensive to do susceptibility analysis for areas much larger than that selected. That is, however why we have inserted a clause that will allow us to look at PSOCs on a case by case basis, if we feel that an hazard may exist that is not covered by the initial delineation area.

9. ISSUE: Is the assessment area the delineated area?

   RESPONSE: Yes.

10. ISSUE: Will turbidities be addressed?

    RESPONSE: That is an issue we hope to discuss in future meetings when susceptibility analysis will be discussed in detail.

11. ISSUE: Will there be a public information plan?

    RESPONSE: Yes. Public meetings will be held. We are tentatively making plans to hold approximately 5 public meetings across the state. We will also be providing information on the overall process and plan development in our quarterly newsletter and the Division of Engineering Home Page. After plan development is completed and the process begun, results will be made available to each public water system. In turn, they can make the information available to their customers. We are also considering dissemination of this information on the Internet.

12. A. ISSUE: The public will perceive this as going toward land use regulations and zoning and cause problems. How are we going to present this to the public to prevent these fears? Have we thought about news releases? (From TAC)

12. B. ISSUE: The public, particularly the agricultural community, may perceive Source Protection activities as restrictive and opening the door to land use management, such as zoning, etc. If so, objections will be raised. The SWAP must be presented to the public in a way that will minimize such fears. Have we considered news releases? (From CAC)

    RESPONSE: We are open to suggestions in this area. The Cooperative Extension Service has expertise in working with the agricultural community. We hope to tap them for assistance in this area. News releases will be sent later in the plan development process.

13. ISSUE: Have water system operator/managers and/or City officials been notified of the SWAP?

    RESPONSE: To date, operators/managers of water systems have not been individually notified. Over the last couple of years we have been presenting information concerning the SWAP requirements at the Annual State Water Meeting and at the Annual Meeting of AWW&WEA. We have presented at a few AWW&WEA District meetings, and plan to make presentations in all of the districts when our plan is complete. The Division of Engineering publishes a quarterly newsletter that is sent to each PWS and a number of other individuals, organizations and government officials. Several articles discussing the SWAP requirements and related information have appeared in the newsletter over the past couple of years. It is our intention to make available through the Internet a summary of SWAP as it develops.

    As suggested we will request that groups such as the Municipal League assist us in the distribution of information in their monthly publications.

14. ISSUE: Has a media kit been put together? A representative of the Agency's public information section should be present.

    RESPONSE: We have not prepared a media kit. We are preparing a news release. The Division of Engineering has a staff development coordinator with experience in Health Education who can assist us in the preparation of our news release and other educational and information dissemination procedures. Prior to release to the AP and other interested parties, the Health Education Division of the ADH will review our news release(s).

15. ISSUE: Have we considered contacting the ADH's Liaison to the Governor to sit on the CAC.

    RESPONSE: No. We will discuss this idea with our management and follow-up on this suggestion. It could be beneficial to obtain input and support from a member of the Governor's staff. (Note: The Governor's liaison was contacted.)

16. ISSUE: Are we sure that the 1000 foot criteria for surface water systems is adequate for those reservoirs in areas of harsh topographic and geologic settings, like the locations of some hydro-electric impoundments?

    RESPONSE: We have extended all radius criteria to 0.25 miles, consistent with the approved Wellhead Protection Program minimum standard. The entire watershed for each impoundment will be delineated and all the PSOCs will be mapped statewide (regardless of delineated area). If a site outside the delineated critical area is deemed to be of concern, it will be included in the evaluation.

17. ISSUE: The water movement in a hydroelectric impoundment is typically more dynamic than other types of impoundments and may more closely resemble the flow dynamics of a river. Have we taken this into consideration?

    RESPONSE: In our proposed method of determining the Intrinsic Susceptibility of a source, we have taken into account the rate of withdrawal (pumping rate) from the impoundment at the intake, the volume of the impoundment, and whether or not there is a controlled discharge from the impoundment. Another category of intrinsic rating factors is the Soils – Land Use / Land Cover category, which includes percent of slope, permeability, erosion potential, and runoff for ground waters and slope and average annual rainfall for surface waters. The theory is that rating all systems with these criteria will result in a relative ranking that takes into account these concerns in an equitable, reliable and repeatable method.

18. ISSUE: Determining the boundary of the assessed area by drawing a circle around the intake does not take into account the flow gradient of the impoundment. Therefore a “5 mile radius around the intake” would be overkill for those lands down gradient of the intake. It is suggested the assessment area for impoundments be 10 miles, in a disproportionately elongated fashion, in the upstream direction.

    RESPONSE: The dynamics of lake systems are more complex than river systems. Contaminants, particularly nutrients, such as nitrogen and phosphorus, affect the water quality as the concentrations increase. Nutrients entering the impoundment both down stream as well as up stream from a particular point will affect the water quality at that point. Nutrients entering a lake system result in algae growth. As the concentrations of nutrients increase, algae blooms result. Algae blooms result in taste and odor occurrences. The by-products of algae and other organic growth are precursors to the formation of disinfection by-products. Lake stratification and turnover may also create conditions where down stream water will affect the water quality at the intake. Therefore, we feel that contaminant sources both up and down stream from the intake require consideration to the fullest extent of our available resources. For this reason, we intend to delineate and consider the entire drainage basin of the reservoir from the dam up stream and not just from the intake upstream, in addition to the assessment area outlined in our plan.

19. ISSUE: It is believed that the quality of drinking water in impoundments, springs, and GWUDI wells have a direct correlation with the conditions of the adjacent watershed. Therefore, the assessment area should be increased from 0.25 mile to 0.5 mile. This additional area would provide data / information to develop further safeguards for the source.

RESPONSE: The relationship between the size of assessment areas for springs / GWUDI wells and for impoundments are, in general, not related to one another. Springs / GWUDI sources, in Arkansas, are generally located in either karst areas or in areas where the bedrock is highly fractured. As a result, we have increased the typical arbitrary radius used for wells to 0.5 miles and added a conjunctive component that further increases the assessment area size. In addition, some wells that have been delineated using scientific methods under the WHPP have much larger areas than this typical arbitrary radius. We will continue to delineate wells in these areas in this fashion. Streams and impoundments are located in a much wider variety of geologic conditions. To double the size of the assessment zone without substantiated reasons is not justified. Additionally, such an increase in the base assessment area would over extend the resources that are available to complete our task within the statutorily required time frame, including an 18-month extension. Finally, the modifications that have been made to the susceptibility analysis and reporting format will tend to further compensate for these concerns.

20. ISSUE: Presently the assessed area for rivers and streams is "1320 feet from the centerline of the river/steam and up-gradient of the intake a distance limited to 3 days travel time of a maximum of 20 miles". The time of travel is based upon low flow conditions. It is suggested that all lands 1000 feet from the water's edge and up-gradient of 20 miles be assessed.

RESPONSE: The process that we are using to delineate assessment areas will utilize GIS to electronically make the delineations. The electronic data currently available for the hydrography in Arkansas is 1:24,000 scale maps digitized from USGS topographic maps and 1:100,000 scale Tiger hydrography maps. This data does not accurately show the water's edge. For this reason, we modified our original assessment width from 1000 feet to 1320 feet in an effort to assure that 1000 feet is actually obtained in most cases. In other words, it would take a stream width of greater than 640 feet to result in an assessment area of less than 1000 feet. The drinking water supply stream widths in Arkansas generally do not approach this width. Upon further review of data available median flow will be utilized rather than low flow conditions.

21.ISSUE: Will the use of average slope negate the true impacts upon the watershed?

RESPONSE: This may be true, however, due to data limitations and time constraints, an individual study of the different slope percentages within a watershed can not be completed. Therefore, the use of the average slope will be utilized. (Note: This issue may be revisited in Phase II.)

22. ISSUE: The SWAP, as drafted, has noted a provision to include PSOCs outside the assessment area to be included at the discretion of the Program management. It is suggested that all NPDES and waste disposal sites within the watershed be included in the assessment.

RESPONSE: The draft document has been modified by adding the following statement: "The number of PSOCs in each category that lies within the assessment area for river / streams and impoundments will be determined. The number of PSOCs in each category that lies outside the assessment area but is within the watershed of a river / stream intake or within the watershed of the impoundment will be identified by Health Risk Category and mapped." With this addition to the procedure, it is felt that the above concern will be eliminated. The provision to include PSOCs outside the assessment area wording, however, has not been eliminated from the document. This provision will instead take on a slightly different meaning. Instead of using the discretion to include such contaminant sources in the susceptibility analysis, it now will provide for the individual discussion of significant potential sources of contamination located outside the assessment area within the final assessment report.

23. ISSUE: The categorization of active landfills, dumps, and wastewater lagoons should be raised to a rating of 2 for ground and surface waters. Inactive landfills, dumps, and wastewater lagoons could be lowered to a category rating of 8 or 9.

RESPONSE: We disagree in lumping active facilities and inactive facilities in the manor suggested. The potential for these types of facilities to contaminate groundwater and surface water equally is not likely. Additionally, some inactive facilities were subject to lesser constraints, if any at all, than active facilities and current regulatory constraints. Specifically, dumps either active or inactive are generally illegal in nature and have not been or are not in compliance with any regulatory controls.

24. ISSUE: Water wells can be direct conduits of contamination to ground water sources. Therefore water well(s) that are within the assessment area should be included when determining the vulnerability of the source.

RESPONSE: We do not disagree and, in fact, have considered the presence of wells within the assessment in the determination of the susceptibility of public drinking water wells.

25. ISSUE: All PSOCs should be identified and inventoried initially within the assessment area. The SWAP can not rely solely upon electronic data for the identification and an inventory of all PSOCs. Qualified personnel such as Sanitarians should be committed at the onset to identify and inventory PSOCs.

RESPONSE: We agree that Phase I Assessments need to be as complete and accurate as possible. The Department will commit all the resource that it can to achieve this goal. However, with the regulatory time constraints and the resources available, we will be unable to ground truth the majority of the sources and must rely upon available electronic data to complete the task.

26. ISSUE: It would seem that wellheads subject to flooding or submersion have a higher susceptibility. Additionally, other drinking water supply wells in the assessment area that are subject to flooding or submersion provide pathways for surface water to enter the aquifer. Are these issues adequately addressed and can flood plain maps be used in the analysis?

RESPONSE: The susceptibility analysis considers whether or not each public drinking water supply well is subject to flooding. We will draw information primarily from our sanitary surveys but will investigate the availability and usability of flood prone maps for this purpose. As indicated above, other wells in the assessment area are being considered. Whether they are in a flood plain and act as an open conduit during flood events is a concern. Where data is available, we will use it to the best of our resources. Certainly, we intend to spot such conditions as ground truthing is performed in the Phase 2 process.

27. ISSUE: Some of the wording used the discussion of the “B” Factor used in the susceptibility analysis formula needs to be better defined (i.e. occurrence, action level, detects, etc.).

    RESPONSE: We agree and will work with the committee to reach a better, more specific definition for these terms.

28. ISSUE: In the Intrinsic Susceptibility analysis, is man–made development projects or pollution potential considered?

    RESPONSE: Yes. In the Intrinsic Susceptibility analysis within the “Land use / Land cover” section, it takes into account man–made developments and / or pollution potential.

29. ISSUE: Why is urban residential listed and weighted higher in the “Land use / Land cover” section than agricultural crop use?

    RESPONSE: The weightings were reviewed by the Citizens and Technical Advisory Committees. The Committees agreed that there is a greater potential for non–point source contamination in urban residential areas where a high percentage of the soil is overlaid with concrete and asphalt thus restricting absorption and increasing run-off. Furthermore the number and diversity of contaminants is greater in urban residential areas.

Public Meeting @ Springdale on December 7, 1998.

Questions / Comments / Responses

1. QUESTION: How is EPA going to use the results of the assessments?

   RESPONSE: EPA has not stated if the results of the assessments will be used in any other fashion other that for information for systems to utilize in developing Source Water Protection Programs.

2. QUESTION: How will the outcome of the assessment affect future regulations?

   RESPONSE: At this point EPA has not stated that the information collected will be used for any other purpose than the development of Source Water Protection Programs.

3. QUESTION: Will land cover be taken into account in the susceptibility analysis for reservoirs? Will the slope of the different land cover types be considered? (i.e. will the slope of pastureland be applied to the pasturelands and the slope of forested lands be applied to forested lands)?

   RESPONSE: Yes. Land cover will be taken into account for all sources. Different weighting factors have been given to the types of land cover within the state. The land cover weighting is a small part of the overall susceptibility analysis.

4. QUESTION: How is the slope for reservoir systems going to be derived?

   RESPONSE: The highest point within the watershed versus the dam height divided by the distance between the two points. This will give us the basin slope.

5. COMMENT: The susceptibility analysis method is biased to groundwater systems (since this is where the best data lies). However, the commenter did not have any suggestions on how to better evaluate surface water systems.

6. QUESTION: What do pump rates have to do with the susceptibility analysis method for reservoirs in the hydrologic section?

   RESPONSE: The pumping rates (or potential pumping rates) may affect the time of travel for a contaminate to reach an intake. The theory is: a pumping capacity of 1000 GPM will draw more water to an intake faster than a pumping capacity of 500 GPM. The pumping capacity will also allow us to assign a weighting factor within the susceptibility analysis.

7. COMMENT: The department has put a lot of work into the developmental process and the plan is acceptable. However, there is still concern over any hidden agenda that EPA may have.

8. QUESTION: Since the data on the county soils maps in the state vary from county to county, what data will be used to maintain consistency?

   RESPONSE: In the four county area of Northwest Arkansas SSURGO data will be utilized. SSURGO data currently does not have statewide coverage therefore we will be utilizing STATSGO soil data in the remainder of the state.

9. QUESTION: Has there been any coordination with the state of Oklahoma?

   RESPONSE: Yes, we have met with Mike Houts of Oklahoma DEQ at a variety of meetings. We also have had numerous telephone conversations. At the Interstate Issues meeting sponsored by EPA in Dallas in May of 1998, we agreed to share information and data, in particular regarding those areas that have drinking water sources that are in common and on both sides of the Arkansas-Oklahoma border. The discussion included questions regarding consumers living in areas where their drinking water may come from within a watershed or source outside of their resident state. There are tentative plans for more formal meetings in the future.

Public Meeting @ Hope, December 08, 1998.

Question / Comments / Responses

10. QUESTION: Will assessments stop at state lines?

    RESPONSE: Assessments will be conducted to, but not beyond state boundaries. Coordination between states is ongoing and essential for complete assessments to be conducted for entire watersheds and / or recharge zones.

11. QUESTION: Will every PSOC in the watershed be identified?

    RESPONSE: Yes. Every effort will be made to identify (to the extent practical) every PSOC within the watershed. Initially electronic data and limited “ground truthing” will be used to identify the PSOCs. Draft maps containing PSOC location and information will be mailed to the PWSs. The PWS will review / edit the maps for accuracy and return them to the ADH for updating and or correction.

12. QUESTION: What is the time frame for the completion of the assessments?

    RESPONSE: EPA has set a time frame of 2 years (plus an additional 18 months subject to EPA approval) to complete the assessments after the SWAP is submitted and approved.

13. QUESTION: Will recharge areas of wells be assessed?

    RESPONSE: Yes where data is available. Conjunctive delineation will be conducted for Springs and GWUDI wells in an effort to include potential contaminants in areas of recharge.

Public Meeting @ Monticello December 10, 1998.

Questions / Comments / Responses

No questions / comments were stated at the Monticello meeting.

Public Meeting @ Little Rock December 14, 1998.

Question / Comments / Responses

14. QUESTION: How will streams be delineated?

    RESPONSE: Intakes that are located in streams will have the entire watershed delineated. The assessment area will be 0.25 miles either side of the centerline of the stream and all of its tributaries within a 3 day time of travel limited by a maximum up-gradient distance (from the intake) of 20 miles (not to exceed state boundaries).

15. QUESTION: Will systems be ranked numerically?

    RESPONSE: No. Upon completion of susceptibility analysis a vulnerability assessment ranking of high, medium, or low will be assigned.

16. QUESTION: Is there any extension of the February 6, 1999 SWAP submission date?

    RESPONSE: No. The February 6, 1999 date is a statutory mandate.

Public Meeting @ Batesville December 15, 1998.

Questions / Comments / Responses

17. QUESTION: Does this plan allow for any funding for public water systems to do assessments?

    RESPONSE: The SWAP is mandated to the State. At this time we have entered into an agreement with USGS to assist us in completing assessments. Within this Plan, funding is not available for public water systems to conduct their own assessments.

18. QUESTION: Will individual sewage disposal systems be identified in the assessments?

    RESPONSE: Yes. We will identify (to the extent practical) all PSOCs within the assessment area.

Certificate of Appreciation

The SWAP staff agreed that some award of recognition was appropriate to be given to the members of the Citizens and Technical Advisory Committees. The people serving on these Committees were dedicated and diligent to examine all data / information, concepts, practices, methodologies, issues, responses, and comments that were presented and / or developed in the effort to assemble the SWAP. Example copies of the “Certificate of Appreciation” are contained on the following pages.

Arkansas Department of Health
Division of Engineering

This Certificate of Appreciation is Awarded to

Walter Felton

For Dedicated Service in the

Development of the Source Water Assessment Plan

As a Member of the Citizens Advisory Committee

Director, Division of Engineering
Supervisor

Source Water Protection Engineer

Source Water Protection Specialist Supervisor
Specialist

Source Water Protection

Arkansas Department of Health
Division of Engineering

This Certificate of Appreciation is Awarded to

Stan Chapman

For Dedicated Service in the

Development of the Source Water Assessment Plan

As a Member of the Technical Advisory Committee

Director, Division of Engineering
Supervisor

Source Water Protection Engineer

Source Water Protection Specialist Supervisor
Specialist

Source Water Protection

Appendix F -- Questions from Guidance Document

Questions from the Guidance Document were presented in an open forum during the Technical and Citizens Advisory Committee meetings. The answers have been summarized but are specific to both committees. The final action has been summarized after the Technical and Citizens summary responses.

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

   TAC response: A news release should be submitted to State newspapers and other media sources. Representatives of other Agencies that are on the committee could help spread information about the Program within their specific interest groups.

   CAC response: A media kit should be developed and made available to media sources or other groups that may be interested. A news release should be submitted to State newspapers, radio and televisions stations. Letters outlining or detailing the Program should be mailed to all water operators/managers and city officials

   Final action: A news release was developed and sent to the Associated Press, United Press International, and local newspapers within the State. The Arkansas Municipal League ran an article in its monthly publication (which is mailed to all City officials). The liaison to the Governor was contacted to help assist in the political realm. Program staff attended water district (State and local) meetings, where presentations were made on the SWAP.

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

   TAC response: No comments were given to this question.

   CAC response: No comments were given to this question.

   Final action: The Technical and Citizens Advisory Committees were broadly represented. The committees were diverse in a personal and professional nature. Please refer to the TAC and CAC mailing list for identification of each Agency, organization, and/or group represented.

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

TAC response: No comments were given to this question.

CAC response: No comments were given to this question.

Final action: The Agency has developed an Internet "Homepage" that links to the SWAP page. Information regarding the SWAP will be updated periodically. Should users have questions that can not be answered by the Internet access a telephone number and contact name will be given. The Agency is also building partnerships within public schools in an effort to initiate a grassroots approach to public education in regard to the SWAP. Opportunities to attend and speak at State and local water utility meetings will also be used to update these groups on the SWAP progress.

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

TAC response: No comment was given to this question.

CAC response: No comment was given to this question.

Final action: Information was utilized from Federal and State agencies. Informational data sets were also obtained from universities, utilities, and companies. These sources of information were added to the existing Program information. New information received, developed, or compiled will be incorporated into the Program as they become available and upon plan approval from EPA.

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

TAC response: No comment was given to this question.

CAC response: The exactness of the assessment is incumbent upon the information utilized. The assessment should be just as accurate and complete as the information used to do them. Enough information has to be available for a meaningful assessment to be conducted.

Final action: In the initial stage of assessments only the information that currently exists can be utilized. Therefore, until additional information can be collected, developed or obtained, assessments will have to be considered complete. As new valid information is received, developed, and /or obtained it will be incorporated into assessments in the form of updates to the SWAP.

6) Should the level of assessment provide for the protection and/or benefit of the public water supply(s)?

TAC response: Yes. If not why should we do this (have the advisory committee meetings)?

CAC response: Yes. The goal is for the water system to provide a better quality of water to the consumer.

Final action: This program will provide better protection of the source waters within the State. The level of assessments will allow for water utilities and citizens, which the system serves, to make an informed choice of the level of protection needed or wanted. The assessment will be based on topographical, hydrogeological, contaminant, and other intrinsic information specific to each water source.

7) What should be the basis for differential levels of assessments to be completed for different public water supplies or categories of public water supplies? System type or size? Preliminary information about the existence of threats? Other?

TAC response: The type of source and its potential for contamination verses the population served could be used as a measuring tool to prioritize assessments. The "level" of assessment will have to remain constant to maintain the validity and integrity of the Program. Assessments conducted at different "levels" could potentially convey the appearance (once the information is made available to the public) that a system's source does not warrant active protection, the population served is not important, or, because of a system's size, it is not important. This potential type of public perception would not be beneficial to the Program goals.

CAC response: The level of assessment should be based on source type and the population served.

Final action: Defining different "levels" of types of assessments for systems (based on population, type of system, or size) would require an assessment within itself. The time lost in doing this would potentially result in some systems not receiving the focus needed or those with like characteristics being grouped together (based upon assumptions). All systems will initially be assessed the same way. Systems found with the most critical need or highest potential for contamination can be prioritized accordingly. Conducting different "levels" of assessments could potentially sequester some systems and their populations. Working relationships with the public and their water systems could become strained. The publics' perception of government is not generally favorable therefore it would be beneficial for the "level" of assessments to be consistent.

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

TAC response: EPA needs to get its programs (Clean Water Act and Safe Drinking Water Act) on the same page. The Clean Water Act people will state that water that has been through a sewage treatment plant is good enough to drink.

The Safe Drinking Water Act people will state that treated sewage is not an adequate raw water source and should not be run through the water treatment plant due to difficulty of treatment. Therefore communication with other State agencies is essential and must be open. With the timeframes involved, the Program can ill afford to be caught up in political or egotistical games. Information gained in the SWAP should be utilized for the purpose of enhancing public protection regardless of the Agency that requests it. All agencies and the public will have access to the information used to complete the SWAP.

CAC response: The lines of communication must be open at all times. Someone (EPA) should assume the responsibility to oversee that each agency is coordinated and working to reach the same type goals. Directives from EPA would help coordination efforts greatly.

Final action: Informational data utilized for the SWAP will be made available (providing the information is not proprietary) to any Agency or other group that may request it. Coordination problems between agencies can be corrected by means of Memos of Understanding.

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

TAC response: Like the WHPP, the SWAP will provide water systems the information (or additional information in some cases) needed to make an informed choice about source protection. The water system and its' customers can formulate the criteria needed for the protection of their own source.

CAC response: Community groups could be coordinated within watersheds to protect the watershed as a whole. It is not very beneficial for a community to establish a SWPP if the community in the headwater does nothing to protect its source water. The customers being served can control protection efforts within a SWPP.

Final action: The SWAP will continue to build on the Wellhead Protection Program. The information gained in establishing the WHPP has proved beneficial in the development of the SWAP. Delineations that have been completed by the WHPP have and will serve as the basis for the program development for ground water sources. The SWAP also provides the opportunity to do a more complete or updated version of the WHPP assessment. Furthermore, the information gained in doing assessments combined with existing historical data will provide the community a logical approach to implement a SWPP. This information may spur communities within the total watershed to take a cooperative approach to protection.

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

TAC response: What the State has proposed seems logical. The WHPP has been approved by EPA so why change it?

CAC response: The WHPP has been in place for several years and seems to be working. The WHPP may need to be updated in some areas, but that is for the State to decide.

Final action: See Appendix B. EPA has approved the WHHP and those systems that have implemented a WHPP have had good success.

11) What contaminants that are not currently regulated by EPA should be part of the state's SWAP program?

TAC response: Phosphorous is becoming an important issue as well as precursors. These chemicals and /or compounds should be monitored.

CAC response: Phosphorous should be monitored as well as anything that has a nutrient loading potential.

Final action: We feel that any contaminant for which a health advisory has been established should be considered in the assessment process. In fact, the susceptibility analysis methodology will consider the presence of contaminants, whether regulated or not, an indication of increased susceptibility. Also, increased levels of phosphorous, while not specifically addressed in the methodology, may result in an increase of THM or HAA levels. Exceedance of DBP or other action levels will result in a higher susceptibility rating.

12) Should the state segment source water protection areas for more focused source inventories? What should be the basis for such segmentation?

TAC response: That is for the Programs management to decide. We see no reason for the segmentation of protection areas. Each source will be treated independently from each other.

CAC response: There should be no overlap in assessments. This will only slow down the progress of conducting assessments.

Final action: Watersheds will be segmented to provide a more focused area to be evaluated. Resources are not available to assess the entire watershed for large basins within the time constraints. Multiple water sources within the same watershed will be evaluated in such a manner as to prevent duplication of contaminant inventories.

13) How should the state define and identify significant potential contamination sources and how should the state undertake their inventory within source water protection areas?

TAC response: No response was given to this question.

CAC response: Some "ground-truthing" will have to occur to define what really exist within the protection area.

Final action: Initially identification of PSOCs will be through the use of electronic databases. "Ground- truthing" of data will occur to assess its accuracy. We will have to rely on program personnel and volunteers to provide updated and / or corrected information. Given the timeframe to complete the SWAP, this is the only logical approach.

14) How will the results of the susceptibility analysis be characterized?

TAC response: Utilizing a low, medium, and high classification would be more acceptable than a numerical rating.

CAC response: No comment given to this question.

Final action: A ranking scheme has been developed (see Section V for methodology) classifying each source as low, medium, or high for susceptibility.

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

TAC response: Communication between States is critical. An agreeable policy should be developed and adhered to by bordering states.

CAC response: Some type of coordination effort must take place.

Final action: An agreement with Oklahoma and Missouri will be critical for Arkansas. This will be worked out on a case-by-case basis. Working relationships and the line of communication have been open in the past, but no written agreement was established. Louisiana will need to define and initiate the type of procedure that they wish to utilize for a cooperative effort with us. It may become essential that EPA facilitate agreements between States that border Arkansas but are but are in different Regions.

16) What contingency plans should be pursued?

TAC response: PWSs will need to decide what contingency plans will be developed for their source(s). Those systems that have source(s) along State borders will need interstate cooperation, possibly facilitated by EPA.

CAC response: No Comment was given to this question.

Final action: Contingency plans will have to be addressed by PWSs that adopt protection plans. We will provide technical assistance to PWSs upon request.

17) What coordination / facilitation activities should the state request of EPA?

TAC response: EPA should facilitate communication efforts between States outside the Region.

CAC response: EPA should initiate the communication efforts between the surrounding States by means of Regional meetings. Furthermore, EPA needs to standardize like programs within the States to insure consistency.

Final action: EPA sponsored meetings have been beneficial in the past. This type of meeting format allows questions, concerns, and guidance from EPA. This format also lessens the likelihood of miss interpretation within and between States.

18) Are compatible and complimentary assessments being done in watersheds shared with other states and countries?

TAC response: No comment was given to the question.

CAC response: No comment was given to this question.

Final action: We will not be able to fully answer this question until the surrounding States submit their plans to EPA and they are approved. However, we have, at a minimum, informal agreements to share data as needed with the States of Texas, Oklahoma, and Missouri.

19) 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?

TAC response: The format should be easily understandable. Results should be made as soon as possible.

CAC response: Results should be made in a timely manner. They should be written at a level that is easily understood.

Final action: A report will be mailed to each water system. Should the system or its customers want additional information they may contact us and we will provide it. We would hope that the customers of the water system would approach the system initially. If their (the customers) question could not be answered by the system, they could be referred to ADH. We plan to release the assessments in groups as they are completed.

20) How and when should the state make available all the information collected during each assessment when someone requests it?

TAC response: No comment was given to this question.

CAC response: No comment was given to this question.

Final action: Information will be made available as FOI requests are received. Once the FOI has been received, the information will be made available within seven working days.

21) What type of maps should be developed to display the results of the assessments?

TAC response: Maps should be made available in GIS format. Black and white 8.5 x 11 maps should be sufficient.

CAC response: Area maps should be easy to read and understand. The maps should reflect all information that is contained in the susceptibility analysis.

Final action: Maps will be produced in GIS format. Maps will be made available in digital for those systems requesting it. Generally maps will be produced in black and white and be 8.5” x 11” in size.

22) How and when should the state make public all information collected during each assessment for a PWS(s)?

TAC response: Information should be made available as the assessments are finalized and completed, but not before the water system receives a copy of the report.

CAC response: No comment was given to this question.

Final action: Upon completion of the assessment, information will be released to the water systems first. Information will then be released to the public. The system must have an opportunity to review the information prior to it's being released to the public.

23) How should the state or delegated entities provide wide notification of the availability of the results and other information collected?

TAC response: Notification of results can be in the form of news releases or public service announcements. The public should be directed to their local water system for additional information.

CAC response: Notification of results can be in the form of news releases in local papers or public service announcements on local radio stations.

Final action: We may make notice of results available through local county health units (each county in Arkansas has one, some have two or more), news releases, the Internet and PSA.

24) What should be the timetable for the state SWAP program implementation?

TAC response: This timetable has been established by EPA.

CAC response: EPA has established this timetable.

Final action: This timetable was established by EPA.

25) How much should the state spend on SWAP program development and implementation, and should the resources come from the DWSRF and/or other sources?

TAC response: The State should utilize all of the allocated funds.

CAC response: No comment was given to this question.

Final action: The State has entered in to a cooperative agreement with the USGS. We have allocated all the 10% Source Water Assessment set-aside funds under the DWSRF for this contract. The 5% WHPP set-aside will be used for agency staffing and program implementation. Use of both of these set-asides is not sufficient to complete the project in the timeframe allowed by statute. Therefore, it will be necessary to request an 18-month extension and additional funds to finalize wellhead activities in this project.

26) Should the state delegate aspects of the assessments? If so, to whom? Should funding be provided to delegated entities?

TAC response: The State should delegate any aspects of the assessments that they deem necessary to meet the timetable set forth by EPA. Unless funding is provided do not expect very much help.

CAC response: Funding should be provided for any group, organization, or agency that the State feels can be beneficial to the development of the SWAP.

Final action: The State has entered into a cooperative partnership with the USGS.

27) How should state agencies coordinate with each other and with other state, federal, and local stakeholders when implementing SWAPs?

TAC response: A document of agreement should be initiated between states. EPA may need to facilitate meetings, conferences, or other intra-state promotional activities. Someone (EPA) will need to set guidelines or protocols for state-to-state or region-to-region activities in to regard to SWAPs.

CAC response: No comment was given to this question.

Final action: Formal and informal discussions and correspondence have transpired between the states of Texas, Oklahoma and Missouri. See Section IX for more detail.

28) How and what should the state report to EPA regarding SWAP implementation?

TAC response: The State should follow the guidance regarding what information is reported to EPA.

CAC response: No comment was given to this question.

Final action: We will report to EPA as outlined in guidance.

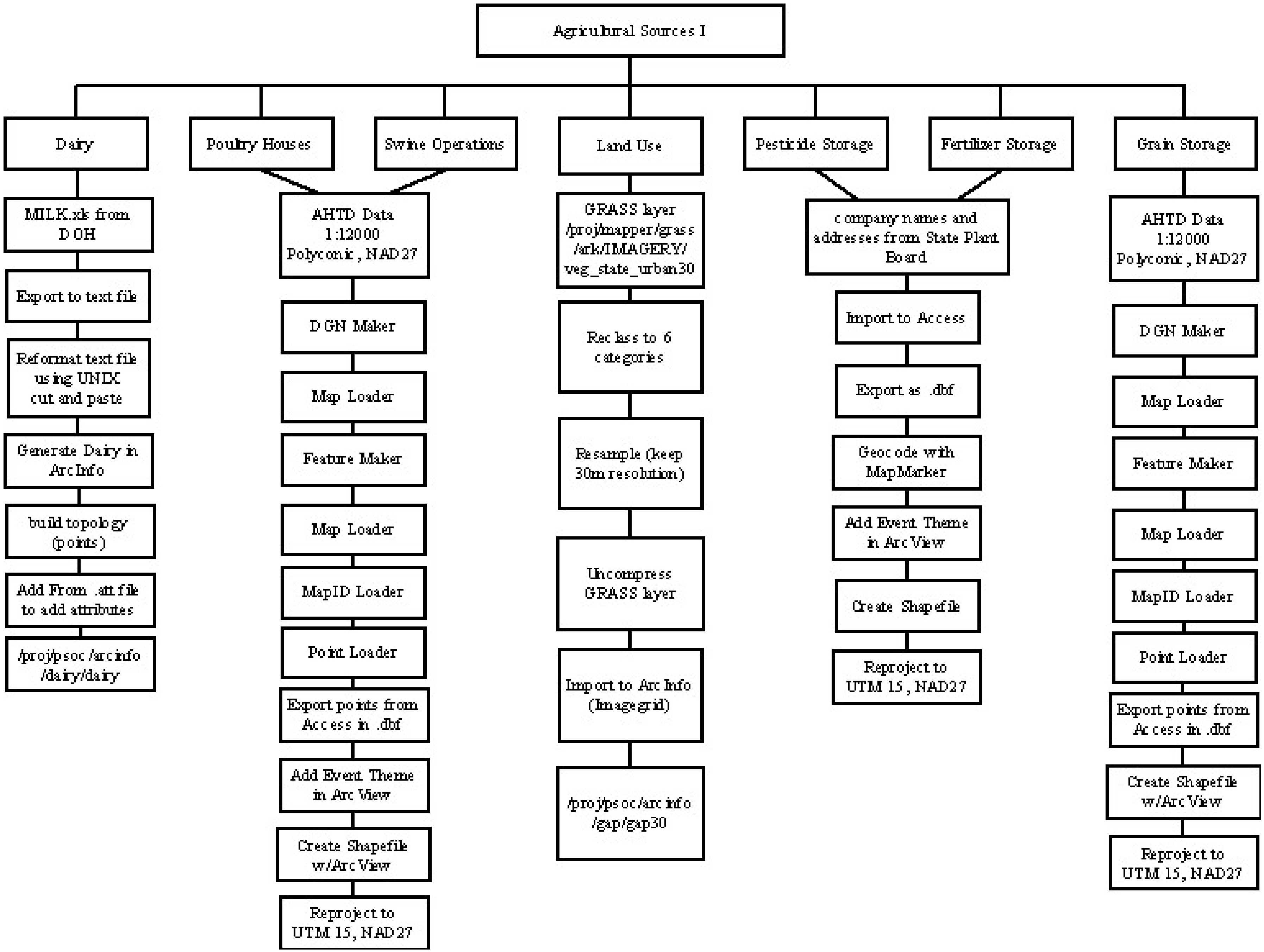
29) How and when should the state update assessments?

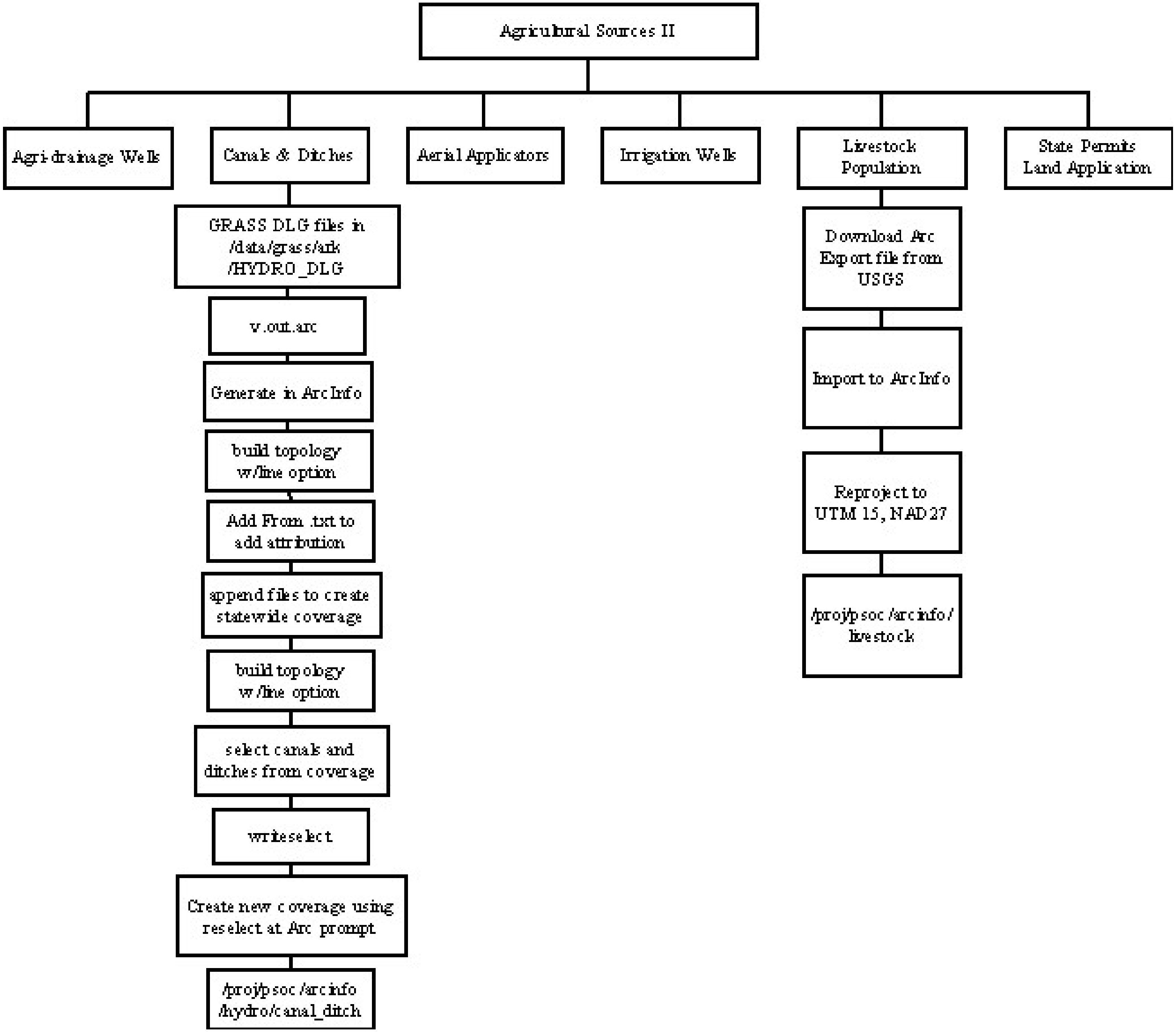
TAC response: Updates should be made when data or information is received that may influence the priority of the source protection.

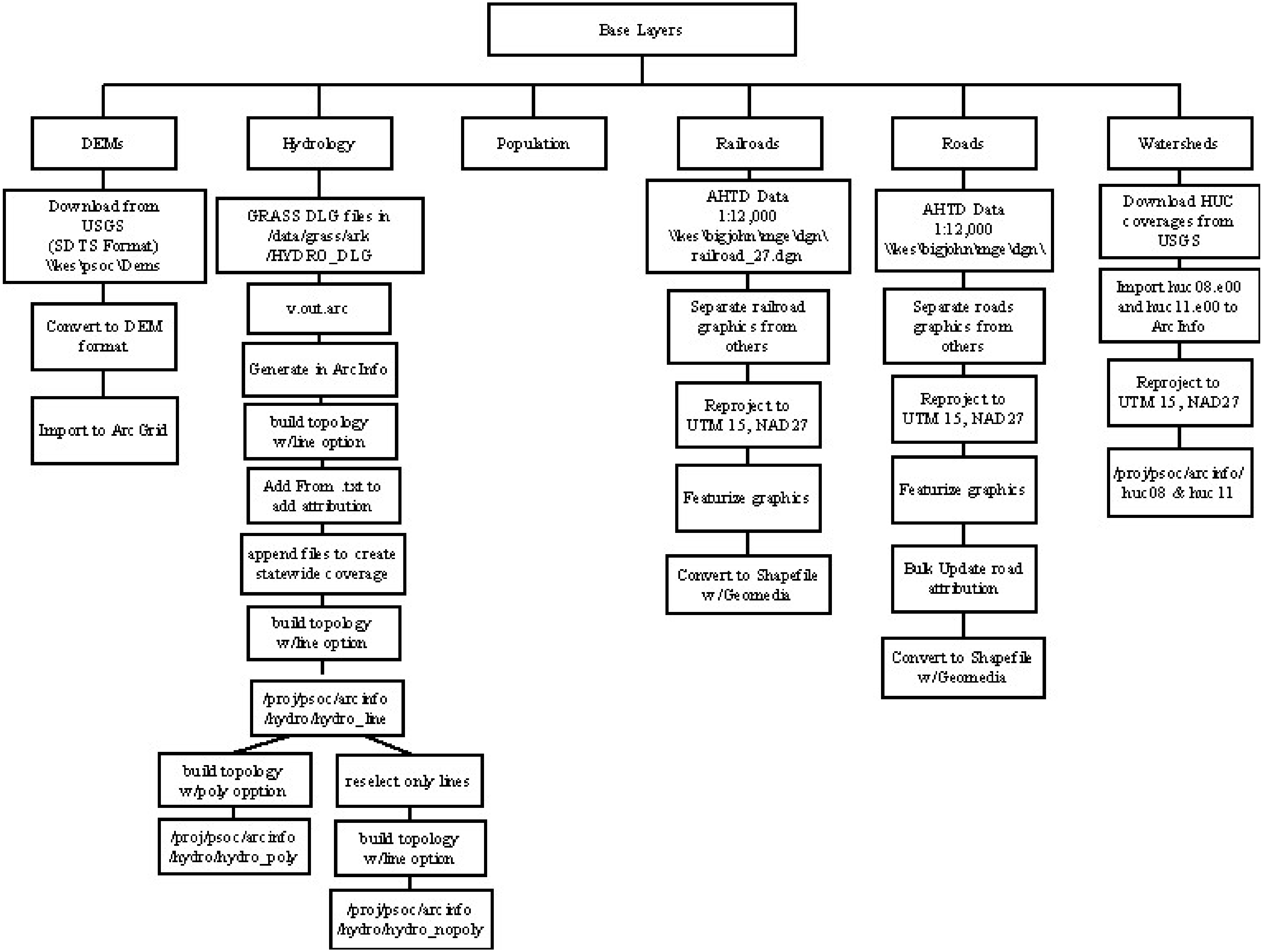
CAC response: Updates to assessments should be made as new information becomes available.

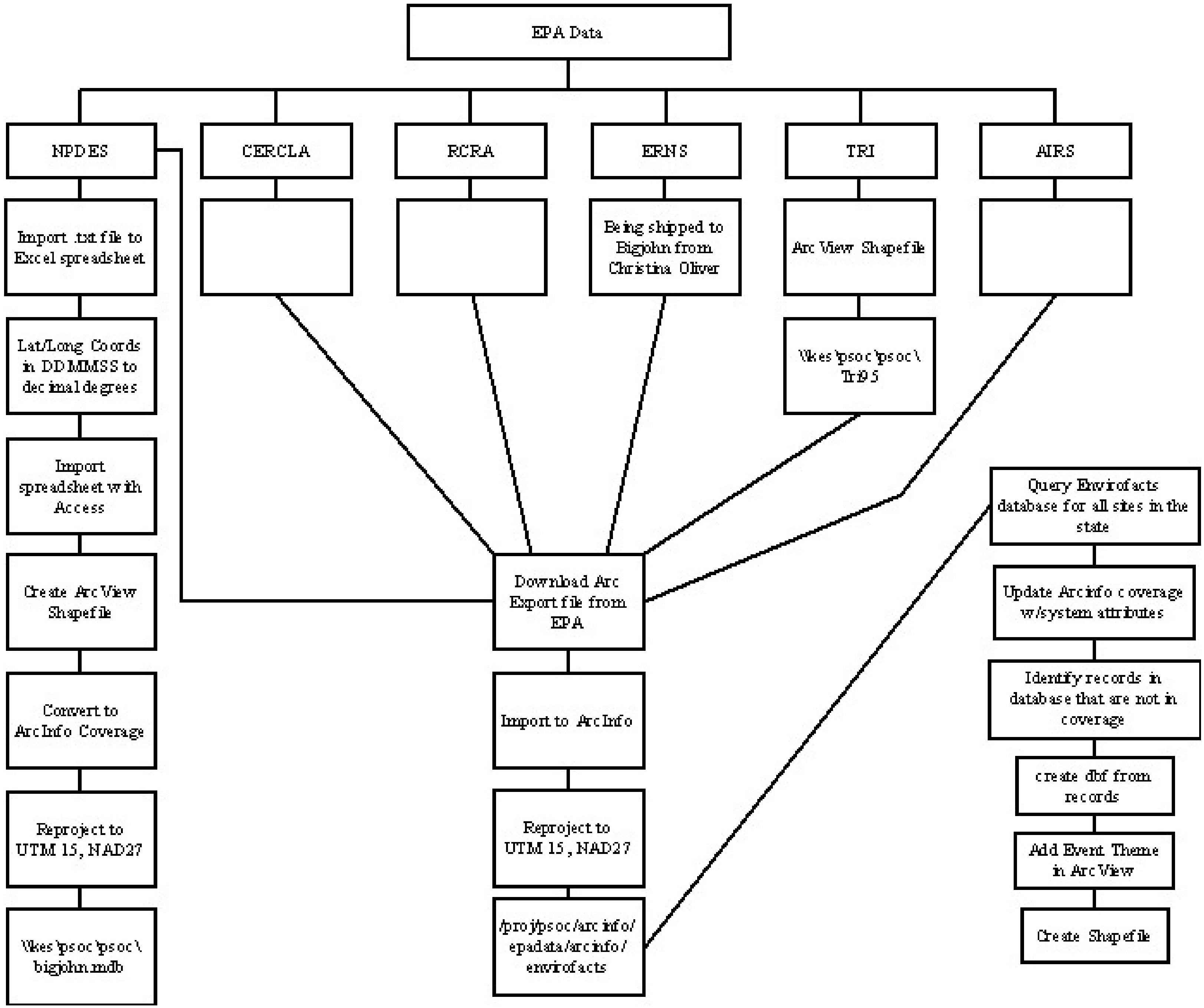
Final action: Upon completion of Phase I Assessments and depending on staffing and resources, a Phase II Assessment process will be initiated. The Phase II process will incorporate any new / updated information that was gained in the Phase I process. Furthermore, assessment areas will be expanded to provide enhanced protection efforts. (See Section VIII for more detail.)

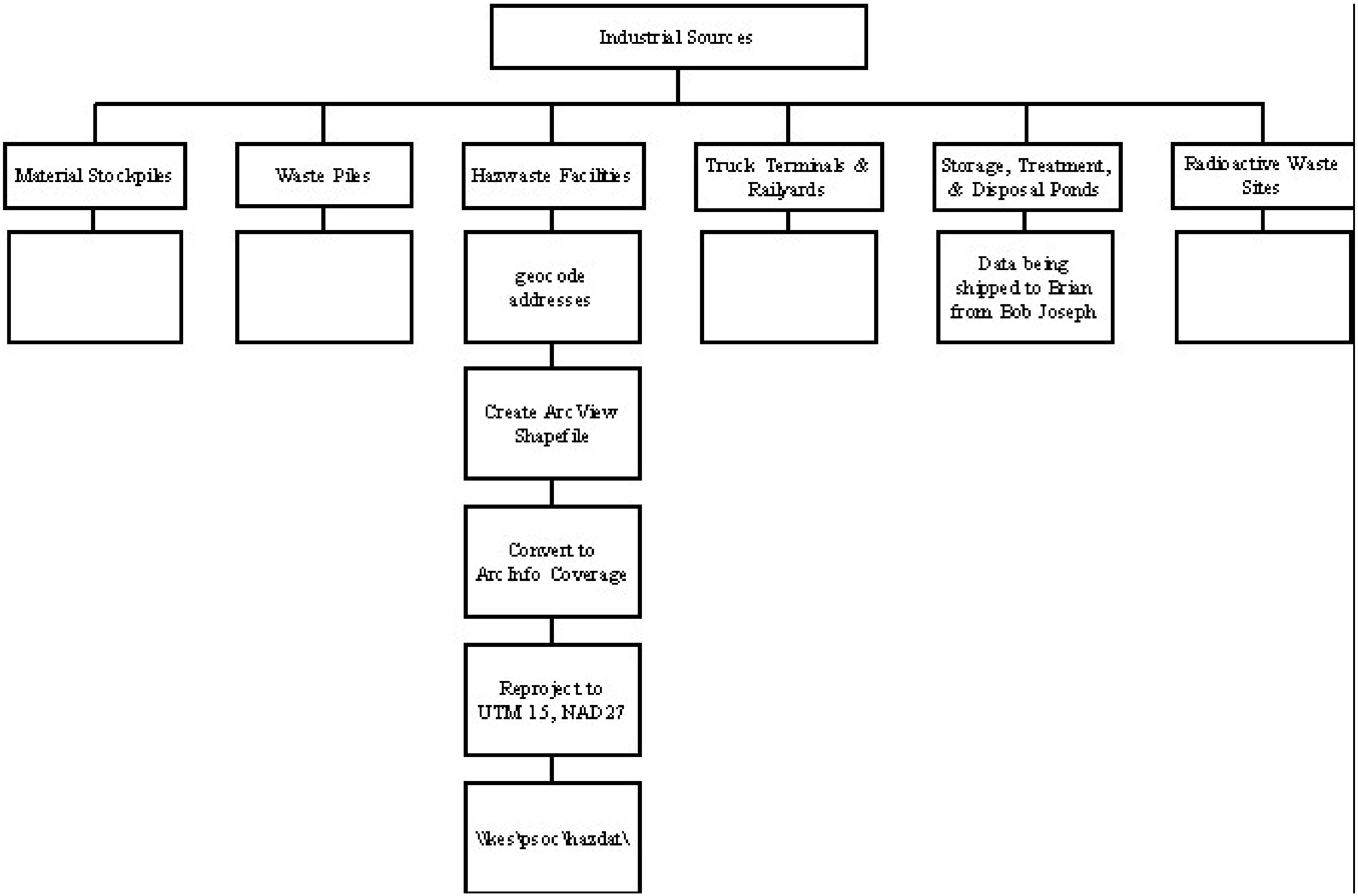
Appendix G -- Database and GIS Development Flow Charts

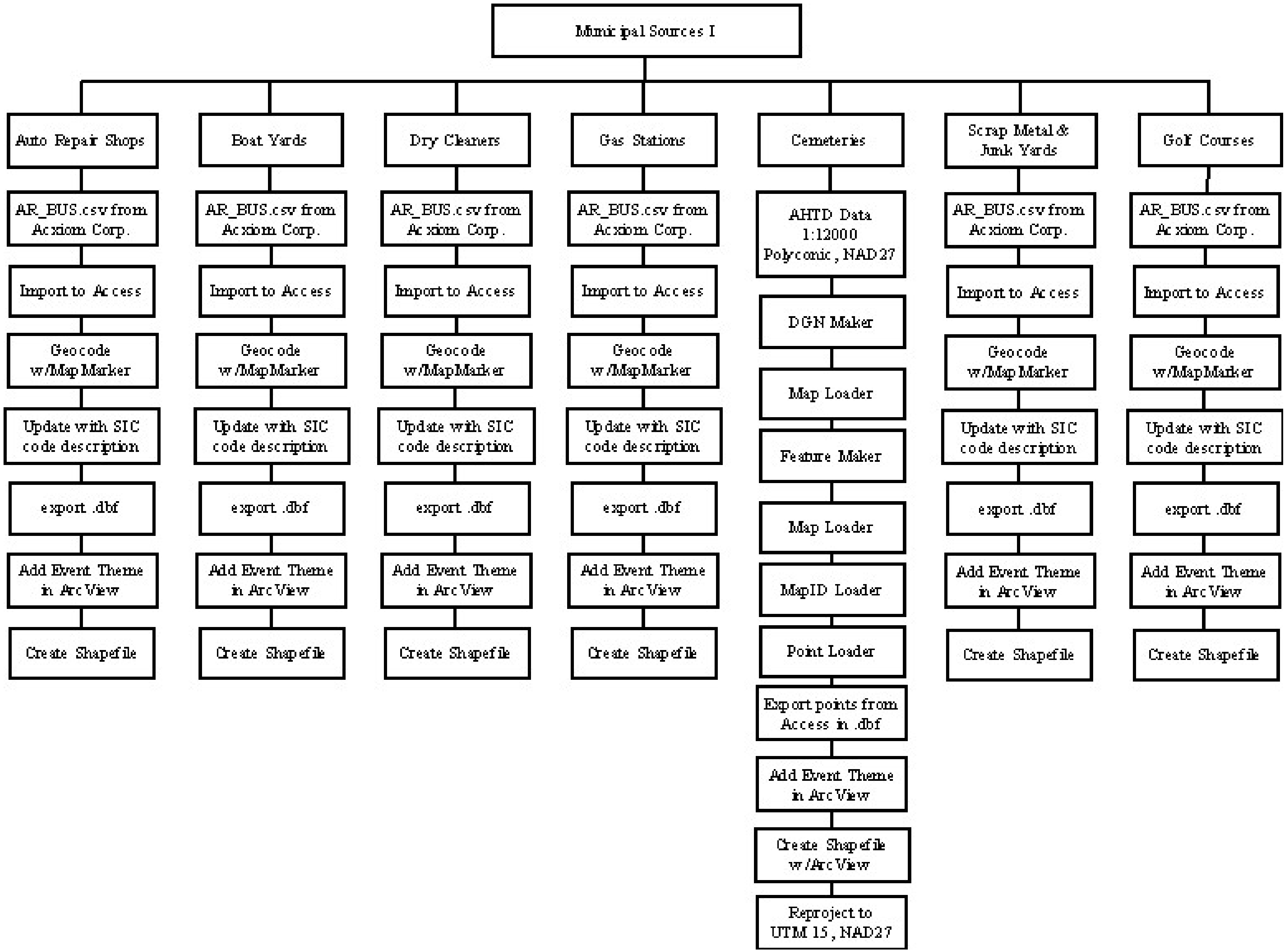

Agricultural Sources I
Dairy
MILK.xls from DOH
Export to text file
Reformat text file using UNIX cut and paste
Generate Dairy in ArcInfo
build topology (points)
Add From .att file to add attributes
/proj/psoc/arcinfo/dairy/dairy
Poultry Houses
Swine Operations
AHTD Data 1:12000 Polyconic, NAD27
DGN Maker
Map Loader
Feature Maker
Map Loader
MapID Loader
Point Loader
Export points from Access in .dbf
Add Event Theme in ArcView
Create Shapefile w/ArcView
Reproject to UTM 15, NAD27
Land Use
GRASS layer /proj/mapper/grass/ark/IMAGERY/veg_state_urban30
Reclass to 6 categories
Resample (keep 30m resolution)
Uncompress GRASS layer
Import to ArcInfo (Imagegrid)
/proj/psoc/arcinfo/gap/gap30
Pesticide Storage
Fertilizer Storage
company names and addresses from State Plant Board
Import to Access
Export as .dbf
Geocode with MapMarker
Add Event Theme in ArcView
Create Shapefile
Reproject to UTM 15, NAD27
Grain Storage
AHTD Data 1:12000 Polyconic, NAD27
DGN Maker
Map Loader
Feature Maker
Map Loader
MapID Loader
Point Loader
Export points from Access in .dbf
Create Shapefile w/ArcView
Reproject to UTM 15, NAD27

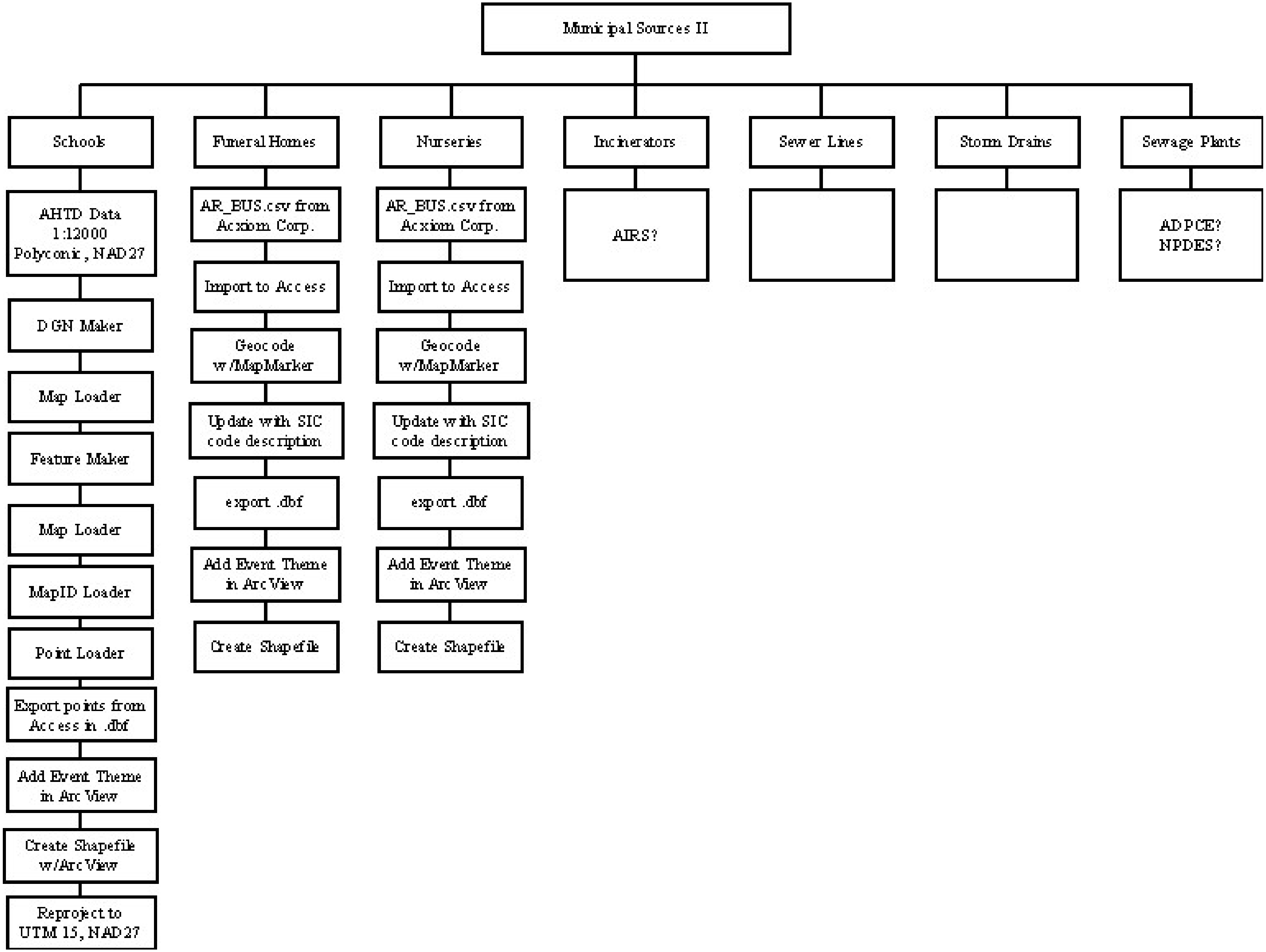

Agricultural Sources II
Agri-drainage Wells
Canals & Ditches
Aerial Applicators
Irrigation Wells
Livestock Population
State Permits Land Application
GRASS DLG files in /data/grass/ark /HYDRO_DLG
v.out.arc
Generate in ArcInfo
build topology w/line option
Add From .txt to add attribution
append files to create statewide coverage
build topology w/line option
select canals and ditches from coverage
writeselect
Create new coverage using reselect at Arc prompt
/proj/psoc/arcinfo /hydro/canal_ditch
Download Arc Export file from USGS
Import to ArcInfo
Reproject to UTM 15, NAD27
/proj/psoc/arcinfo/ livestock

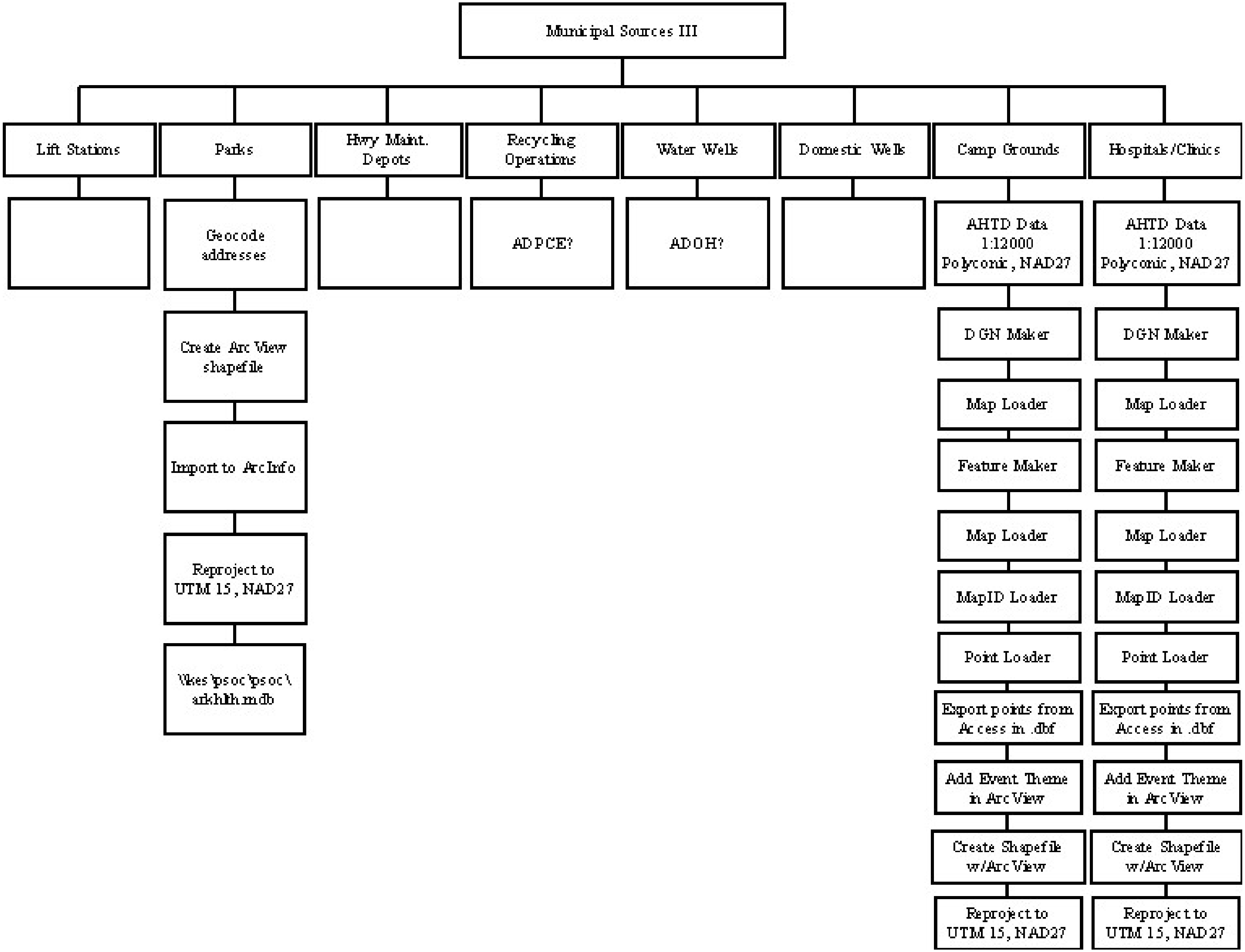

Base Layers
DEMs
Hydrology
Population
Railroads
Roads
Watersheds
Download from USGS (SDTS Format) \\kes\psoc\Dems
Convert to DEM format
Import to Arc Grid
GRASS DLG files in /data/grass/ark /HYDRO_DLG
v.out.arc
Generate in ArcInfo
build topology w/line option
Add From .txt to add attribution
append files to create statewide coverage
build topology w/line option
/proj/psoc/arcinfo /hydro/hydro_line
build topology w/poly opption
/proj/psoc/arcinfo /hydro/hydro_poly
reselect only lines
build topology w/line option
/proj/psoc/arcinfo /hydro/hydro_nopoly
AHTD Data 1:12,000 \\kes\bigjohn\mge\dgn\ railroad_27.dgn
Separate railroad graphics from others
Reproject to UTM 15, NAD27
Featurize graphics
Convert to Shapefile w/Geomedia
AHTD Data 1:12,000 \\kes\bigjohn\mge\dgn\
Separate roads graphics from others
Reproject to UTM 15, NAD27
Featurize graphics
Bulk Update road attribution
Convert to Shapefile w/Geomedia
Download HUC coverages from USGS
Import huc08.e00 and huc11.e00 to ArcInfo
Reproject to UTM 15, NAD27
/proj/psoc/arcinfo/ huc08 & huc11


EPA Data
NPDES
CERCLA
RCRA
ERNS
TRI
AIRS
Import .txt file to Excel spreadsheet
Lat/Long Coords in DDMMSS to decimal degrees
Import spreadsheet with Access
Create ArcView Shapefile
Convert to ArcInfo Coverage
Reproject to UTM 15, NAD27
\\kes\psoc\psoc\ bigjohn.mdb
Being shipped to Bigjohn from Christina Oliver
Arc View Shapefile
\\kes\psoc\psoc\ Tri95
Download Arc Export file from EPA
Import to ArcInfo
Reproject to UTM 15, NAD27
/proj/psoc/arcinfo/ epadata/arcinfo/ envirofacts
Query Envirofacts database for all sites in the state
Update Arcinfo coverage w/system attributes
Identify records in database that are not in coverage
create dbf from records
Add Event Theme in ArcView
Create Shapefile


Industrial Sources
Material Stockpiles
Waste Piles
Hazwaste Facilities
Truck Terminals & Railyards
Storage, Treatment, & Disposal Ponds
Radioactive Waste Sites
geocode addresses
Data being shipped to Brian from Bob Joseph
Create ArcView Shapefile
Convert to Arc Info Coverage
Reproject to UTM 15, NAD 27
\\kes\psoc\hazdat\


Municipal Sources I
Auto Repair Shops
Boat Yards
Dry Cleaners
Gas Stations
Cemeteries
Scrap Metal & Junk Yards
Golf Courses
AR_BUS.csv from Acxiom Corp.
Import to Access
Geocode w/MapMarker
Update with SIC code description
export .dbf
Add Event Theme in ArcView
Create Shapefile
AHTD Data 1:12000 Polyconic, NAD27
DGN Maker
Map Loader
Feature Maker
Map Loader
MapID Loader
Point Loader
Export points from Access in .dbf
Add Event Theme in ArcView
Create Shapefile w/ArcView
Reproject to UTM 15, NAD27


Municipal Sources II
Schools
AHTD Data
1:12000
Polyconic, NAD27
DGN Maker
Map Loader
Feature Maker
Map Loader
MapID Loader
Point Loader
Export points from Access in .dbf
Add Event Theme in Arc View
Create Shapefile w/Arc View
Reproject to UTM 15, NAD27
Funeral Homes
AR_BUS.csv from Acxiom Corp.
Import to Access
Geocode w/MapMarker
Update with SIC code description
export .dbf
Add Event Theme in Arc View
Create Shapefile
Nurseries
AR_BUS.csv from Acxiom Corp.
Import to Access
Geocode w/MapMarker
Update with SIC code description
export .dbf
Add Event Theme in Arc View
Create Shapefile
Incinerators
AIRS?
Sewer Lines
Storm Drains
Sewage Plants
ADPCE?
NPDES?


Municipal Sources III
Lift Stations
Parks
Hwy Maint. Depots
Recycling Operations
Water Wells
Domestic Wells
Camp Grounds
Hospitals/Clinics
Geocode addresses
Create Arc View shapefile
Import to ArcInfo
Reproject to UTM 15, NAD27
\\kes\psoc\psoc\arkhlth.mdb
ADPCE?
ADOH?
AHTD Data 1:12000 Polyconic, NAD27
DGN Maker
Map Loader
Feature Maker
Map Loader
MapID Loader
Point Loader
Export points from Access in .dbf
Add Event Theme in Arc View
Create Shapefile w/Arc View
Reproject to UTM 15, NAD27
AHTD Data 1:12000 Polyconic, NAD27
DGN Maker
Map Loader
Feature Maker
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Point Loader
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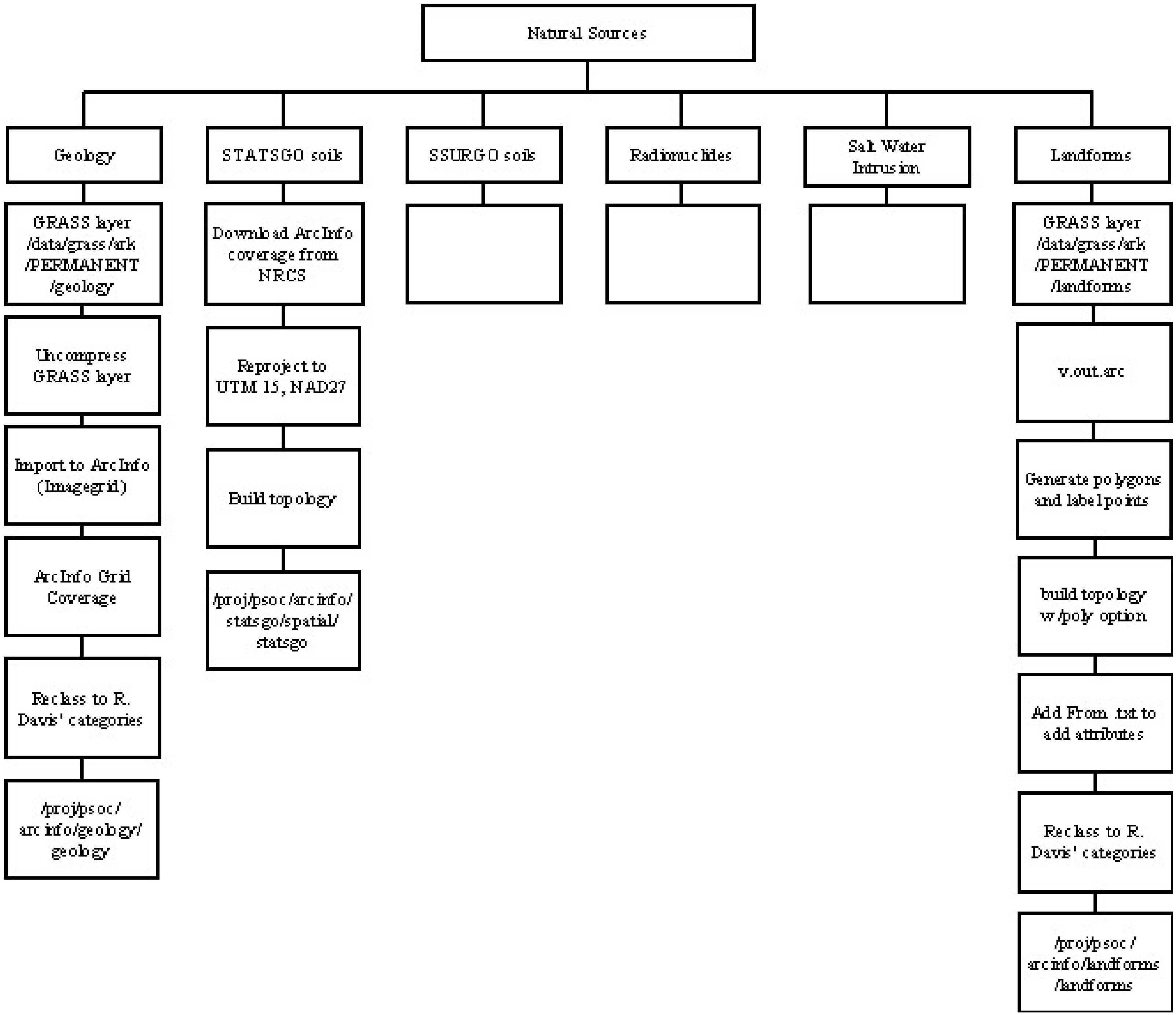
Natural Sources
Geology
STATSGO soils
SSURGO soils
Radionuclides
Salt Water Intrusion
Landforms
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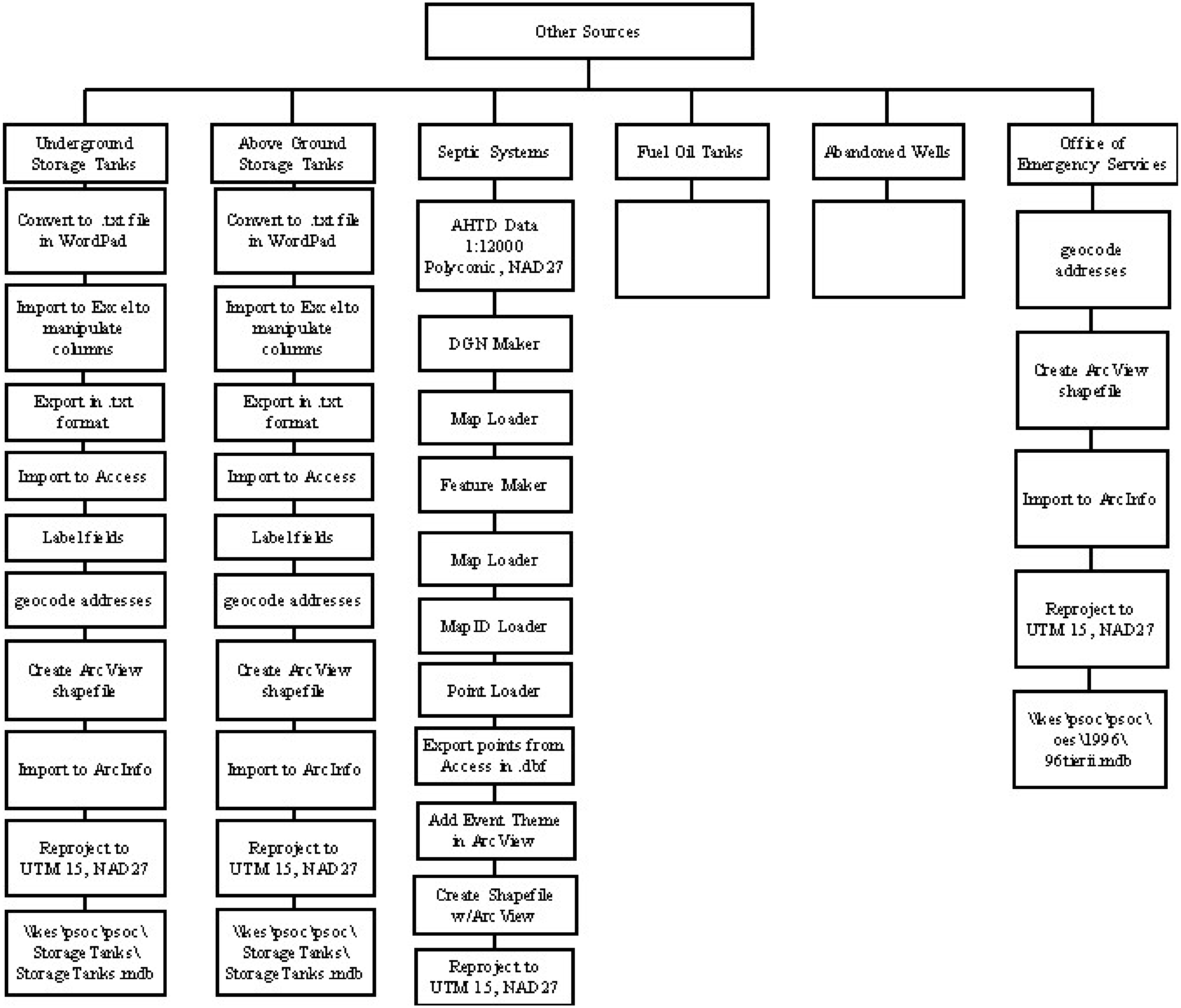
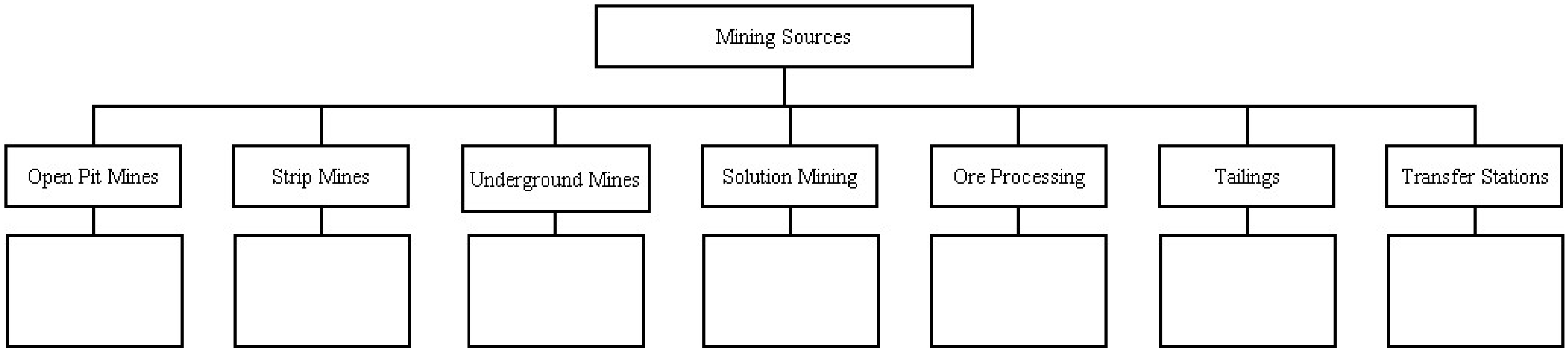
Uncompress GRASS layer
Import to ArcInfo (Imagegrid)
ArcInfo Grid Coverage
Reclass to R. Davis' categories
/proj/psoc/ arcinfo/geology/ geology
Download ArcInfo coverage from NRCS
Reproject to UTM 15, NAD27
Build topology
/proj/psoc/arcinfo/ statsgo/spatial/ statsgo
GRASS layer /data/grass/ark /PERMANENT /landforms
v.out.arc
Generate polygons and label points
build topology w/poly option
Add From .txt to add attributes
Reclass to R. Davis' categories
/proj/psoc/ arcinfo/landforms /landforms


Other Sources
Underground Storage Tanks
Convert to .txt file in WordPad
Import to Excel to manipulate columns
Export in .txt format
Import to Access
Label fields
geocode addresses
Create ArcView shapefile
Import to ArcInfo
Reproject to UTM 15, NAD27
\\kes\psoc\psoc\Storage Tanks\Storage Tanks.mdb
Above Ground Storage Tanks
Convert to .txt file in WordPad
Import to Excel to manipulate columns
Export in .txt format
Import to Access
Label fields
geocode addresses
Create ArcView shapefile
Import to ArcInfo
Reproject to UTM 15, NAD27
\\kes\psoc\psoc\Storage Tanks\Storage Tanks.mdb
Septic Systems
AHTD Data 1:12000 Polyconic, NAD27
DGN Maker
Map Loader
Feature Maker
Map Loader
Map ID Loader
Point Loader
Export points from Access in .dbf
Add Event Theme in ArcView
Create Shapefile w/ArcView
Reproject to UTM 15, NAD27
Fuel Oil Tanks
Abandoned Wells
Office of Emergency Services
geocode addresses
Create ArcView shapefile
Import to ArcInfo
Reproject to UTM 15, NAD27
\\kes\psoc\psoc\oes\1996\96tierii.mdb


Mining Sources
Open Pit Mines
Strip Mines
Underground Mines
Solution Mining
Ore Processing
Tailings
Transfer Stations

Appendix H Arkansas-Oklahoma Arkansas River Compact Commission -- 1998 Engineering Committee Report

ARKANSAS-OKLAHOMA
ARKANSAS RIVER COMPACT COMMISSION

ENGINEERING COMMITTEE REPORT
1998

COMMITTEE ASSIGNMENTS

1. *PROGRESS TOWARD MEETING THE GOAL OF REDUCING PHOSPHORUS LOADING IN THE ILLINOIS RIVER BY 40%.*

There is a lengthy history of water quality concerns in the Illinois River watershed. In the 1980's, the Supreme Court reviewed the question of whether water quality standards in Oklahoma could be extended into Arkansas.

A Cooperative "Clean-Lakes" Project Phase I Diagnostic Feasibility study on Lake Tenkiller was completed in June 1996, to determine the levels of nutrients, metals, and pesticides within the water column and metals in the sediment of Lake Tenkiller. Nutrient loading from point and nonpoint sources into the Illinois River was determined by monitoring river tributaries and utilizing existing water quality databases. Selected samples collected during runoff events were used to calibrate an event-bases runoff model to predict total quantity of nitrogen and phosphorous exported from nonpoint sources in the Illinois River Basin. The mean annual concentrations of phosphorous, nitrogen, and chlorophyll a measured throughout Lake Tenkiller were indicative of eutrophic conditions. The study recommended the eutrophication process be controlled or reversed by reducing phosphorous input to the lake from both point and nonpoint sources. The recommendations included a short-term goal of 30-40% reduction of influent total phosphorous loading within the next five years.

After the final report was released, EPA proposed that a phosphorus reduction goal be developed. Arkansas and Oklahoma agencies worked with EPA to propose a voluntary phosphorus reduction goal. Thus, the adoption of the phosphorus reduction goal by the Compact at the 1997 annual meeting comes after a series of examinations of water quality concerns in the Illinois River.

Attached is a listing of the data available for the stations and graphs indicating the loadings of the stations.

2. ANNUAL YIELD AND DEFICIENCY REPORT

A computation of the annual yield and deficiencies of the compact area was prepared by Terrance E. Lamb of Hydrologic Information Services. The report indicates that there was no violation of compact requirements.

PRESENTATIONS

1. USGS

A presentation was made by Reed Green regarding calculations of phosphorus loadings. The discussion centered on comparisons of base flow phosphorus and storm event phosphorus loadings, and how sampling programs should consider both in order to calculate accurate loadings.

2. U of A - HIGHWAY 59 MONITORING STATION PROJECT

Dr. Marc Nelson of the University of Arkansas made a presentation regarding results of the storm water sampling project funded through the Compact. The information gathered in this project was supplemented by a research project funded by USGS. The research project is to determine optimal sampling frequency in order to determine accurate loadings.

RECOMMENDATIONS

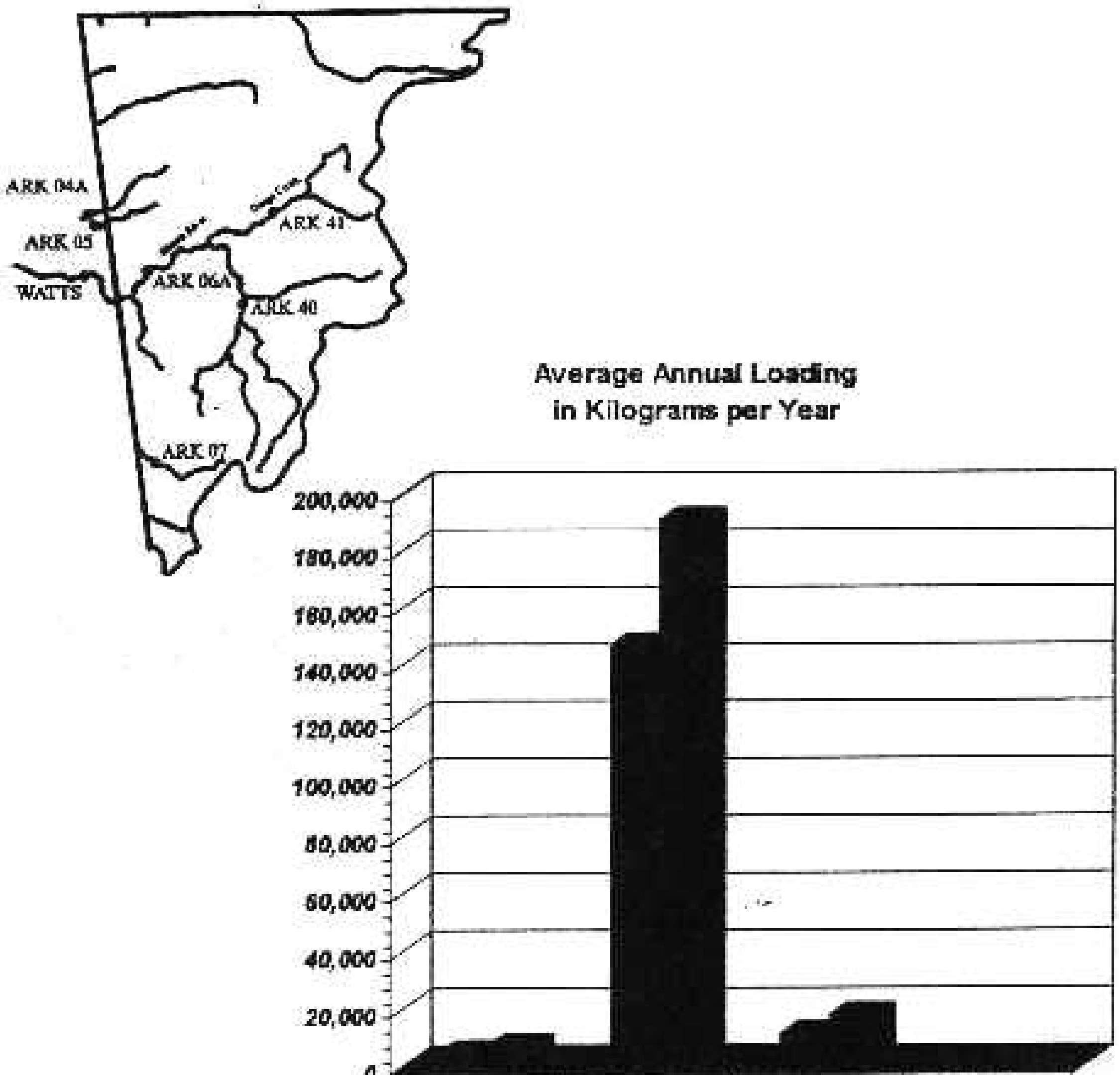
1. The Committee voted to recommend continuation of the Hwy. 59 Monitoring Station project for another year. Cross sectional analysis of the river bed at the station will be added to the last year's sampling program. The cost for the sampling program will be $41,691.

2. The Committee voted to recommend that the contract for computation of annual yield and selected hydrologic data for the Arkansas River Basin area for water year 1998 be awarded to Terrance E. Lamb, Hydrologic Information Services, in the amount of $3,400. The estimated cost of preparing this document, for Compact budget purposes, is $3,600 for water year '99, and $3,800 for water year 2000.

Arkansas Committee Member **Oklahoma Committee Member**

________________________ ________________________

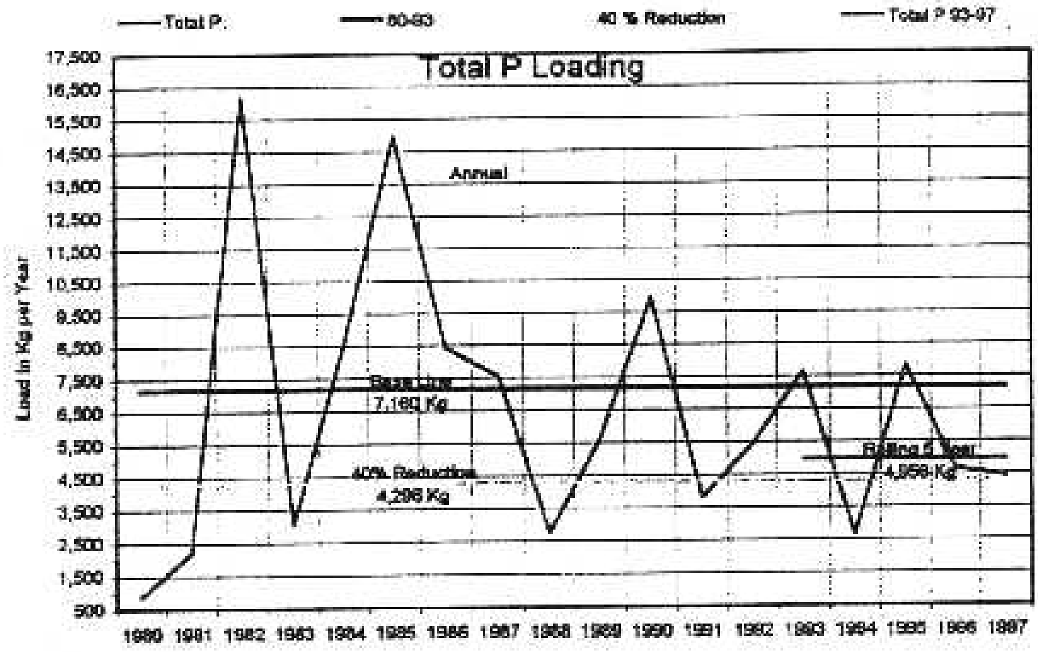
Summary Loadings
Illinois River



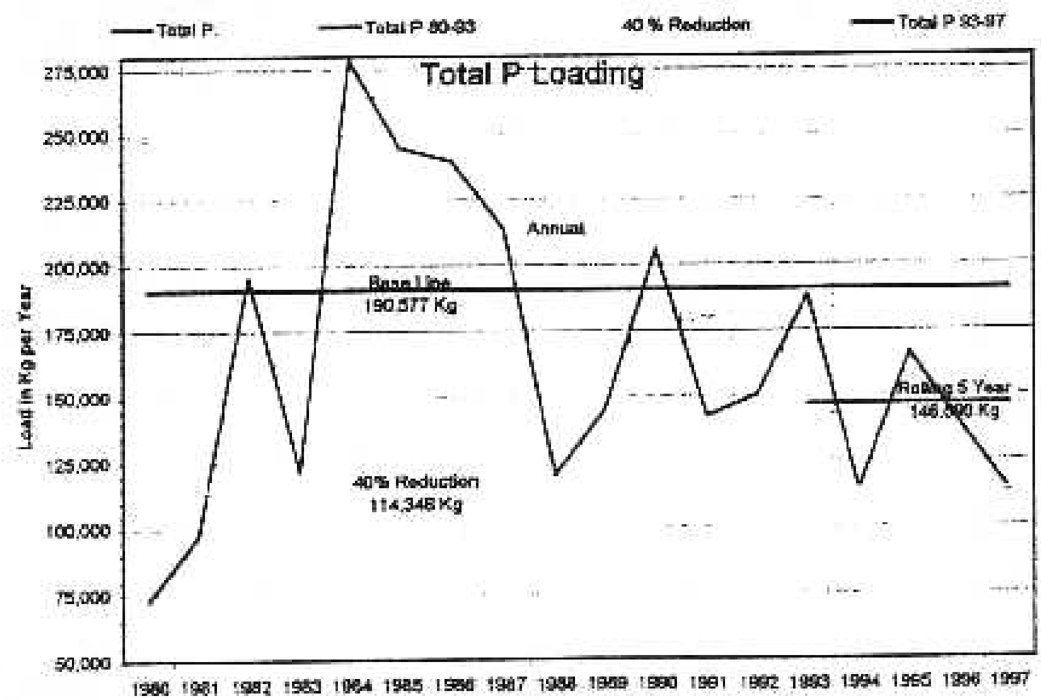
	Ark 07	Ark 06a (Watts)	Ark 05	Ark 04a (5855)
■ Total P 93-97	4,956	146,690	11,470	2,869
■ Total P 80-93	7,160	190,577	17,566	3,267

ARKANSAS

ARK 07 Baron Fork at Dutch Mill



ARK 06A Illinois River Near Siloam Springs with Watts flow



9/9/98

ARKANSAS

ARK 41 — LOADING

Year	Flow (cfs)	Total Phos. (mg/L)	Ortho Phos. (mg/L)	total kg/day	total pd/day	total kg/year	total pd/year	ortho kg/day	ortho pd/day	ortho kg/year	ortho pd/year
95	90	0.71	0.60	155	342	56,762	124,877	133	292	48,502	106,704
96	140	0.83	0.79	284	625	103,693	228,125	270	594	98,587	216,890
Avg.	115	0.77	0.70	216	475	78,833	173,476	196	431	71,478	157,251

ARK 40 — LOADING

Year	Flow (cfs)	Total Phos. (mg/L)	Ortho Phos. (mg/L)	total kg/day	total pd/day	total kg/year	total pd/year	ortho kg/day	ortho pd/day	ortho kg/year	ortho pd/year
95	329	0.12	0.05	97	213	35,332	77,730	39	86	14,299	31,457
96	203	0.07	0.06	36	80	13,324	29,312	31	68	11,270	24,793
Avg.	266	0.10	0.06	63	139	23,012	50,627	36	79	13,164	28,961

ARK 07 — LOADING

Year	Flow (cfs)	Total Phos. (mg/L)	Ortho Phos. (mg/L)	total kg/day	total pd/day	total kg/year	total pd/year	ortho kg/day	ortho pd/day	ortho kg/year	ortho pd/year
80	10	0.103		2	5	878	1,932				
81	18	0.135		6	13	2,220	4,884				
82	37	0.484		44	97	16,178	35,591				
83	27	0.125		8	18	3,039	6,685				
84	52	0.183		23	51	8,472	18,638				
85	79	0.211		41	90	14,973	32,940				
86	64	0.147	0.144	23	51	8,411	18,505	23	50	8,228	18,101
87	63	0.134	0.115	21	45	7,549	16,607	18	39	6,470	14,233
88	32	0.097	0.071	8	17	2,767	6,087	6	12	2,017	4,437
89	50	0.124	0.099	15	34	5,598	12,317	12	27	4,449	9,787
90	102	0.109	0.053	27	60	9,966	21,926	13	29	4,796	10,552
91	49	0.086	0.069	10	23	3,810	8,382	8	18	3,048	6,706
92	48	0.127	0.084	15	33	5,457	12,005	10	22	3,586	7,889
93	104	0.083	0.062	21	46	7,659	16,849	16	35	5,756	12,662
94	37	0.081	0.071	7	16	2,673	5,882	6	14	2,357	5,184
95	54	0.162	0.055	22	47	7,855	17,280	7	16	2,641	5,809
96	62	0.084	0.075	13	28	4,677	10,289	11	25	4,167	9,166
97	37	0.067	0.046	6	13	2,211	4,863	4	9	1,523	3,350
average	51	0.141	0.079	18	39	6,501	14,302	10	22	3,614	7,950

ARK 36A — LOADING

Year	Flow (cfs)	Total Phos. (mg/L)	Ortho Phos. (mg/L)	total kg/day	total pd/day	total kg/year	total pd/year	ortho kg/day	ortho pd/day	ortho kg/year	ortho pd/year
80	173	0.470		199	438	72,668	159,869				
81	280	0.420	0.140	267	588	97,593	214,705	89	196	32,531	71,568
82	591	0.370	0.282	533	1,177	195,428	429,941	408	898	149,110	328,042
83	352	0.386	0.318	333	732	121,542	267,398	274	603	100,096	220,210
84	708	0.442	0.303	764	1,680	278,884	613,546	528	1,161	192,730	424,005
85	947	0.289	0.232	670	1,475	244,876	538,727	538	1,183	196,352	431,974
86	879	0.305	0.275	656	1,443	239,600	527,119	592	1,303	216,334	475,936
87	815	0.294	0.251	586	1,288	213,877	470,530	500	1,101	182,756	402,063
88	531	0.253	0.222	328	722	119,934	263,856	288	634	105,194	231,427
89	558	0.291	0.260	397	874	145,074	319,162	355	781	129,663	285,251
90	1,127	0.204	0.137	563	1,239	205,639	452,406	377	829	137,652	302,835
91	724	0.220	0.183	390	857	142,350	313,171	323	711	118,086	259,789
92	780	0.222	0.176	412	907	150,515	331,134	328	722	119,845	263,658
93	1,163	0.181	0.130	516	1,135	188,316	414,383	370	813	135,227	297,498
94	674	0.190	0.185	313	688	114,147	251,124	305	670	111,236	244,719
95	783	0.237	0.181	455	1,000	166,057	365,325	347	763	126,737	278,822
96	693	0.225	0.204	382	840	139,465	306,822	346	761	126,294	277,847
97	897	0.213	0.173	311	684	113,548	249,806	255	562	93,237	205,122
average	685	0.290	0.215	485	1,068	177,297	390,053	361	793	131,690	289,719

Average Concentration Levels at Each Station

Station Ark 07

Year	Total Phos. (mg/L)		Percent Decrease
80-93	0.152		
90-94		0.098	35.36%
91-95		0.108	29.13%
92-96		0.106	30.27%
93-97		0.094	38.09%

Station Ark 07

Year	Ortho Phos. (mg/L)		Percent Decrease
80-93	0.101		
90-94		0.069	31.95%
91-95		0.069	31.62%
92-96		0.071	30.19%
93-97		0.063	37.74%

Station Ark 06A

Year	Total Phos. (mg/L)		Percent Decrease
80-93	0.311		
90-94		0.203	34.71%
91-95		0.210	32.55%
92-96		0.212	32.07%
93-97		0.210	32.60%

Station Ark 06A

Year	Ortho Phos. (mg/L)		Percent Decrease
80-93	0.235		
90-94		0.165	29.56%
91-95		0.173	26.15%
92-96		0.178	23.96%
93-97		0.178	24.17%

Station Ark 05

Year	Total Phos. (mg/L)		Percent Decrease
80-93	1.354		
90-94		0.871	35.69%
91-95		0.844	37.70%
92-96		0.847	37.47%
93-97		0.793	41.46%

Station Ark 05

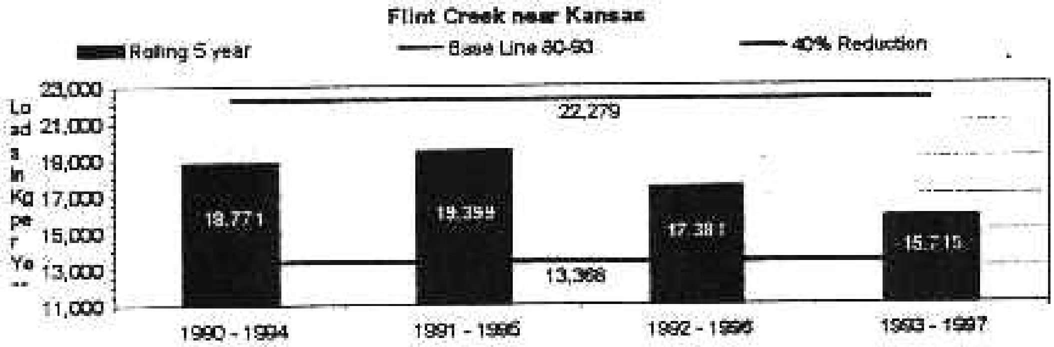
Year	Ortho Phos. (mg/L)		Percent Decrease
80-93	1.066		
90-94		0.688	35.50%
91-95		0.687	35.57%
92-96		0.694	34.95%
93-97		0.722	32.34%

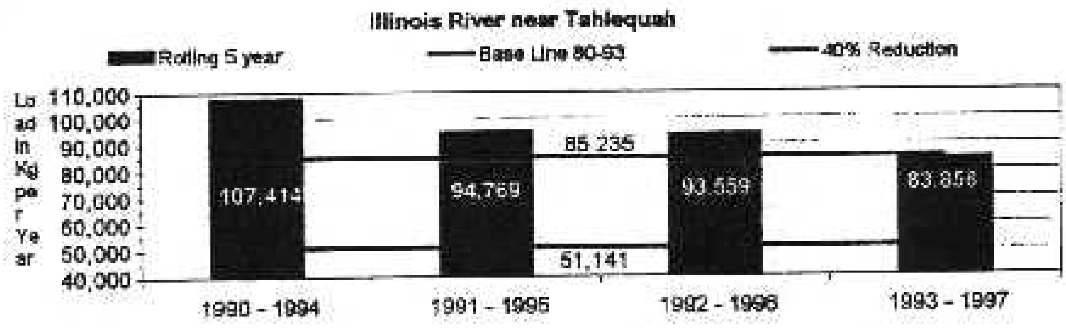
Station Ark 04A

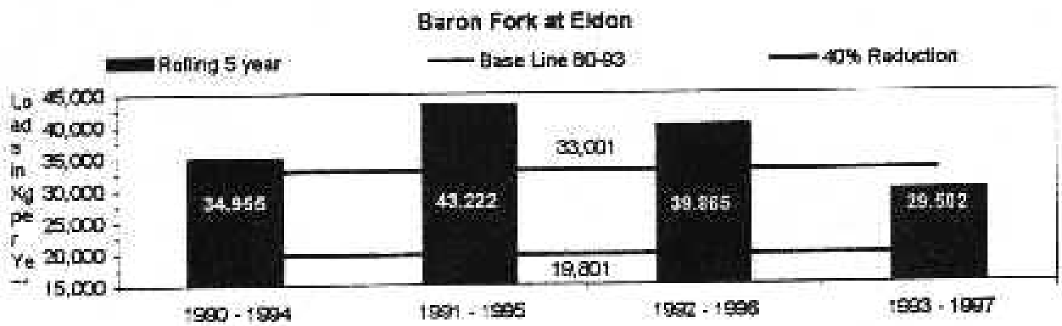
Year	Total Phos. (mg/L)		Percent Decrease
80-93	0.078		
90-94		0.052	33.44%
91-95		0.055	29.96%
92-96		0.055	30.08%
93-97		0.059	24.85%

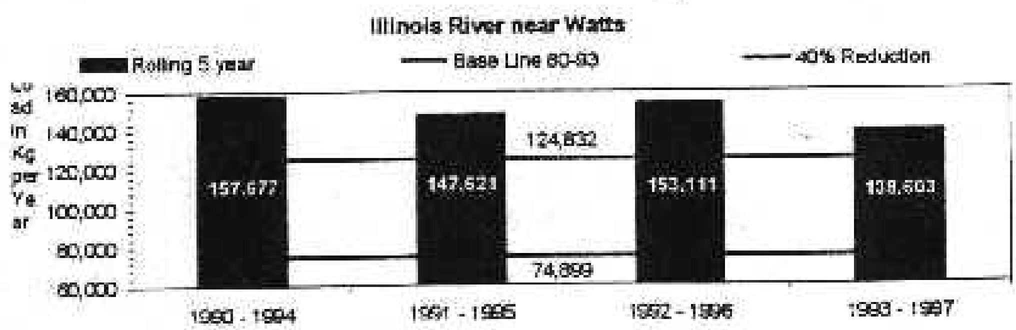
Station Ark 04A

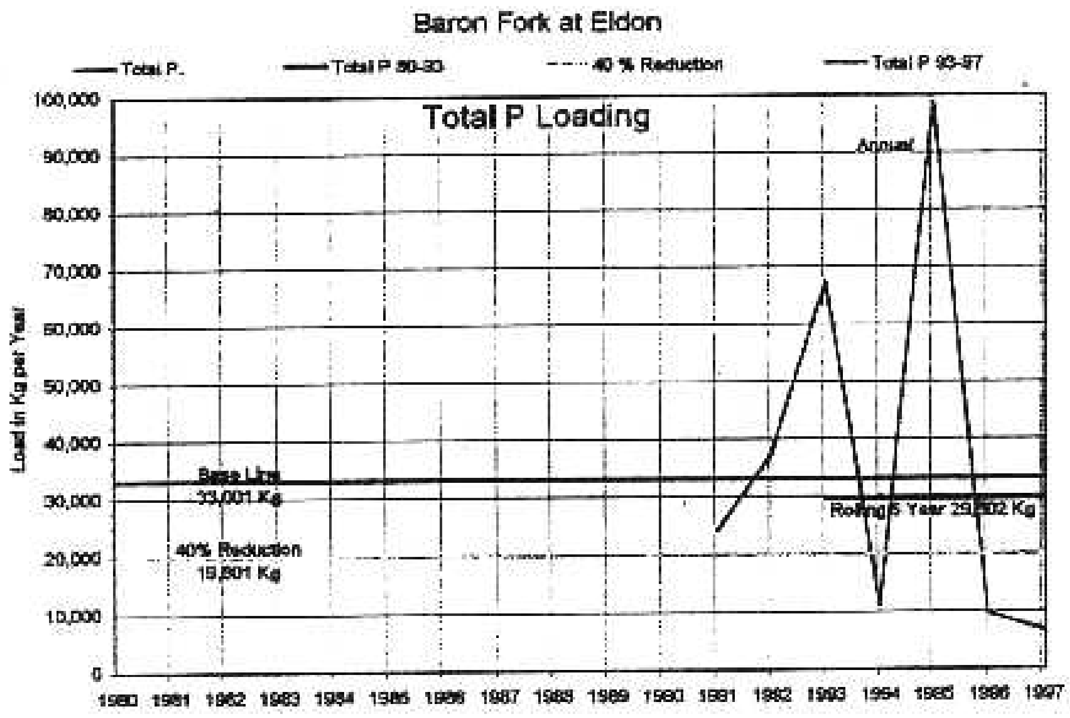
Year	Ortho Phos. (mg/L)		Percent Decrease
80-93	0.051		
90-94		0.042	17.14%
91-95		0.047	6.77%
92-96		0.050	0.96%
93-97		0.049	3.20%


Flint Creek near Kansas
Rolling 5 year
Base Line 80-93
40% Reduction
Loads in Kg per Year
23,000
21,000
19,000
17,000
15,000
13,000
11,000
22,279
18,771
19,359
17,381
15,715
13,368
1990 - 1994
1991 - 1995
1992 - 1996
1993 - 1997

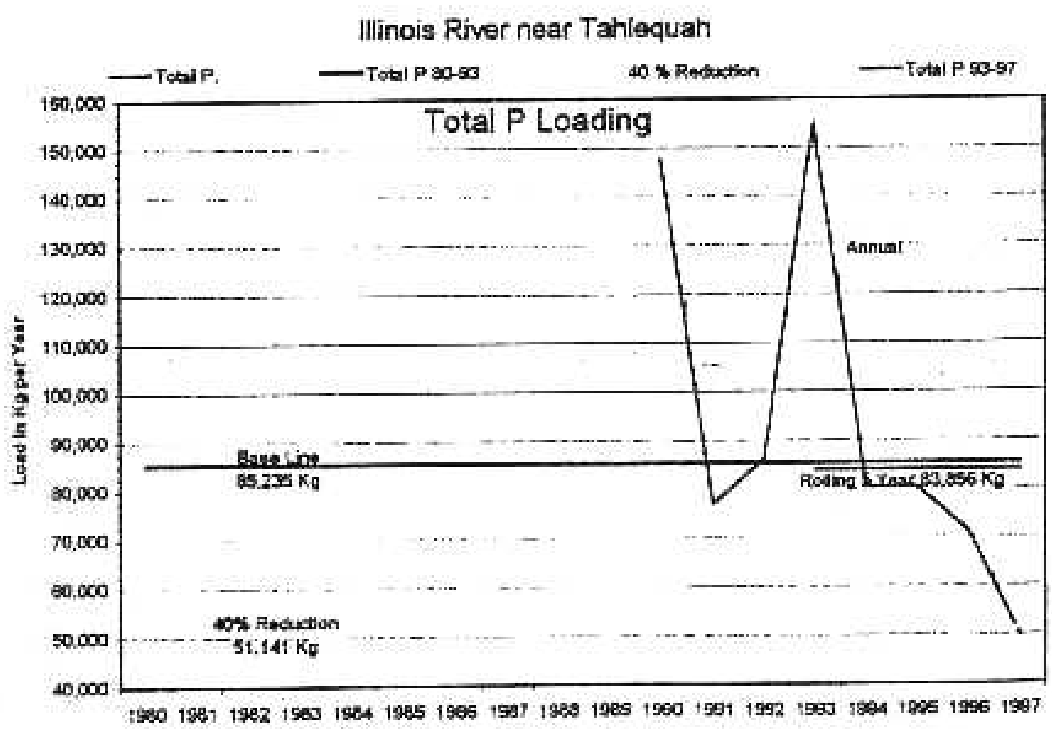

Illinois River near Tahlequah
Rolling 5 year
Base Line 80-93
40% Reduction
Load in Kg per Year
110,000
100,000
90,000
80,000
70,000
60,000
50,000
40,000
107,414
94,769
85,235
93,559
83,858
51,141
1990 - 1994
1991 - 1995
1992 - 1996
1993 - 1997


Baron Fork at Eldon
Rolling 5 year
Base Line 80-93
40% Reduction
Loads in Kg per Year
45,000
40,000
35,000
30,000
25,000
20,000
15,000
34,956
43,222
33,001
39,865
29,502
19,801
1990 - 1994
1991 - 1995
1992 - 1996
1993 - 1997


Illinois River near Watts
Rolling 5 year
Base Line 80-93
40% Reduction
Load in Kg per Year
160,000
140,000
120,000
100,000
80,000
60,000
157,677
147,621
124,832
153,111
138,603
74,899
1990 - 1994
1991 - 1995
1992 - 1996
1993 - 1997



Baron Fork at Eldon
Total P.
Total P 80-93
40 % Reduction
Total P 93-97
Total P Loading
Load in Kg per Year
Annual
Base Line
33,001 Kg
40% Reduction
19,801 Kg
Rolling 5 Year 29,802 Kg



Illinois River near Tahlequah
Total P.
Total P 80-93
40 % Reduction
Total P 93-97
Total P Loading
Load in Kg per Year
Annual
Base Line
85,235 Kg
Rolling 5 Year 83,856 Kg
40% Reduction
51,141 Kg

OKLAHOMA

Baron Fork at Eldon				Loadings	
Year	Flow (cfs)	Total Phos. (mg/L)	Ortho Phos. (mg/L)	Total P kg/year	Ortho P kg/year
1980	77				
1981	201				
1982	296				
1983	184				
1984	364				
1985	593				
1986	536				
1987	491				
1988	269				
1989	320				
1990	666				
1991	451	0.060	0.065	24,161	26,175
1992	440	0.095	0.056	37,340	22,011
1993	700	0.108	0.060	67,280	37,551
1994	328	0.037	0.023	10,885	6,899
1995	422	0.263	0.046	98,887	17,329
1996	432	0.025	0.033	9,652	12,869
1997	332	0.023	0.021	6,676	6,142
Average	395	0.087	0.043	36,412	18,397

Illinois River near Watts				Loadings	
Year	Flow (cfs)	Total P (mg/L)	Ortho P (mg/L)	Total P kg/year	Ortho P kg/year
80	173	0.423		65,324	
81	260	0.190		44,149	
82	591				
83	352				
84	706				
85	947				
86	879				
87	815				
88	531				
89	558	0.210	0.150	104,725	74,804
90	1,127	0.181	0.118	182,557	118,347
91	724	0.162	0.090	104,606	58,234
92	760	0.161	0.127	109,646	86,358
93	1,163	0.277	0.176	287,513	182,438
94	674	0.168	0.128	101,197	77,102
95	753	0.143	0.130	100,301	90,971
96	693	0.188	0.192	116,622	118,709
97	573	0.163	0.120	83,472	61,452
Average	684	0.206	0.137	118,192	96,491

States succeed in reducing basin pollution

BY DAVE HUGHES
ARKANSAS DEMOCRAT-GAZETTE

FORT SMITH — Voluntary efforts by municipalities, farmers and poultry producers to reduce phosphorus levels in the waters of the Illinois River Basin of Northwest Arkansas and northeast Oklahoma are paying off, a new report says.

The report was presented Wednesday by the Engineering Committee of the Arkansas-Oklahoma Arkansas River Compact Commission, which is holding its annual meeting here. The meeting continues today.

The commission, composed of Arkansas and Oklahoma officials, was formed 28 years ago to resolve disputes over the Arkansas River Basin.

A reduction of phosphorus levels "is great cause for optimism for people who were worrying about this problem," commission Chairman Emon Mahony of Fort Smith said Wednesday.

The commission's Engineering Committee report showed that the amount of phosphorus detected in samples at four Arkansas sites on the Illinois River dropped by an average of 25 percent over the past five years.

The sites were on Flint Creek and Sager Creek near West Siloam Springs, Okla.; on Baron Creek near Lincoln; and on the Illinois River near Siloam Springs.

Three of the four monitoring sites in Oklahoma did not show the dramatic decreases in phosphorus concentrations like those in Arkansas. In fact, one site, on the

See POLLUTION, Page 5B

Arkansas Democrat-Gazette

Pollution

• Continued from Page 1B

Illinois River near Watts, Okla., showed an increase in phosphorus levels of more than 11 percent.

One site on Flint Creek near Kansas, Okla., showed a 29.5 percent decrease. The other two sites showed decreases of 10.6 percent and 1.62 percent.

Randall Mathis, director of the state Department of Pollution Control and Ecology, said Wednesday that Arkansas' phosphorus reduction figures are better because Arkansas has had more experience in dealing with the problem.

"We've been working on the problem longest because we've had the problem longer," he said.

Much of the phosphorus problem in Northwest Arkansas is traced to poultry waste, which has a high phosphorus content.

Mahony said he thought the difference in the results between the two states was the difference in the maturity of the poultry industry in the two states. He added, though, he believed recent legislation passed in Oklahoma and continued effort by its officials would reduce phosphorus levels in Oklahoma in the next three years.

Arkansas has been monitoring phosphorus levels longer, giving it a richer log of data. Oklahoma has been monitoring only for a year.

"Oklahoma has one year of data to compare on. I'm not ready to say one state is better than another based only on one year's data," said [illegible]

Smith, executive director of the Oklahoma Water Resources Board and compact commission member.

Government officials and compact commission members said they were encouraged by the findings and that the two states overcame differences to agree on the monitoring program.

"I'm encouraged that the two states are working together," Smith said. "I hope we stop the finger-pointing and arguing about a lot of things now that this is put into place."

After years of negotiating, the compact commission adopted a proposal last year, already backed by the pollution control agencies of both states, to reduce phosphorus levels in the Illinois River by [illegible] percent. The reduction was originally proposed in an Oklahoma State University study that suggested phosphorus reductions were necessary to slow the deterioration of Lake Tenkiller near Tahlequah, Okla. The lake is fed by the river.

"Everybody has to buy into this or it's not going to work," Mathis said.

Chuck Bennett, chief of the Water Division of the Pollution Control and Ecology Department, attributed the reduction in phosphorus to efforts by municipalities to better treat their sewage before dumping it into the streams that feed the Illinois River.

He also said farmers who use animal waste fertilizer on their land and the poultry industry that generates chicken waste have done a good job in responding to the call to reduce phosphorus in streams.

While the measures have been voluntary, Bennett said the poultry industry is under considerable pressure to reduce the amount of phosphorus that washes into streams. He said the report showed the measures the industry adopted are working.

Appendix I -- Arkansas Drinking Water State Revolving Loan Fund – EPA Approval Letter and 1997 Set-Aside Workplan

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

NOV 25 1998

RECEIVED
98 NOV 30 PM 2:37
ARKANSAS DEPT. OF HEALTH
DIVISION OF ENGINEERING

Mr. Ron G. Hill
DWSRF Manager
Arkansas Soil and Water
Conservation Commission
101 East Capitol, Suite 350
Little Rock AR 72201

Dear Mr. Hill:

Thank you for your submittal of Drinking Water State Revolving Fund (DWSRF) 1997 workplans for our review. I am pleased to inform you these workplans are approved.

As you may be aware, the Government Performance Results Act (GPRA) of 1993, requires Federal agencies to set goals, measure performance, and report on accomplishments. By establishing performance goals which are both objective and measurable, GPRA forces Federal agencies to focus on results and the benefits attained by the public. Our yearly report to Congress will be directly related to the success of Arkansas's DWSRF program, an integral component to the Region's Performance Plan. We encourage you and Arkansas Department of Health to evaluate your performance goals which should accurately reflect problems specific to your DWSRF needs and to develop performance indicators that will measure relevant outputs and deliverables. We will be happy to talk with you and provide any assistance you may need in incorporating these ideas into your 1998 workplans.

Your continuing efforts to provide assistance to public and private water systems are greatly appreciated. Please feel free to contact me or Russell Bowen, Chief of the SRF & Projects Section at 214/665 7120 if you need further assistance.

Sincerely yours,

Joan E. Brown

Joan E. Brown
Chief
Assistance Programs Branch

cc: Mr. Harold Seifert
Arkansas Department of Health

Mr. Bob Macon
Arkansas Department of Health

Arkansas Department of Health

BUREAU OF ENVIRONMENTAL HEALTH SERVICES

DIVISION OF ENGINEERING

SDWA STATE SET-ASIDES
FFY97 WORKPLAN

TABLE OF CONTENTS

SDWA SET-ASIDES – FY97 WORKPLAN

I. Introduction

Under Section 1452 of the SDWA each primacy State can set aside funds from its SRF capitalization grant for certain prescribed activities. In Arkansas, the Arkansas Department of Health, Division of Engineering (DOE) will be responsible for implementing all set-aside fund activities with the exception of the administrative cost set-aside, which will be implemented by the Arkansas Soil and Water Conservation Commission.

A workplan for each set-aside must be submitted to EPA for approval before any federal ACH withdrawals can be made, except that a workplan is not required for the administrative cost set-aside. Consequently, this document will address those set-aside activities to be implemented by the DOE.

The requested set-aside amounts from the FFY97 Capitalization Grant are summarized in the following table. The full amount of set-aside funding is being requested. This is due in large part to the uncertainties involved in predicting the resources needed to implement new programs required under the SDWA.

SET-ASIDE	AMOUNT REQUESTED $	% OF CAPITALIZATION GRANT
State Program Management	1,255,880	10
Small System Technical Assistance	251,176	2
Local Assistance and Other State Programs		
Wellhead Protection	627,940	5
Source Water Assessment	1,255,880	10
TOTAL	3,390,876	27
Capitalization Grant FY97	12,558,800	100

A large portion of the set-aside funds will be used to support staff for new and expanding programs. This presents three immediate hurdles in predicting expenditures and outputs: 1) State hiring policies and procedures result in a slow hiring process, 2) the availability of qualified applicants, and 3) outputs for new and expanding programs will be hard to define.

In general the DOE's goals and objectives for the set-aside funds will be to implement all SDWA mandated regulations within the prescribed time frames. The ultimate measure of success will be retention of State primacy, no loss or reduction of grant funds, and the percentage of Arkansans being served by PWSs that continuously meet all health-based federal and state requirements during the year.

The DOE will routinely review program activities for accomplishment of stated goals and outputs for each set-aside. Adjustments will be made as necessary to insure results are achieved. The State PWSS program currently undergoes yearly and mid-year evaluations by EPA Region 6 staff. This review will also look at accomplishments in the various activities.

II. State Program Management Set-Aside

Section 1452(g)(2) allows the State to use up to 10% of its capitalization grant for implementing activities under this set-aside. However, the State must provide a dollar-for-dollar match to use these funds. Further, half of the State match must be in addition to the amount the State expended for public water supply supervision in FY93 and not include any funds used to match other federal grants. Since the annual PWSS grant is the only federal grant currently received where matching funds are required, this condition is rendered silent. Referencing the table presented in the State IUP; there is more than enough credit available to satisfy the matching funds condition of this set-aside.

The following table presents the projected FTEs for implementing activities under this set-aside. Refer to Appendix B for a more detailed budgetary break down.

POSITION TITLE	NO. FTEs
Engineer Supervisor	1
Engineer PE	5
Pollution Control Inspector	4
Engineer Technician	1
Health Program Analyst	1
Administrative Assistant I	1
Secretary II	1
Chemist II	1
Senior Programmer Analyst	1
TOTAL	16

The goal of these set-aside funds is to provide the necessary staff resources to enable the DOE to continue to provide a satisfactory level of service to the public water systems to insure compliance with or, when necessary, enforcement of all SDWA and State regulations. As is the case in most states, the DOE strives to achieve compliance first through training and other technical assistance to water systems. This effort has become a constant struggle since the promulgation of regulations under the 1986 SDWA amendments and, now, the 1996 SDWA amendments.

The objective of this set-aside is to enable the DOE to adequately address existing and anticipated regulatory requirements. This will be accomplished through the addition of new staff resources, as shown in the preceding table.

The technical positions (i.e.; engineer supervisor, engineers, inspectors, and technician) to be added should enable the DOE to spread its current staff workloads with a corresponding increase in technical assistance. This should also enable the DOE to devote more time towards planning and designing implementation strategies for new federal regulatory requirements and provide the personnel to implement the strategies.

The Engineer Supervisor, two Engineer PEs, and two Pollution Control Inspectors will be assigned to work within our Field Surveillance Section. The Engineer PEs will provide needed assistance in project plan and specification reviews, construction inspections, sanitary surveys of surface water systems, training and technical assistance to water operators. The Inspectors will provide needed assistance in sanitary surveys of groundwater systems, complaint investigations, training and technical assistance to water operators, and tracking of monitoring compliance. The Supervisor will provide supervision and oversight of these positions and will assume other administrative duties.

[Outputs: The addition of new positions will allow the DOE to redistribute workloads to insure a more timely response to its customers. Currently the DOE is having difficulty in meeting its goal of two weeks for initial plan review/approval on submitted projects, especially in some high growth areas. The new positions will aid the DOE in achieving this goal in these high growth areas. The number of PWS sanitary surveys should remain reasonably constant. However, additional staff will allow for more in depth, on-site inspections and a more timely completion of the written reports. These positions will also enable staff to devote more time and effort towards providing technical assistance and training to water operators and the public as needed.]

The primary tasking for one of the Engineer PEs will be to work in the Comprehensive Performance Evaluation (CPE) program. The DOE has a fledgling CPE program to aid water systems in identifying areas where improvements can be made to the overall operation of the system and to assist the system in implementing the improvements. At present the CPE program staff consists of one engineer on a part time basis. [Output: Estimate an additional six CPEs per year.]

The remaining two Engineer PEs and two Pollution Control Inspectors will be assigned to work within our Technical Support Section. The Engineer PE positions will be used to supplement existing staff in SWTR (GWUDI) implementation and will be the primary resources to plan for and implement upcoming regulations such as the DDBP, ESWTR, GWDR, and others. [Output: Estimate an additional 25 GWUDI assessments each year. More timely and more in depth technical assistance to PWSs determined to have GWUDI sources. New positions should provide for the development of expertise and timely planning efforts for upcoming federal regulations.]

The Inspector positions will be utilized in the transient noncommunity water system program for activities such as sanitary surveys, compliance inspections and assistance, inventory data updates, compliance monitoring, and similar tasks. [Output: The number of TNCWSs is not expected to increase significantly over the next few years, but the additional positions will allow for more in depth sanitary surveys and technical assistance to these systems. An increase in technical assistance activity should result in better compliance results for this category of PWS. New positions will allow for more timely updating of the TNCWS inventory system, which will in turn aid other staff in their work in source water protection and other activities. These positions will also allow the opportunity for reassignment of some activities which will result in an existing Supervisor having the time to better track compliance monitoring to insure all systems are monitored on time and will allow time for other administrative and supervisory tasks.]

The Engineer Technician will be used primarily to aid in data entry. Once the DOE has its GIS system up and running, this person will be responsible for digitizing hard copy data and entering it into the system. The person will also be available to aid in inventory and compliance data entry and updates, as well as confirmation of data. [Output: Timely digitizing and entry of all data to insure the GIS is, and remains, a useful tool.]

The Health Program Analyst will be used in day to day administrative activities to track the DOE’s use of the set-aside funds, the federal PWSS grant, the CWA Section 106 grant, and other budgetary items. [Output: Insure all grant applications and supporting documents are submitted on time. Track program expenditures and bill the appropriate agency for reimbursement of expenses. Other administrative tasks as assigned.]

The ratio of technical staff to clerical staff has risen dramatically since passage of the 1986 amendments. This increase in technical staff with the subsequent increase in paperwork has lead to a critical shortfall in clerical support. The proposed Secretary position (along with another under the section 1452(k) set-aside) and Administrative Assistant position will help to fill this need. [Outputs: Insure timely and proper filing of documents. More support for typing and/or word processing of documents. Provide for adequate supervision of clerical staff.]

The ADH’s Division of Public Health Laboratories (PHL) serves as the principal state laboratory for compliance monitoring under the SDWA. For the PHL to continue to retain certification status for new and existing regulated contaminants, it will be necessary to increase support to the PHL in the form of positions and equipment. One chemist position will be funded to insure adequate staffing for new and existing analytical procedures. [Output: Complete sample analyses, analytical reports, and deliver to DOE within four weeks of sample receipt.] An Senior Programmer Analyst position will be funded to coordinate and manage the PHL’s LAN and LIMS systems insuring ready access to analytical results. [Output: Facilitate the implementation of a fully functional LIMS system for easy retrieval and query of laboratory analytical results.]

There will be both recurring and non-recurring expenses associated with these new positions. Typical expenditures will include such items as: office furniture, other office equipment and supplies, laboratory equipment, staff training, rental of office space, PCs, upgrading of LAN capabilities, routine M&O, travel, etc. (Refer to Appendix B for more detail.)

The outputs and deliverables can at present only be categorized in a general fashion as an increase in technical assistance and regulatory compliance efforts and the maintenance of SDWA primacy. The increase in staff resources will help with existing workloads; but even more importantly, it will enable the DOE to better address and implement upcoming regulatory requirements of the SDWA. Until these new programs are implemented, it is premature to try and assign concrete numbers or tasks for outputs and deliverables. The new programs will strive to plan and implement regulations such as the IESWTR, ESWTR, D/DBP, GWDR, capacity development, arsenic, radon, etc. There will be regulatory milestones to be met under the new programs, but implementation will be an ongoing process.

III. Small System Technical Assistance

Section 1452(g)(2) allows the State to use up to 2% of its capitalization grant for implementing technical assistance activities of Section 1442(e), since no separate funding has been appropriated for initiating these activities.   The full set-aside amount is being requested to provide assistance to small water systems in assessing and implementing capacity development.

This assistance will be accomplished through contract services. Requests for Proposals are being prepared to solicit interested contractors to provide the necessary assistance under the oversight of the DOE. It is anticipated that contracts will be implemented in a “circuit rider” format with on-site visits to assess needs and provide recommendations. Two contracts are envisioned. One contract will focus on financial and managerial capacity development. The other contract will focus on technical capacity development with a special emphasis on small surface water source systems.

CONTRACT	AMOUNT ($)
Financial/Managerial Capacity	125,588
Technical Capacity	125,588

The goals and objectives for this set-aside are to assist those water systems that lack sufficient capacity to maintain compliance with state and federal regulations to identify and correct deficiencies. Initially, systems to receive priority will be chronic violators and other problem systems. Outputs and deliverables will include such items as: number of systems contacted, number of on-site visits, number of assessment reports, and number of corrective action plans developed, and number of systems implementing the plans.
[Outputs: Four evaluations per month per contract.]

The contracts will be in effect from the date of award through June 30, 1999. Contracts, by State law, cannot extent past the end of a biennium. There are, however, procedures in place that allow for extending contracts into a new biennium with legislative concurrence. So long as funding is available and the need exists, the activities under this contract should be ongoing with no definite completion date to reach all systems in need. Copies of the final Request for Proposals can be submitted to EPA Region 6 for review if so requested.

The contractor will be required to submit monthly status reports to the DOE. The reports will include, among other items, those listed above as outputs and deliverables. The reports will be reviewed by DOE staff to insure that the contractor is abiding by the terms of the contract and progressing in a satisfactory manner.

Should the contract costs be less than the requested set-aside amount, there are other options for unused funds including: 1) return to the loan fund, 2) use to procure additional services from the contractor of record or other contractor, or 3) use for DOE staff to perform other technical assistance activities aimed at capacity development. A workplan addendum will be submitted to EPA for review if activities are undertaken in addition to the original contracts.

IV. Local Assistance and Other State Programs Set-Aside

Section 1452(k) allows the State to use up to 15% of its capitalization grant for implementing activities under this set-aside. The objectives of these activities are to insure continuation of the State WHP program, to develop an EPA approved SWA program plan, and to implement a successful SWA program. The ultimate deliverable from this set-aside will be a fully integrated, public health conscious, and ongoing source water protection program.

The State plans to use the funds in two primary program areas: Wellhead Protection (WHP) Program and Source Water Assessment Program (SWAP). Under this Section up to 10% of the set-aside may be used in SWAP activity, leaving 5% for use in WHP activity.

A. Wellhead Protection Program

Over 67% of the State's community and nontransient, noncommunity water systems rely on groundwater sources for their drinking water. As such, a large portion of the groundwater systems will be affected by existing and upcoming SDWA requirements.

The State WHP Program Plan received approval from EPA in 1990. The program is presently staffed by one full time hydrogeologist. Funding for this position comes in part from Clean Water Act Section 106 funding (transferred under a MOU from the Arkansas Department of Pollution Control and Ecology to the DOE) and in part from SDWA Public Water Supply Supervision Program funding. To simplify payroll records for this position, it will be transferred to the set-aside account. [Output: Twenty PWS wellhead protection area delineations. Six potential source of contamination inventories. Public outreach and training as needed.] This will free up the limited Section 106 funds for use in negotiations with the ADPC&E or other agencies for activities that provide benefit to the state WHP efforts. This could include formal agreements or contracts to research, consolidate, and reformat data useful to the SWA Program.

In addition, six new staff positions will be added: Engineer Supervisor, Pollution Control Inspector, Senior Geologist, Information System Planner (GIS Program Administrator), Microbiologist, and Secretary. Each of these positions will perform activities that support the WHP and SWA programs. The following table presents the projected FTEs for implementing activities under this set-aside. Refer to Appendix B for a more detailed budgetary break down.]

POSITION TITLE	NO. FTEs
Engineer Supervisor	1
Hydrogeologist *	1
Senior Geologist	1
Pollution Control Inspector	1
Information System Planner	1
Microbiologist II	1
Secretary II	1
TOTAL	7

(* For budgetary purposes, the Hydrogeologist is classed as an Engineer Supervisor in Appendix B.)

The Pollution Control Inspector, Senior Geologist, and Engineer Supervisor will be assigned to our Technical Support Section. The inspector will work within our WHP program. Responsibilities will revolve around the delineation of wellhead protection areas. Tasks will include such items as: collection of pertinent hydrogeologic data during site inspections and from the files of other agencies, delineating wellhead protection areas, inventor of potential sources of contamination, and public outreach to encourage wellhead and groundwater protection efforts statewide. [Output: Data collection, public outreach and technical assistance as needed. 100 delineations per year] The Senior Geologist will work within the source water protection program. Responsibilities will revolve around GWUDI determinations for public water supply wells. Tasks will include such items as: site inspections, collection of well construction and production records, general geologic evaluations around wellheads, and evaluation of pertinent data for GWUDI determinations and reports. [Output: 72 GWUDI determinations per year.] The Engineer Supervisor will provide direction and oversight for our WHP program, the GWUDI aspects of the SWTR, activities to address upcoming EPA regulations, and other administrative functions. [Output: Supervisory tasks as necessary to insure program long-range needs are met and implementation of all supporting activities.]

At the heart of any successful WHP or SWA program is an in-house, user friendly GIS system to record program data and map pertinent items of concern. The Information System Planner will be responsible for implementing a GIS system for the DOE. System software and ancillary hardware will need to be acquired and installed. An in-house evaluation is currently underway to determine the most appropriate GIS system for program needs, as well as compatibility with other state and federal agency systems. It will be the responsibility of this position to provide guidance in the selection of equipment, insure correct and timely installation, and maintain the system. [Output: Specify equipment/software, oversee installation, and in corporate program needs into GIS system. Assume overall supervision of DOE's LAN system and information technology support group.]

A new Secretary II position will be added. Clerical support has not previously been available to the WHP program, but rather has been provided under the PWSS program. In order to comply with requirements under the 1986 and 1996 SDWA, the number of technical staff members has grown in a disproportional number to clerical support. The addition of this position will help offset the shortfall. [Output: Insure timely and proper filing of documents. More support for typing and/or word processing of documents.]

A new Microbiologist II position will be added. This position is needed in order for the PHL to be able to increase its in-house microscopic particulate analysis (MPA) capability. The MPA is an important tool in making groundwater under the direct influence (GWUDI) of surface water determinations under the Surface Water Treatment Rule. These decisions are, in turn, critical in making site-specific decisions on wellhead protection area delineations and water treatment needs. [Output: 100 additional MPA analyses per year.]

There will be both recurring and non-recurring expenses associated with these new positions. Typical expenditures will include such items as: office furniture, other office equipment and supplies, laboratory equipment, staff training, rental of office space, PCs, upgrading of LAN capabilities, routine M&O, travel, etc. (Refer to Appendix B for more detail.)

B. Source Water Assessment Program

Under the SDWA each state must develop and implement a Source Water Assessment and Protection Program. Primary tasks of this program involve delineations and assessments of source water protection areas for each public water system. Section 1452(k) allows each state to use up to 10% of its capitalization grant for completing these activities. Funding for this activity is limited to the FFY97 capitalization grant, but the funds can be obligated over a four-year period. The State will use these funds under a joint funding agreement with the USGS to delineate drinking water source protection areas, locate existing data on potential contaminants and compile the data into a GIS system, assess the susceptibility of each source to potential contaminants, and prepare reports on the findings.

Staffs of the DOE, USGS, and the University of Arkansas are working together in a cooperative effort to develop the SWA program document that must be submitted to EPA for approval. A Technical Advisory Committee and a Citizens Advisory Committee have been formed and have been meeting with the aforementioned to develop an acceptable approach for the overall SWA program.

It was necessary for the DOE and the USGS to sign the joint funding agreement before obtaining set-asides workplan in order for USGS to be able to finalize its FFY99 budget. This became necessary due to delays in obtaining EPA's approval of the SRF capitalization grant and in receiving initial comments on the set-asides workplan. It was to the point of signing, or risk loosing the opportunity for the agreement.

Appendix A contains summary information on the proposed assessment approach, aspects of the SWAP to be implemented prior to final approval, and a timeframe for program plan submittal to EPA. Approval of this set-asides workplan will be considered as an interim approval of our SWAP approach by EPA. [Output: The development of source water protection reports for each public water system in accord with federal timelines and guidance. For more specific information on proposed timelines and tasks to be accomplished refer to the DOE/USGS joint agreement.]

CONTRACT	AMOUNT ($)
SWAP Joint Funding Agreement W/ USGS	$1,255,880

Should the contract cost be less than the requested set-aside amount, there are other options for the unused funds including: 1) return to the loan fund, 2) use to obtain additional service from the contractor or other source, 3) use to purchase ancillary hardware or software for the GIS system, 4) apply towards required program management and coordination of the USGS Agreement, or 5) other as yet unidentified services. A workplan will be submitted to EPA for review if activities are undertaken in addition to the original contract.

V. ADH Cost Center Adjustments

Agency accounting procedures require that both the Division of Engineering and the Division of Public Health Laboratories set-up additional cost centers if SRF set-aside funds are used for any expenditures. The DOE has already implemented procedures to create the necessary cost centers for its use. Rather than require the PHL to do likewise further complicating internal budget and audit processes and to simplify intra-agency fiscal accountability and controls, the DOE will implement the following alternative to funding new PHL position costs.

The new Microbiologist II, Chemist II, and Senior Programmer Analyst positions will be funded with State PWS Fees. In turn, three existing DOE positions will be removed from the State PWS Fees account and will be funded using SRF set-aside funds. It is anticipated that the substitute positions will be two Engineer PEs and one Pollution Control Inspector. It will be difficult to obtain an exact trade-off of funds, but it will be accommodated as closely as possible.

APPENDIX A

SWAP STRATEGY

APPENDIX A

Following is a summary of how Arkansas proposes to proceed in the development and implementation of a Source Water Assessment Plan in the State of Arkansas.

The purpose in establishing the Arkansas' Source Water Assessment Program (SWAP) is three fold:

1) To comply with the source water protection requirements of the Safe Drinking Water Act Amendments of 1996 (SDWA). Under Section 1453 of the SDWA Amendments, each State shall submit to the EPA Administrator for approval, "a source water assessment program within the State's boundaries." The State "shall carry out the program either directly or through delegation." This is to be done "for the protection and benefit of public water systems and for the support of monitoring flexibility."

2) To provide another means to enhance the ADH's continuing efforts to protect public drinking water supply sources under the State's Public Water Supply Supervision Program (PWSSP). Under the PWSSP, source protection through regulation, education, and technical assistance is an integral program component.

3) To develop a management tool for public water utilities to enhance the protection of their source(s) of drinking water.

The Arkansas SWAP will be implemented as a part of the current PWSSP. The ADH's existing "Rules and Regulations Pertaining to Public Water Systems" contain minimum criteria on the location, construction, and protection of public water supply sources.

The first component of the source water assessment program will be the delineation of a source protection area for each public water supply source in the State. The delineation process is dependent upon the type of source. Source types include impoundments, rivers and streams, springs (defined as surface water by State regulation), ground water under the direct influenced of surface water (GWUDI wells), and normal ground water (wells).

The State's Wellhead Protection Program will remain unchanged from the current EPA approved program plan. The development of the State's SWAP will build upon the existing WHPP and incorporate a program for all surface water sources in the State. The statutory deadline dictates that assessments for all sources be completed 24 months after the State plan is approved by EPA, with a possible 18-month extension. Therefore, it will be necessary for the State's SWAP to be flexible. It is our intent to phase the assessment process in such a fashion as to meet the deadlines that we are confronted with and provide an assessment that will be meaningful. The first phase, to be completed by the statutory deadline, will provide completed assessments that will allow the initiation of local source water protection plans and provide a priority ranking system for the refinement of the assessments on a continuing basis.

The State of Arkansas has approximately 1535 individual public drinking water sources. Included in this total are 180 surface sources (69 impoundments, 30 rivers/streams, 31 springs and 50 GWUDI wells) and 1355 ground water systems. It is our intent to enter into a cooperative agreement with the USGS to perform activities that will, in general, include database development, source delineations, inventorying of PSOCs and susceptibility analysis of each source. A report will be generated by the USGS and provided to the ADH for review, editing and distribution to each public water system and the general public.

As alluded to above, the State's approach will incorporate a phased assessment for each source. Data is the limiting factor to how each assessment will be completed. In the northwestern four counties of Arkansas reliable data is more abundant allowing for a more detailed delineation and assessment. This will allow for delineation and assessment of individual recharge zones for wells and springs, as well as a more detailed assessment of the watershed of the reservoir and stream sources in this area within State boundaries.

Lack of data in other areas of the State will necessitate a more generalized and in some cases regionalized delineation and assessment approach. Limited data is available on recharge areas for most of the major aquifers utilized in Arkansas. Where the data is available and deemed reliable, it will be mapped and used in the assessment process as an enhancement of the State's approved WHPP.

The watersheds of all drinking water source impoundments and streams will be delineated within the State boundary. A more distinct and manageable protection area will be delineated for detailed assessment in the early phase of the process and will be used for priority setting for additional, more detailed work in the future. This area is more fully described below:

- Impoundments (Lakes, Reservoirs, etc.): Within the watershed, the areas defined by the following criteria will be a part of the delineated assessment area.
  - All lands within a 5-mile radius around the intake that are,
    - Within 1,320 feet of the shoreline at the impoundment's high water level, and
    - Within 1,320 feet of either side of the centerline of all tributaries, and
  - All lands within a 0.5-mile radius of the intake, regardless of watershed boundaries.

- Rivers and Streams: All lands within 1,320 feet of either side of the centerline of the river / stream and all its tributaries within a 3 day time of travel limited by a maximum distance up gradient from the intake of 20 miles.

- Groundwater Sources: An area as defined in the State of Arkansas' WHPP. As an enhancement to the existing WHPP, the SWAP will consider watersheds and / or basins from which contamination of the well is likely and deemed of significance by the State.

[*Potential sources of contamination that are outside the delineated protection area may be incorporated into an assessment at the discretion of the State, dependant upon the prevalent topographical and hydrogeologic characteristics of the area.*]

The delineation concept as generally described above has been presented to and discussed by both the State's Technical and Citizens Advisory Committees. The process for susceptibility analysis is expected to be similar in nature to the process developed in the regional assessment of water sources performed by EPA Region VI staff. This issue is still under consideration and no definite procedure has been developed. The topic of susceptibility analysis will be raised and debated in upcoming advisory committee meetings.

We will provide completed assessment reports to each public water system. It will be the water system's responsibility to advise its customers of the report's availability. We expect to make all data available over the Internet and provide copies upon individual request, as appropriate.

Program activities will be refined and continue to evolve past the deadline date as Program Staff assist communities and water systems in the State to develop local watershed and wellhead protection programs. The assessment should aid local groups or agencies in developing their source water protection plans to protect against the worst hazards and to focus their resources to the greatest areas of need. Each local plan may be customized to the particular assessment area and the hazards, both actual and potential, contained therein.

The ADH will assist local governments in the development of a management plan for potential contaminant sources. The management plan may include ordinances enacted at the local level, as well as other local options, for reducing the threat of water contamination within the delineated protection area. In addition, new and / or existing activities with contamination potential within this protection area will be noted by the ADH and /or the local government and passed on to other involved State agencies for their consideration in permitting or other regulatory actions.

(The reader should note that this will be an evolving program. Delineation methodology and other program components will continue to be refined as staff gain training and experience in administering the program.)

The DWSRF set-aside fund expenditures for assessments to be expended prior to approval of the State's SWAP will cover approximately the first two years of our proposed four year cooperative agreement with the USGS. In our cooperative agreement, the USGS will provide database development, source water delineations, PSOC inventories, susceptibility analysis and the submittal of a report for each system to the ADH for review, editing and distribution. In order to insure that the deadline for completion of the assessments is met, it will be necessary that the following preliminary tasks be initiated prior to SWAP approval. Funding for these tasks will be from the source water assessment set-aside.

Database Development

Consultation with state, university, local, and federal agencies will take place to determine the existence, structure, validity, and condition of existing electronic and paper databases needed for this project. Agreements with these agencies will be negotiated to update and validate all of these databases.

A determination will be made as to the final set of databases to be developed and used in the source water assessments. Initial efforts will focus on developing coordinate databases for all ground water and surface water sources within the state. Other broad categories of databases will include, but not be limited to basin characteristics, aquifer characteristics, and land surface characteristics. Early in the project, decisions will be made as to the relative importance (ranking/prioritizing) of various PSOC databases. Those deemed the highest priority will be addressed first, with those of lower ranking receiving less priority.

All databases used in the development of the SWAP will be given appropriate documentation in the form of data dictionaries. The data dictionaries will fully describe the fields, data within the fields, QA/QC parameters, as well as conform to existing state standards for data dictionaries. The complete package of databases developed will be made available to all interested agencies and parties in Arkansas once the program is implemented.

Delineations

Delineations will conform to the guidelines and definitions that have been established by the Arkansas Department of Health in the SWAP development and the approved State Well Head Protection Plan. The critical areas will be delineated on an agreed upon base map. The watersheds or contributing areas for surface water sources will be plotted on topographic map bases. Source waters requiring separate special consideration will be delineated using criteria specific to their situation. There may be many such circumstances found in portions of the State where basin or aquifer characteristics warrant additional effort; such as areas where PSOCs are high in density and in certain other ground water and surface water situations.

PSOC Inventories

Consultations will be held with all pertinent agencies / divisions that manage PSOCs or have existing PSOC databases, to determine the type of data attributes, data locations, quality of data, data availability, and status of documentation. Existing location data may be used (if deemed adequate), GPS methods may be used for field locations, or map locations may be used for locating the PSOCs.

Summary

The following is a summary of tasks to be accomplished early in the process prior to receiving final EPA approval of the State SWAP. Some tasks will be simultaneous, as well as sequential:

1.) Identify and accurately locate source water supplies (surface and ground).
2.) Identify existing data and coverage.
3.) Establish a database management system.
4.) Identify special case water sources.
5.) Establish an assessment scheme.
6.) Prioritize PSOCs.
7.) Verify, update, and transform a percentage of data and coverage.
8.) Delineate contributing watersheds.

9.) Build a percentage of basin characteristics coverage.
10.) Perform time of travel computations.
11.) Delineate a percentage of critical areas.

The time frame for completion and submittal of the State's SWAP to EPA will be dictated by the public participation process. We will continue to meet with the Technical and the Citizens Advisory Committees. Starting mid- to late summer we will be conducting a series of local/regional workshops for the general public. Additionally, we plan to post developing SWAP information on our existing Internet web site (http://health.state.ar.us/eng/doe.htm). We plan to have a final draft ready to go to public notice by the end of the year. Completion and submittal to EPA is planned for the end of January 1999.

Appendix J -- USGS Cooperative Aggreement and Workplan

Appendix J -- USGS Workplan

WORK PLAN

SOURCE-WATER ASSESSMENT TO DETERMINE THE POTENTIAL SUSCEPTIBILITY OF ARKANSAS DRINKING-WATER SUPPLIES TO CONTAMINATION

U.S. Geological Survey
Center for Advanced Spatial Technology
Department of Geology, University of Arkansas

December 17, 1998

BACKGROUND AND PROBLEM

The 1996 Amendments to the Safe Drinking-Water act require that each state prepare a source-water assessment for all public water supplies. States are required to determine the sources of drinking water, to identify potential sources of contamination, and the susceptibility of the water supplies to these potential sources of contamination.

Drinking-water sources in Arkansas included both ground water and surface water. The ground-water sources include wells and the surface-water sources include free-flowing rivers, reservoirs, and springs. All of these sources, to varying degrees, are susceptible to potential sources of contamination (PSOC's) that may be located within or near the area influencing the water source. After delineating the area directly influencing the water source, the PSOC's existing within that critical area must be inventoried, and the potential adverse impacts of the PSOC's on the drinking-water source must be evaluated.

OBJECTIVES AND SCOPE

The objective of the source-water assessment project is to determine the potential susceptibility of all 1,565 Arkansas public drinking-water supplies to contamination. This will be accomplished by performing four broad work elements: data-base development, delineation of source-water assessment areas, PSOC inventories, and susceptibility assessments. In addition, a technical advisory committee (composed of local, State, and Federal agency personnel) and a citizens advisory committee (stakeholders) will be formed to provide input and feedback on the assessment plan and throughout the project.

This 4-year project will be conducted by the U.S. Geological Survey (USGS) under the direction of the Arkansas Department of Health (ADH). Various activities will be outsourced to the Department of Geology, University of Arkansas and the Center for Advanced Spatial Technology (CAST). The Arkansas Water Resources Center (AWRC) will administer and coordinate the work by the Department of Geology, University of Arkansas and personnel of CAST under the direction of the USGS. The Department of Geology will perform the assessment of public drinking-water supplies in four counties (Benton, Carroll, Madison, and Washington) in northwest Arkansas. These supplies include both surface- and ground- water sources. CAST will supply and develop data layers for GIS to assist in the assessment of the drinking-water supplies in the State, and develop methodologies for assessment using GIS. Because of the divergent nature of the work by the Department of Geology and CAST, separate detailed scopes of work are attached as Appendices 1 and 2, respectively.

APPROACH

<u>Data-Base Development</u>

Extensive data bases exist, either in electronic or paper format, in the files of many local, State, University, and Federal entities in the State of Arkansas that will need to be brought together for this project. These files, with the help of the originating agencies, will have to be updated, verified, augmented, and made to be compatible to be useful for this effort and for the future. The USGS will act as the focal point and will assume the task of major developer of these data bases and will manage the data that are included, either directly or by oversight of work performed by another agency. The major tasks within this objective will be to identify existing data bases; determine the availability, structure, and condition of these existing data bases; and to develop a data-base management system into which these data bases and new data can be incorporated.

Consultation with State, university, local, and Federal agencies will take place to determine the existence, structure, validity, and condition of existing electronic and paper data bases needed for this project. Agreements with these agencies will be negotiated to update and validate all of these data bases. It is anticipated that assistance in accomplishing this task will come from the originating agencies and from the Arkansas Department of Health.

A determination will be made as to the final set of data bases to be developed and used in the source-water assessments. Initial efforts will focus on location coordinate data bases for all ground-water and surface-water sources within the State. Other broad categories of data bases will include, but not be limited to: basin characteristics, aquifer characteristics, and land-surface characteristics. A preliminary list of coverages to be developed are shown in Appendix 3.

Early in the project, decisions will be made as to the relative importance (ranking/prioritizing) of various PSOC data bases. Those deemed high priority will be addressed first, with those ranking lower receiving less attention.

All data bases will be housed, during the project, on USGS computers. They will be developed by USGS and by CAST using the latest versions of ESRI products including Arc/Info and Arc View. The completed package of coverages will be made available to all interested agencies and parties in Arkansas.

All data bases used in the development of the source-water assessment program will be given appropriate documentation in the form of meta data. The meta data will describe fully the fields, data within the fields, QA/QC parameters, as well as conform to existing State standards for meta data.

<u>Delineation of Assessment Areas</u>

For both ground-water and surface-water sources in Arkansas, “assessment areas” (as defined below by the Arkansas Department of Health) will be delineated. The “contributing basin” will be delineated for surface-water sources also. For ground-water sources, criteria already approved in the Arkansas Well-Head Protection Program will be used to delineate the “assessment areas.”

It is expected that there will be special situations for selected drinking-water sources for both surface water and ground water for which criteria more specific to those selected sources will be developed. These situations may include unique or atypical basin characteristics or hydrogeologic factors or situations existing in the area that are particularly threatening to the source water. All delineated areas will be included in the statewide coverage incorporated into the overall data base.
The “assessment area” is defined as a delineated area around the intake or well head of public water systems that establishes the general boundaries of contaminant inventory and susceptibility analysis. The area will not extend past the State boundaries and will be determined by a fixed radius, topographical method, or hydrogeologic analysis method.

For impoundments (lakes, reservoirs, ponds):

Areas within the contributing watershed defined by the following criteria will be considered to be the "assessment area:"

- All lands within a 5-mile radius of the intake that are
  - Within 1/4 mile of the shoreline at the impoundment's high water level, and
  - Within 1/4 mile of the centerline of all tributaries, and
  - Within a 0.5-mile radius of the intake, regardless of watershed boundaries.

For rivers and streams:

- All lands within 1/4 mile of the centerline of the river or stream and all its upstream tributaries within 3-days travel time during median flows. Limited by a maximum distance upstream from the intake, determined by an arc with a 20-mile radius.

For springs and "Ground Water Under the Direct Influence" (GWUDI) wells:

- The assessment areas for springs and GWUDI wells, in the absence of better information, will consist of an arbitrary fixed radius of 0.5 mile. In addition to this base 0.5-mile radius, delineation and assessment of surface-water bodies that encroach upon this base area will be performed.

  - For an impoundment that intersects with the base assessment area, all the area within a 3.0-mile radius of the well or spring that is within 0.25 mile of the maximum water level of an impoundment and 0.25 mile either side of the centerline of any of its tributaries, will be delineated and assessed.

  - For a stream that intersects with the base assessment area, all the area within a 3.0-mile radius of the well or spring that is within 0.25 mile of either side of the stream or any of its tributaries, will be delineated and assessed.

For wells:

- An area as defined in the State of Arkansas' Wellhead Protection Plan, generally described as an area within a 0.25-mile radius of the wellhead.

(PSOC's that are outside the delineated assessment area may be incorporated into an assessment at the discretion of the Arkansas Department of Health).

The USGS will be responsible for the delineation of most surface-water assessment areas. The Department of Geology will perform the delineations for both ground- and surface-water sources for a four-county area in northwestern Arkansas (Benton, Carroll, Madison, and Washington). CAST will delineate the remainder of the ground-water sources. These delineations will conform to the guidelines and definitions established by the Arkansas Department of Health and the approved State Wellhead Protection Plan. The assessment areas will be delineated on an agreed-upon base. The watershed or contributing area delineations for ground- and surface-water sources will be made on the USGS 1:24,000 topographic map base. Any delineations performed by entities outside of the USGS will be reviewed by the USGS for accuracy and appropriateness.

Source waters requiring separate special consideration will be delineated using criteria specific to their situations. There may be many of these circumstances found in the northwest portion of the State, in areas where PSOC's are in high density, and in certain other ground-water and surface-water situations where basin or aquifer characteristics warrant additional effort.

PSOC Inventories

Inventories of PSOC's within the assessment areas will be performed by using existing data available in both electronic and paper form from State, local, and Federal agencies having the most current data. The USGS will work with these agencies to have the locational data verified to a satisfactory resolution. Consultations will be held with all pertinent agencies/divisions that manage or regulate PSOC's or have existing PSOC data bases, to determine the type of data attributes, data locations, quality of data, data availability, and status of documentation. Electronic data base coverages in ARC/INFO format of PSOC's will be updated and new coverages will be created by CAST. Although locations of PSOC's within the assessment areas will be most closely determined, the series of PSOC coverages will be statewide to the extent possible. A list of the PSOC's likely to be included is in Appendix 3.

Susceptibility Assessments

Analysis of the susceptibility of the source waters to contamination will be performed for each public water supply. Within each delineated assessment area, an analysis of the susceptibility of the water source will be made for selected PSOC's located in the area. Weighting factors will be assigned to classes of PSOC's and a composite relative rating scheme will be developed to assess the overall susceptibility of the source water for each public water supply. Aquifer characteristics, geology, soils, hydrologic factors, and other factors deemed necessary will be included in the assessment. The susceptibility assessment will be developed by USGS, ADH, and members of the Technical Advisory Committee and Citizens Advisory Committee.

PRODUCTS

Quarterly progress reports will be submitted to ADH by USGS. These reports will summarize the progress from the previous quarter and outline any products developed and delivered to ADH by USGS, Department of Geology, and CAST.

WORKPLAN/TIMELINE

Federal FY '98

Task	1997		1998								
	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Project planning	X	X	X	X							
Identify SW supplies					X	X	X				
Verify intake locations								X	X	X	X
Identify/locate existing data/PSOC coverages						X	X	X	X	X	X
Establish DB management system								X	X	X	X
Establish assessment scheme; prioritize PSOC's								X	X	X	X
Verify/update/transform data/coverages							X	X	X	X	X
Delineate contributing watersheds										X	X
Build basin characteristics coverages											X

Federal FY'99

Task	1998			1999								
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Data base management	X			X			X			X		
Build basin characteristics coverage	X	X	X	X								
Remaining work on surface water data bases/coverages and work on same for ground-water sources	X	X	X		X	X	X	X	X			
Perform time of travel computations					X	X	X	X	X	X	X	X
Delineate assessment areas (SW & GW)	X	X	X	X	X	X	X	X	X	X		
Preliminary maps to Arkansas Health Dept.					X							
Modify assessment model and report format											X	X
Identify special case water systems (SW, GW, & GWUDI)					X	X	X	X	X	X	X	
Verify/update/transform data coverages (SW & GW)							X	X	X	X	X	X
Final system reports to Arkansas Health Dept. (surface water)												

Federal FY'00

Task	1999			2000								
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Data base management	X			X			X			X		
Susceptibility Analysis and Final system reports to Arkansas Health Dept. (surface water)					X	X	X	X				
Susceptibility assessments (ground water)									X	X	X	X
Finalize Final Report format			X	X								

Federal FY'01

Task	2000			2001								
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Data base management	X			X			X			X		X
Susceptibility assessments (ground water)	X	X	X	X	X	X	X	X	X	X	X	X
Final system reports to Arkansas Health Dept. (ground water)						X	X	X	X	X	X	X

BUDGET

State (fiscal year)	USGS	Department of Geology (with overhead)	CAST (with overhead)	TOTAL
1998	$202,025	0	$66,525	$268,550
1999 (10/98 -- 6/30/99)	$209,070	$12,850	$110,880	$332,800
2000	$242,190	$36,960	$42,630	$321,780
2001	$210,200	$33,390	0	$243,590
2002	$50,900	0	0	$50,900

APPENDIX 3. Data Bases and Coverages

Intake Locations
Contributing Watersheds
Reservoir Boundaries
Critical Areas
Land Use - Land Cover
Soils
Geology
Water Quality
Rainfall/Runoff
Transportation/Pipelines
Basin Characteristics
Population Density
Wellhead/Spring Location
Hydrologic Data
    Depth to Water
    Water Table/Piezometric Surface
    Aquifer Base/Top
    Hydraulic Conductivity
    Porosity
    Saturated Thickness
    Aquifer Extent
    Recharge Areas
    Karst Features
Well-Construction Data
Pumping Data
	PSOC's
	    Agricultural Sources
	        Confined Animal Operations
	        Land-Surface Disposal Sites
	        Agricultural Chemical Usage
	    (Fertilizer/Pesticide)
	        Drainage Wells
	    Industrial Sources
	        Point Sources
	        Hazardous-Waste Facilities
	    (Active/Abandoned)
	        Radioactive Waste Sites
	        NPDES Permitted Sites
	        UST's/AGST's
	    Oil and Gas
	        Well Fields (Active/Abandoned)
	        Storage Facilities
	    Injection Wells (Class I and II; Class V)
	    RCRA/CERCLA Sites
	    National Priority List Sites
	    Municipal Sources
	        Landfills
	        Sewage Treatment Plants
	        Other Significant Sources
	    Residential Sources
	    Septic Fields
	    Mining Sources
	    Spill Sites
	    DOD Sites
	    OFA Sites/Activities
	    Non-Point Sources

Source Water Assessment Program for Benton, Carroll,

Madison and Washington Counties, Arkansas

Submitted By: Ralph K. Davis, Department of Geology, University of Arkansas

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Date: October 8, 1998

Purpose

Develop a management tool for public water utilities to enhance the protection of their source of drinking water via identification of source water assessment areas of drinking water supplies and identification of potential sources of contamination within distinct delineated areas.

Scope

Delineate and assess the area for approximately 140 public drinking water sources in four counties in northwest Arkansas. This represents about 9% of the public drinking water sources in Arkansas. Table 1 lists the estimated total numbers of drinking water sources that are wells, surface water systems, springs and GWUDI located in the four county area.

Table 1
Estimated Number of Public Drinking Water Sources in Each County
(based on data provided by ADH fall 1998)

County	Wells	Springs/ GWUDI	Surface Water Lakes/Rivers	Total
Benton	43	2/0	2/2	49
Carroll	60	1/0	1/0	62
Madison	12	1/2	1/0	16
Washington	8	1/0	2/0	11
Totals	123	5/2	6/2	138

Definitions

Assessment Area: A delineated area around the intake or well head of public water systems that establishes the general boundaries for Susceptibility Analysis and Vulnerability Assessment. The area will not extend past the State boundaries and will be determined by a fixed radius, topographical or hydrogeological method.

- Impoundments (Lakes, Reservoirs, etc.):

  Within the watershed, the areas defined by the following criteria will be a part of the total assessment area;
  - all lands within a 5-mile radius around the intake that are,
    - within 1320 feet of the shoreline at the impoundment's high water level, and
    - within 1320 feet of either side of the centerline of all tributaries, and
  - all lands within a 0.5-mile radius of the intake, regardless of watershed boundaries.

- Rivers and Streams:

  All lands within 1320 feet of either side of the centerline of the river/ stream and all its tributaries within a 3-day time of travel limited by a maximum distance upstream from the intake of 20 miles determined by an arc with a 20 mile radius. Time of travel shall be calculated using median flow conditions and a stream slope determined by the difference between the highest point in the entire watershed and a set elevation at the intake.

- Springs and GWUDI Wells:

  An area within a 0.5-mile radius not to exceed State boundaries. Conjunctive delinearions will be made for all areas where a surface water body exists within the 0.5 mile radius base assessment area. The conjunctive delineation will then be a 3 mile radius not to exceed State boundaries. The delineation of the assessment area for springs/ GWUDI Wells will also be based upon existing data for recharge area delineations, where available.

- Wells:

  An area as defined in the State of Arkansas' Wellhead Protection Plan, generally described as an area within a 0.25-mile radius of the well head.

Ground Water: Naturally occurring water occupying the zone of saturation in the ground below the surface of the earth.

GWUDI: Ground Water Under the Direct Influence of Surface Water.

High Water Level: The line of the shore of an impoundment that is reached at the normal spillway elevation.

Mediam Flow Conditions: (USGS definition)

Off Stream Storage: A natural or man-made basin used for the purpose of storing raw water for use by a public water system as a supplement to the primary source of raw water.

PSOC's: Potential Sources of Contamination

Surface Water: Water that flows over or rests upon the surface of the earth. The term surface water includes rivers, lakes, impoundments, reservoirs, and springs in addition to other man-made and naturally occurring bodies of water on the surface of the earth.

Time of Travel: (USGS definition & methodology)

Method

The delineation and assessment will be conducted in accordance with the procedure described in the document entitled "Source Water Assessment Program" prepared by the Arkansas Department of Health (ADH).

Task List - Surface Water**
Impoundments

I. Evaluation of existing data base quality and availability,
   A. Evaluate Existing Data Bases
      1. Watershed Characteristics Data
      2. Hydrogeologic Data
      3. Intake Locations
      4. PSOC's
      5. Water Quality Data
   B. Generation of Data Bases (To be provided)*

II. Perform Watershed/Assessment area Delineations
   A. Watersheds (within State boundaries)*
   B. Reservoir Boundaries and Tributaries*
   C. Intake Locations*
   D. Protection Areas*

III. Create/Transform Ancillary Data Layers
   A. Agricultural Chemical Use*
   B. Watershed Characteristics*
   C. Geology*
   D. Land USe/Cover*
   E. PSOC's
   F. Precipitation Data*
   G. Transportation/Pipelines*

IV. Base Maps to ADH for Editing/Updating
   A. PSOC's plotted
   B. Delineations

V. Edited Base Maps
   A. Modification of Delineations
   B. Modification of Data Layering

VI. Perform Susceptibility Analysis
   A. PSOC's Within the Assessment Area
   B. PSOC's Within the Watershed

VII. Provide Report to ADH as each water system is completed

* Items to be provided by CAST and/or USGS
**All data layers and base maps are to be provided by CAST and/or USGS

Task List - Surface Water**
Rivers/Streams

I. Evaluation of existing data base quality and availability,
- A. Evaluate Existing Data Bases
  1. Watershed Characteristics Data
  2. Hydrogeologic Data
  3. Intake Locations
  4. PSOC's
  5. Water Quality Data
- B. Generation of Data Bases (To be provided)*

II. Perform Watershed/Assessment area Delineations
- A. Watersheds (within State boundaries)*
- B. Reservoir Boundaries and Tributaries*
- C. Intake Locations*
- D. 3-day Time of Travel
- E. Protection Areas*

III. Create/Transform Ancillary Data Layers
- A. Agricultural Chemical Use*
- B. Watershed Characteristics*
- C. Geology*
- D. 3-day Time of Travel and/or 20 miles maximum upstream distance
- E. Land USe/Cover*
- F. PSOC's
- G. Precipitation Data*
- H. Transportation/Pipelines*

IV. Base Maps to ADH for Editing/Updating
- A. PSOC's plotted
- B. Delineations

V. Edited Base Maps
- A. Modification of Delineations
- B. Modification of Data Layering

VI. Perform Susceptibility Analysis
- A. PSOC's Within the Assessment Area
- B. PSOC's Within the Watershed

VII. Provide Report to ADH as each water system is completed

* Items to be provided by CAST and/or USGS

**All data layers and base maps are to be provided by CAST and/or USGS

Task List - Surface Water**
Springs and GWUDI Wells

I. Evaluation of existing data base quality and availability,
- A. Evaluate Existing Data Bases
  1. Spring and GWUDI Well Locations
  2. Hydrologic Data
  3. Geologic Data
  4. PSOC's
  5. Water Quality Data
  6. Well - Construction Data
  7. Production/Pumping Data
  8. Soils (Permeability, Depth to Bedrock) from SSURGO Data
  9. Aquifer Characteristics
- B. Generation of Data Bases (To be provided)*

II. Perform Watershed/Assessment area Delineations

III. Create/Transform Ancillary Data Layers
- A. Agricultural Chemical Use*
- B. Geology*
- C. Land USe/Cover*
- D. PSOC's
- E. Precipitation Data*
- F. Transportation/Pipelines*

IV. Base Maps to ADH for Editing/Updating
- A. PSOC's plotted
- B. Delineations

V. Edited Base Maps
- A. Modification of Delineations
- B. Modification of Data Layering

VI. Perform Susceptibility Analysis
- A. PSOC's Within the Assessment Area

VII. Provide Report to ADH as each water system is completed

* Items to be provided by CAST and/or USGS
**All data layers and base maps are to be provided by CAST and/or USGS

Task List - Wells**

I. Evaluation of existing data base quality and availability,
   A. Evaluate Existing Data Bases
      1. Well Head Locations
      2. Hydrologic Data
      3. Geologic Data
      4. PSOC's
      5. Water Quality Data
      6. Well - Construction Data
      7. Production/Pumping Data
      8. Soils (Permeability, Depth to Bedrock) from SSURGO Data
      9. Aquifer Characteristics
   B. Generation of Data Bases (To be provided)*

II. Perform Watershed/Assessment area Delineations

III. Create/Transform Ancillary Data Layers
   A. Agricultural Chemical Use*
   B. Geology*
   C. Land USe/Cover*
   D. PSOC's
   E. Precipitation Data*
   F. Transportation/Pipelines*

IV. Base Maps to ADH for Editing/Updating
   A. PSOC's plotted
   B. Delineations

V. Edited Base Maps
   A. Modification of Delineations
   B. Modification of Data Layering

VI. Perform Susceptibility Analysis
   A. PSOC's Within the Assessment Area

VII. Provide Report to ADH as each water system is completed

* Items to be provided by CAST and/or USGS
**All data layers and base maps are to be provided by CAST and/or USGS

Product

Report to ADH as each public source of water supply is completed. Report will include:

A. Base Maps With
   1. PSOC's Plotted
   2. Delineation of Assessment Area

B. Susceptibility Analysis for PSOC's Within the Assessment Area

Time-Line

Project Duration - October 1, 1998 to June 30, 2001

Year 1 - October 1, 1998 to June 30, 1999

October 1, 1998 - February 1, 1998 - Complete Delineations for surface water sources, and GWUDI wells and springs with conjunctive delineations and deliver to ADH by February 1, 1999. These will be distributed to the water systems for review of PSOC's and returned for editing by May 1, 1999.

June 1, 1999 - Begin susceptibility analysis for PSOC's within delineated areas. The first priority will be on surface water sources, and GWUDI wells and springs with conjunctive delineations.

Year 2 - July 1, 1999 to June 30, 2000

Continue susceptibility analysis with emphasis on surface water sources, and GWUDI wells and springs with conjunctive delineations.

Begin susceptibility analysis of other GWDUI wells and springs

Deliver final product to ADH as each system is completed so they can make delivery to the respective water system.

Year 3 - July 1, 2000 to June 30, 2001

Complete all susceptibility analyses.

Deliver final products to ADH as each one is completed.

Plan of work
for Spatial Data Development and Analysis
in Support of the Arkansas Source Water Assessment Program

INTRODUCTION

The following is a plan of work for the digital spatial and attribute data development and analysis work proposed by the Center for Advanced Spatial Technologies, University of Arkansas, Fayetteville.

The basic purpose for the work proposed here is to obtain information on the location of wells in the state of Arkansas that provide public water and the location and characteristics of Potential Sources of Contamination (PSOC) that are in their immediate vicinity (either ¼ or ½ mile – for wells). The purpose of the work is to develop base data that can be used by the US Geological Survey to assess the potential for contamination for the state's wells. PSOC data needed for assessment of public surface water sources (impoundment's, rivers, etc.) shall also be provided to the USGS. The assessment performed by USGS will be provided to the Arkansas Department of Health as part of the EPA required program on source water assessment (EPA 816-R-97-009 "State source water assessment and protection program guidance"). Because of the large number of wells and potential PSOCs it would be enormously expensive to field map all these data. Using Geographic Information Systems (GIS) technologies and existing data, the goal of this task of the effort is to develop a data set that can serve as a useful basis for assessing the potential for contamination for these wells. The current work is seen as the first aspect of a long-term program that will involve field work.

Proposed Tasks and Brief Descriptions

TASK 1 – Data Acquisition

A. Identification / Collection of PSOC data for the state of Arkansas.
B. Collection / Manipulation of base GIS data layers
C. Assessment of Digital Data sources and determination of pertinent "must-have" data sets
D. Department of Health will provide CAST a "geo-coded" Public Water Intake system database that contains all x, y coordinates (decimal degrees; NAD27) with related well log information that will be required for the PWS Assessment as detailed in the proposed assessment methodology (see TAC/CAC meeting notes).

I. GIS Data Layers

1. Geology (1:500k) vector
2. Soils (STATSGO 1:250k) vector
3. Poultry/Swine houses (AHTD cells, all but one county)
4. Land Cover reclass of GAP (30m raster)
5. Canals and Ditches (1:100k vector TIGER/DLG) will any attribution be required?
6. Irrigation Wells (as determined by ASWCC) has not been mentioned in meetings
7. NPDES and TRI (EPA, vector data in Arc Info)
8. Highways by classification, railroads, airports, bridges (AHTD)
9. Pipelines (TIGER/DLG? 1:100k)
10. RCRA
11. ERNS
12. Cemeteries (AHTD/GNIS)
13. Schools (AHTD/GNIS)
14. Septic Systems (Rural structures from AHTD)
15. Mines (GNIS)
16. Elevation (30m where available; else 80m)
17. Streams/Rivers (DLG 1:100k)
18. Dairies (Ark. Dept. of Health)

II. PSOC's

As identified USGS and as ranked by Health/Contamination Risk to Public Water Systems by the USGS and Dept. of Health.

1. Above ground storage tanks
2. Under ground storage tanks
3. Leaking storage tanks
4. Agri Industry (fertilizer storage, sales, etc)
5. Pesticides applied per acre (Rick Bell at USGS 228-3620 in LR)
6. Airports (Are these shown on Highway Dept. info, can we distinguish by size
7. Repair Shops (Auto, Farm, furniture)
8. Cemeteries (from Cordova's work)
9. Chemical Storage (dealers, paints, solvents)
10. Dry cleaners
11. electric substations (PCB's are what we're looking for)
12. Golf Courses
13. Gravel Pits (PC&E Streaming Mining)
14. Highways (can we distinguish Fed, US, state, county etc. so we can weight them differently based upon likely hood of transport and traffic)
15. Manufacturing facilities (non-specific)
16. Pipelines
17. Oil and gas wells
18. Salvage yards
19. Sewage treatment plants (NPDES facilities)
20. Septic tanks
21. Landfills (PC&E should be sending)
22. Water wells

23. Confined animal operations
24. Aquaculture (AHTD hydro layer)
25. Land application(Solid Waste Div. of PC&E)
26. waste water lagoon (Discharge data)
27. In-steam gravel removal (PC&E Permits)
28. RCRA
29. CERCLA (Superfund)
30. Marinas (and other recreation on lakes)
31. Mining

TASK 2 - Decide to Purchase and/or Convert key PSOC data to digital format

USGS and the Department of Health will create a statewide, digital database of oil and gas wells with latitude and longitude coordinates from the Department of Health and Oil and Gas Commission's databases. CAST will create a statewide GIS coverage from this newly created database. No commercial data will be used.

TASK 3 - Geo-code PSOC's

Geo-code ALL transient PSOC's that have been pulled from the various sources and reclass them into their relevant "Health/Contamination Risk" as determined by the Dept. of Health and the USGS (8/18/98 meeting in Little Rock). All of these geo-coded PSOC's will be included on the first set of draft maps and reports (see task 5 below) so that the spatial, temporal; attribute data quality can be determined by the localities. These PSOC's will be assigned a unique ID for data editing purposes and business names will be included on the DRAFT 8.x11 maps. *It is believed that this would be the most effective means of data verification*.

TASK 4 - Seamless Data Base Assembly

Create seamless, statewide coverage of all PSOC's and GIS data layers.

TASK 5 - Macro Development

The draft maps will be created using various GIS macros, developed at CAST. Several macros will be developed in order to process the GIS data analysis of each well into a useful (MS Access) form for the Dept. of Health. These macros will be for CAST's internal use and are not part of the project deliverables.

TASK 6 - Draft Map production

Individual 8-1/2"x11" black/white maps shall be produced for each of the approx. 1400 public groundwater sources in Arkansas, with the exception of wells under the direct influence of surface water (GWUDI) which require conjunctive delineation (see Task 10). Each map will identify the groundwater source, the wellhead protection zone, PSOC's, and appropriate roads and landmarks necessary for locating these features. The wellhead protection zone shall be 1/4 mile for normal wells, unless independently delineated by the Dept. of Health, and 1/2 mile for (GWUDI) wells, unless requiring conjunctive delineation (see Task10). An accompanying page for each map will list each PSOC by business name or equivalent. Due to the nature of the data being incorporated, these maps will most likely contain errors and will need QA (c.f. Task 7). These are draft maps, to be reviewed, by the Dept. of Health officials and the local water supplies, for accuracy of PSOC locations and attribution. Changes will be made, directly on a hard-copy of the map; after field verification and returned to CAST for digital data editing (c.f. Task 7). CAST is responsible for creating a set of instructions for data editing that are to be followed by the local water utilities and approved by the Dept. of Health. The Dept. of Health is responsible for shipment of these maps to and from the local water utilities and will provide, as well as enforce, the return schedule of these maps from the local water utilities. As the maps are returned to the Dept of Health, they will be checked by Dept. of Health personnel for accuracy before being mailed back to CAST for digital data editing.

TASK 7 - Digital Data Editing

As edited paper copies are returned to CAST, the digital data for PSOC locations and attribution will be updated and edited within the GIS data layers and the related MSAccess database tables.

TASK 8 - Small Format Cartographic Production of Final Maps

Final (8.5"x11", color, digital maps) will be <u>re-created</u> by CAST after digital data edits. These maps will be provided to the Dept. of Health in a digital format (.pdf). The maps and accompanying text report will be contained within individual files and grouped by Public Water System. This will make future Web publishing of this material very easy for the Dept. of Health.

TASK 9 - Metadata Production

FDGC compliant metadata will be created for each GIS data layer and delivered with all distributed GIS data in a report at the end of the project.

TASK 10 - Identify GWUDI Wells w/Streams inside Base Assessment Area

CAST will identify those GWUDI Wells in which the 100k hydrography passes through the base assessment area.

TASK 11 - Calculation of Upgradient / Downgradient from each well-head and report the relative elevation of each PSOC within the buffer zone around each well.

CAST will compute the upstream/downstream areas within each buffer zone using the best available raster elevation data. PSOC elevations will be computed, relative to the elevation of the Public Water Source intake. This information will be associated with all PSOCs within the "zone of influence" around each PWS (ie ¼ mile buffer from wells, etc.) and be entered as database attributes into the MS Access tables for the PSOC's.

TASK 12 - Determination of PSOC Distance Weighting

CAST will compute distance buffers, as determined by the assessment model, from each public ground water source. This data will be required for application of a weighting factor to each PSOC, as determined within the assessment methodology.

TASK 13 - Construction, Updates and Delivery of Access/Excel base data sets suitable for final assessment calculation by Department of Health

Final modification and delivery of all digital information, according to the current assessment methodology, required to calculate each public water intake system's relative susceptibility to local contaminants within the Department of Health's desired software package, MS Access.

TASK 14 - Preparation, Publication and Delivery of Final Report

The final report will include metadata and GIS analysis methodologies employed by CAST during the course of the project. All digital data developed for this project will be delivered in its respective (ie corresponding) digital format (eg. Pdf, excel spreadsheet, shapefile, Arc-Info coverage, etc.) and on appropriate digital media. (CD-ROM)