TEXAS COMMISSION ON ENVIRONMENTAL QUALITY SOURCE WATER ASSESSMENT REPORT

Prepared for

PWS #0470015

UPPER LEON RIVER MWD

COMANCHE, Texas

TCEQ

Prepared by

TCEQ's Source Water Assessment and Protection Program

in cooperation with the United States Geological Survey
and the United States Environmental Protection Agency

5/28/2003

TCEQ Delivers Your Source Water Assessment

To All Public Water System Officials:

We are glad to provide you with this Phase I Source Water Assessment of the water sources used by your system. The 1996 Amendments of the Safe Drinking Water Act require all states to assess their public water sources and provide the results to each respective water system. The assessment is developed with the goal of providing public water systems with useful information that will be of significant assistance in their ongoing implementation of source water protection. Source water protection is a voluntary program. Your only regulatory obligation is to notify your customers through your Consumer Confidence Report that you have received the assessment.

The assessment is designed to provide you with an efficient tool for future protection of your water system. For example, it might assist you in reassessing your monitoring regimen, which could ultimately allow you to realize some cost savings as well as better serving your customers. We want to emphasize that these assessments do not indicate or imply health risks. The assessment is designed to help identify activities and conditions that may affect your drinking water sources in the future.

TCEQ staff will be available to assist you in understanding the assessment and to explain how the information can be used to enhance your operations and to implement a source water protection program. You can reach TCEQ staff at **(512)239-4691** or access information on our website at: **http://www.tceq.state.tx.us/permitting/waterpermitting/pdw/swap/swp.html**.

A conference on the assessments and source water protection has been scheduled for August 19 and 20, 2003, in Austin, Texas. Please mark your calendars. Details on this event will be provided to you in the coming weeks and are available on our website.

"THANK YOU FOR YOUR CONTINUED EFFORTS TO PROTECT TEXAS WATER"

PWS ID 0470015 CO

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

UPPER LEON RIVER MWD 5/28/2003

PO BOX 67
COMANCHE TX 7644267

Dear Water System Manager:

As required by the 1996 Safe Drinking Water Act Amendments, the Texas Commission on Environmental Quality has completed a source water susceptibility assessment (SWSA) for your public water supply (PWS) system. The SWSA methods were produced in a cooperative effort with the United States Geological Survey (USGS) and input from members of the public through regularly held forum discussions. The attached report includes a delineation of areas providing water for each of your PWS system's sources, an inventory of the regulated and unregulated drinking water contaminants within this delineated area, and a determination of the PWS system's relative susceptibility to contamination.

The results of the assessment may provide new insights into the activities near your water source(s) and should be used as a guideline for implementing source water protection. We encourage you to develop measures that can help prevent contamination of your water supply and investigate the source water protection program via the internet at http://www.tceq.state.tx.us/permitting/waterperm/pdw/swap /swp.html where you will find helpful tools, forms and guidance for starting a source water protection program. If you do not have internet

Please read the methodology section of the report and then review the appendices that contain specific results for your water system. If there are any errors or questions you have regarding the report, please provide comments in writing to the address below. We will respond to all written comments once assessments are completed for all PWS in the state.

Sincerely,

Greg Rogers, Team Leader
Water Supply Division
Public Drinking Water Section
Source Water Assessment and Protection Program, MC 155
P O BOX 13087
Austin, TX 78711-9958

Enclosures: Source Water Assessment Report
cc: Region 3 without enclosures

Frequently Asked Questions - Source Water Assessments

1. **Q.** What is a source water susceptibility assessment (SWSA)?

A. The source water susceptibility assessments are reports of the susceptibility of public water systems to 227 drinking water contaminants. The results include a rating of High, Medium or Low for each of the contaminants.

2. **Q.** Why did the TCEQ do this work?

A. The assessment reports were federally mandated under the Safe Drinking Water Act.

3. **Q.** How is a public water supply (PWS) system's susceptibility determined?

A. Susceptibility is determined through the use of geographic information system (GIS) software. Assessments are based on six major assessment components:

1) identification of the source of water,
2) delineation of the area contributing water to the source,
3) determination of natural properties which contribute to susceptibility,
4) evaluation of non-point source contaminants,
5) evaluation of point source contaminants, and
6) inclusion of contaminant detections above a TCEQ threshold concentration from water quality monitoring sites

4. **Q.** Why is the report so long?

A. The first 24 pages describe everything that went into the assessments and how they were completed. The appendices and maps at the end of the report are specific to a water system and make up the results of the assessment.

5. **Q.** What does point source contamination mean?

A. These are contaminants that can be traced back to a specific point.
EXAMPLE: Gasoline from an underground storage tank at a gas station.

6. **Q.** What does nonpoint source contamination mean?

A. These are contaminants that can originate from multiple points and cannot be traced back to a specific location.
EXAMPLE: Pesticides draining from suburban lawns after a rain fall.

7. **Q.** Our system received a HIGH susceptibility to a contaminant, is there a public health threat?

A. NO. A HIGH susceptibility means there are activities near the source water and the natural conditions of the aquifer or watershed make the source susceptible to this contaminant. If contaminant levels above allowable limits have been detected for your water system, you would receive a separate notification.

8. **Q.** Are some of the contaminants in the assessment related to the treatment process?

A. YES. Refer to appendix A for contaminants that may be related treatment.

8. **Q.** How should a PWS system use the results of the SWSA for their system?

A. The results of the assessments should be used as GUIDELINES in implementing protection measures. A summary of the results will be included in the Consumer Confidence Reports (CCR).

9. **Q.** What information should be included in the CCR?

A. Reporting requirements of assessment results will be included in the CCR guidance and template to be sent out in spring/summer 2003. As a minimum, all systems will have to report that the assessment is complete and on file with the water system. Note: at no point should the general public have access to detailed location information such as latitude and longitude of wells and intakes. However, general information such as which aquifer or reservoirs are used is required by the CCR.

10. **Q.** The results of the SWSA indicate a water system is "highly susceptible" to certain contaminants. How do I figure out which contaminants?

A. Review Appendices E, G and I of the report.
Appendix E lists high susceptibility rated contaminants by water source;
Appendix G indicates the number and distance of general classes of point sources that are potential sources of contamination; and Appendix I illustrates the proximity of point sources to the water source.

11. **Q.** If the data used in calculating the susceptibility rating of our water system is inaccurate, (inaccurate data may include: locations of intakes or wells, well depth, pump rate, etc.), can the assessment be recalculated?

A. YES. Although every effort was made to obtain accurate data prior to assessment, water systems may identify inaccuracies and submit written corrections along with documentation.

Note: Systems will be re-assessed after June 1, 2003

12. **Q.** Our system could not find the well logs for our well. What does that mean?

A. Well log information, along with aquifer information, is used to determine the capture zone for each well. If this information is missing, a 1/2 mile radius circle is used to represent the capture zone.

13. **Q.** This report shows the presence of potential sources of contamination (PSOC) near my well, but I know they don't exist. What should I do?"

A. Note any discrepancies in the report and provide documentation supporting your position. Discrepancies will be evaluated and the assessment will be performed again using the newly acquired data. Please send all comments and changes in writing.

Note: Systems will be re-assessed after June 1, 2003

14. **Q.** How can I verify the structural integrity of my well? There are no records available from the driller or the previous owner."

A. An engineer or other professional can be hired to perform a down-hole video survey to document the screened interval and a cement bond long to determine the annular cement. This can be done the next time your pump is pulled for servicing.

15. **Q.** How will contaminant susceptibility ratings affect a PWS system?

A. Susceptibility ratings will allow PWS systems to focus source water protection efforts on potential sources of contaminants. The results of the assessments may be used to adjust monitoring schedules and may reduce monitoring costs by identifying contaminants of concern.

You can also use this information to select future well sites that have fewer potential sources of contamination.

16. **Q.** Our system purchases treated water from another public water system. Is this information included in our assessment?

A. NO. The assessments only use wells or intakes identified during TCEQ inspections as operational, demand, emergency, or test. In some cases a raw water source has been included if it feeds a canal system that a water supply is drawing from.

17. **Q.** Where can I find more information on these contaminants and their effects on water quality standards?

A. Visit the Environmental Protection Agency's (EPA) website where you will find information about contaminants and water quality standards. Contact the EPA at the following web address: **http://www.epa.gov** Another helpful website is **http://www.chemfinder.com**

18. **Q.** What is the difference between "source susceptibility" and "system susceptibility"?

A. For PWS systems with multiple source waters, the assessment software assesses each individual drinking water source, producing a report for each well or intake. The overall system susceptibility report is an average of all the individual water source assessments.

19. **Q.** Do I have to send copies to all customers?

A. NO. You should, however, understand the results well enough to explain them to your customers.

20. **Q.** The assessments made use of a Geographic Information System (GIS) incorporating geographical data. Is this data available to the public?

A. YES, write to the Source Water Assessment and Protection (SWAP) Team and provide the team with blank CD-R disks and the data will be provided to you or let you know who to contact. The request should be mailed to:

TCEQ/ Water Supply Division
Source Water Assessment & Protection
P.O. Box 13087 MC-155
Austin, TX. 78711-3087

21. **Q.** How does a water system go about implementing protection measures?

A. A water system can enroll in the Source Water Protection Program (SWP). Guidance explaining requirements of membership in the SWP program is available at:

http://www.tnrcc.state.tx.us/permitting/waterperm/pdw/swap/swp.html

You may also write to the above address for more information. Beginning June 1, 2003, we expect to begin working closely with water systems interested in implementing protection measures for their source water.

22. **Q.** I can't understand this report. It's too technical and I don't know what it means.

A. Take your time, write down questions you have regarding the report and send them to TCEQ for review. Beginning June 1, 2003, our staff will address any issues you have.

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1. Introduction

1.1 Introduction

Source water assessments are designed to provide information unique to each public water system (PWS) regarding the susceptibility of their source waters to contamination. Public water systems should review their assessment report thoroughly, paying close attention to any contaminants that the PWS has received a high and medium susceptibility rating. By using the information on contaminant susceptibility contained within this source water assessment report, the PWS can target source water protection efforts toward specific potential sources of contamination (PSOC). Information on how to obtain source water assessment reports and a system susceptibility summary may be made available to the public through consumer confidence reports to assist communities in understanding the source of their water, potential chemical and/or microbiological impacts to the source water, and support best management practices (BMPs) needed to protect source waters. In addition, the results of the source water assessments may be used to adjust chemical and microbiological monitoring sample schedules, potentially reducing monitoring costs by identifying contaminants of concern.

Note: **A high susceptibility does not mean there is a health threat or a maximum contaminant level (MCL) violation.** The assessments are designed to identify the activities and the related contaminants that may affect the water system. A MCL violation will result in a high susceptibility score because that contaminant has already been found in the drinking water and the public will have already been made aware through required reporting procedures.

1.2 Background

Source water assessments are mandated through Section 1453 of the 1996 Amendments to the Safe Drinking Water Act (SDWA). The 1996 SDWA Amendments require each state to develop Source Water Assessment and Protection (SWAP) Programs to:

- Delineate boundaries of areas providing source waters for all public drinking water systems.
- Inventory origins of regulated and unregulated drinking water contaminants within the delineated area.
- Determine the public water system's susceptibility to contamination.
- Inform the public of the results of the assessment.

The draft State program document, "The State of Texas Source Water Assessment and Protection Program Strategy", was submitted to EPA in February 1999 and was created through a series of Public Forum and Technical Steering Committee meetings. After incorporation of public comment, EPA approved the TCEQ SWAP strategy on November 6, 1999.

1.3 Approach

In a cooperative effort with the United States Geological Survey (USGS), the Texas Commission on Environmental Quality (TCEQ) produced a scientifically defensible method for assessing the susceptibility of Texas' 6700 public water systems to 227 drinking water contaminants. The source water assessments are based on six major components: (1) identification of the source of water (and structural integrity of ground water wells), (2) delineation of the contributing area, (3) determination of the degree to which naturally occurring aquifer / watershed properties of the delineated area contribute to source water susceptibility, (4) evaluation of non-point source contaminant susceptibility, (5) evaluation of point source susceptibility (and for ground waters, the attenuation of susceptibility related to longer contaminant

transport rates and selected properties of aquifers), (6) evaluation of the activities within 1000 feet of a surface water body, called the Area of Primary Influence, and (7) incorporation of contaminant detections above TCEQ threshold concentrations from water quality monitoring activities. Component susceptibility ratings from each water source, for each contaminant, are combined into an overall susceptibility rating for each contaminant for the PWS system.

Under each of the assessment components (with the exception of the delineation component), a relative susceptibility rating of high, medium, and low is produced. The rating scale under each component is derived from observed statistical breaks in the frequency distribution of statewide attributes or by best professional judgement. A component-based approach using software developed specifically for the assessments was used given the large number of public water systems, sources, data sets, attributes, and decision rules required to produce a comprehensive susceptibility assessment for a PWS. The software also enables TCEQ staff to re-run assessments in the future as data sets are updated or data accuracy improved. A more detailed explanation of the methodology used to assess source waters for their potential to become contaminated may be found in Section 3.

1.4 Purpose of Report

The purpose of this document is to present the results of the source water assessment to the public water system. This assessment report includes:

- An introduction and overview of the source water assessment methodology.
- Information on the public drinking water system and its drinking water source(s).
- A brief summary of the assessment results listing the contaminants for which the system has been determined to have a high or medium susceptibility rating.
- Detailed results of the assessments including component scores for contaminants with high or medium susceptibility ratings for each source of drinking water for the system.
- Maps of drinking water sources and potential sources of contaminants (PSOCs) identified within and around the delineated assessment areas.
- A list of the 227 identified drinking water contaminants used within this assessment.
- Count of PSOCs located within the assessment area.
- Information on how to use the assessment results through the TCEQ's Source Water Protection Program.

The results of the report can serve a number of purposes:

- The TCEQ may be able to use the assessment results to reduce or modify the chemical and/or bacteriological samples.
- The water system may take this information and develop a better understanding of the environmental factors that may be affecting their source waters. This can then lead to targeted source water protection activities to address areas of greatest concern.
- This detailed report is intended for use by the water system, however, a condensed summary of the results will be required by the Consumer Confidence Reports (CCR) and may be part of the 2004 template. There will be no specific source location information required in the CCRs, only a reference to source aquifer or water body.

2. Overview of Methodology

Susceptibility, in this report, is defined as the potential for a public water supply to withdraw water which has been exposed to a listed contaminant at a concentration that could pose a public health concern. Susceptibility of a water supply to contamination is related to 1) the physical integrity of the ground water well or surface water intake, 2) the physical, geologic, hydrologic, chemical and biological characteristics of the contributing area to the well or intake, 3) the type and number of potential sources of contamination (PSOCs) and land use within the contributing area, and 4) the nature and quantity of contaminants that have been or potentially could be released within the source area.

The TCEQ SWAP program has assembled over 100 data sets of potential sources of contamination (PSOCs) from existing TCEQ databases such as the industrial hazardous waste, municipal solid waste, and wastewater permitting program areas; from source water protection inventories and PWS set-back inspections, and databases from other state and federal agencies. Each PSOC is associated with chemical or biological contaminants from the list of 227 drinking water contaminants (Appendix A). Contaminants were assigned to each PSOC based on site-specific information contained within agency documents or from information on contaminants historically associated with various types of activities or processes using references such as Shineldecker (1992).

Using Geographic Information Systems (GIS) supported software and extensive databases, source water assessments integrate the results of six assessment components into one susceptibility summary component that produces a susceptibility rating for 227 identified contaminants for the public drinking water system. This process is completed through a software system designed in partnership with the USGS. The identification and delineation components are concerned with assembling data for use in other components. Five of the components (Intrinsic Susceptibility, Non-point Source, Point Source, Area of Primary Influence for surface water only, and Contaminant Occurrence) result in susceptibility ratings that are used in the Susceptibility Summary component to calculate the overall susceptibility assessment ratings.

In addition to compiling PSOC data sets, the SWAP program has assembled information on each water well and intake operated by a PWS systems. Information gathered by TCEQ PWS inspections, well log review, file research, and chemical and microbiological sampling was entered into a database. The assessment software relies upon detailed water well and surface water intake locations, water well construction details, site-specific geology, and well production information.

Comprehensive spatial data sets assembled by the USGS in support of the SWSA include: major and minor aquifers and their hydrologic properties; land use; soil type; climate; slope; elevation; surface water flow analysis; TCEQ, USGS and Texas Water Development Board (TWDB) chemical and microbiological monitoring analysis; non-point source statistical analysis for specific chemical constituents for surface water and ground waters; automated watershed delineation; and automated ground water capture zone delineation.

2.1 Identification

Only water wells and surface water intakes with a status of operational, demand, emergency or test (wells under development) are assessed. The first step in the assessment process is the identification of the location and structural integrity information for each water source (either water well or surface water intake) and its associated hydrographic data. Structural integrity refers to those mandatory properties for groundwater wells or surface water intakes defined in the Rules and Regulations for Public Water Systems 30 TAC Chapter 290 Subchapter D §290.41. If data on location or structural integrity is lacking, the system may receive a high susceptibility to all contaminants since default conservative assumptions are used. Every effort was made by TCEQ staff to obtain missing locational and integrity data from the public water supply prior to commencement of assessments.

Hydrogeologic data collected for groundwater wells includes the major aquifer the well screen is in as well as properties of that aquifer for later use in the delineation and intrinsic characteristics components. Aquifer properties include the three-dimensional extent of the aquifer, hydraulic conductivity, porosity, regional potentiometric surface, saturated thickness, and transmissivity. Hydrographic data collected for surface water intakes includes major river basin name, hydrologic region, and hydrologic unit. Under the identification component, a susceptibility rating is produced for ground water sources only and is based on well structural integrity.

2.2 Delineation

Once the location and hydrologic properties are obtained in the identification component of the assessments, the area that contributes water to the well or intake is delineated. For wells, delineation of a capture zone will determine the time-of-travel of water to the well. Time-of-travel is the time (in years) that it would take a molecule of water (and therefore any associated contaminant) in a specific location to travel to the water well. Time-of-travel capture zones are expressed in increments of 2, 5, 10, 20 and 100 years (these-time-of travel zones can be found in appendix I). In some cases, such as in unconfined aquifers, capture zones may not extend to 100 years. Delineations of water wells are produced in one of four ways, depending on aquifer type. The five major aquifer categories used in the source water susceptibility assessments include unconfined isotropic aquifers, confined isotropic aquifers, alluvial aquifers along rivers, anisotropic karst aquifers, and a final category of "unknown" for water wells that do not obtain water from the mapped major and minor aquifer systems, or that obtain water where an aquifer determination cannot be made. If no aquifer type is available, a fixed radius of one half mile is applied. This will be shown in the appendix I maps as a violet circle around the well without any time-of-travel zones. Since stream flow is an over-riding influence on alluvial aquifers, water wells located within these alluvial aquifers are assessed using a surface water approach. A watershed is generated for each alluvial well.

Flow-net analysis was used to delineate capture zones for unconfined and confined aquifers. Using specially-developed GIS software, the portion of the flow net that defines the contributing area for the water supply well was identified and a determination of the time-of-travel to the well for all aquifer categories was made (with the exception of the Edwards Aquifer where data from the USGS flowpath investigations for the Edwards Aquifer were used). Using this approach, the characterization of the aquifer is such that the vertical movement of water to the water table is not approximated; only the horizontal movement. The assumption is that the contributing area to a well in an unconfined system is the area directly above the flowpaths for a specified end time (2, 5, 10, 20, and 100 years). In a confined system, the contributing area is that area within specified end times or terminating in the outcrop of the aquifer for similarly specified end times.

Travel times for potential contaminants vary greatly in Karst systems such as the Edwards aquifer. As water levels rise or fall in the Edwards aquifer there are potentially more or fewer conduits to transmit the flow; therefore travel times for potential contaminants may vary for a given area depending on the water levels in the aquifer. Travel times in the Edwards aquifer can potentially be much shorter in many areas than for a typical aquifer composed of sand and gravel. For these reasons, the time-of-travel approach was not used for assessing the Edwards aquifer. A more conservative approach using flowpath information was selected. The USGS has conducted numerous investigations on the Edwards aquifer and has delineated flowpaths within the system using hydrologic, geologic, geochemical, and numerical information. The assessment for a well is conducted by first determining the corresponding aquifer flowpath for the well. The flowpath is then delineated upgradient from the well back to the area where recharge enters the aquifer from the surface. Along this flowpath, where the aquifer is confined, a confined assessment is conducted; where the aquifer is unconfined, an unconfined assessment is conducted. Most of the recharge to the Edwards aquifer is by streams that cross the outcrop area (recharge zone); therefore, where the flowpath for the assessed well intersects the outcrop area, a surface water assessment is conducted for the corresponding stream(s).

The assessments require the delineation of the contributing areas for surface water intakes, each intake receives a delineation of three watershed types:

- Total Watershed Area – the entire watershed upstream from the PWS intake on a stream or the entire watershed for the reservoir on which the PWS intake is located.
- Contributing Watershed Area – the watershed for the reservoir on which the surface water intake is located or the watershed upstream of a surface water intake located on a stream excluding all non-PWS reservoirs with normal storage capacity greater than 1,000 acre-feet.
- Area of Primary Influence – the area within 1,000 feet of a reservoir, and for all streams discharging directly to the reservoir, the area within 1,000 feet of the center of the stream channel for an estimated 2 hour time-of-travel immediately upstream of the reservoir. For intakes on streams, the area of primary influence is the area within 1,000 feet of the estimated 2 hour time-of-travel upstream from the intake. Contaminants located within the area of primary influence are those that the PWS may be most susceptible to due to their proximity to the intake.

Watersheds were delineated using specially developed software using a statewide, seamless 30 meter digital elevation model re-sampled to a 60 meter resolution by the USGS; flow accumulation and flow direction datasets; and hydrography datasets (stream and reservoir boundaries). The delineation of watersheds for intakes on canals lacking flow data was accomplished by generating a one half mile buffer around the intake location. In addition, watersheds were delineated for all monitoring stations and were used in the development of equations for the non-point source component.

2.3 Intrinsic Characteristics, Aquifer / Watershed Properties

Intrinsic characteristics are those natural features of the landscape and climate that contribute to the contamination susceptibility of ground or surface water. Intrinsic characteristics include land surface slope, soil characteristics (erodibility of soil, clay content, leakance), precipitation, runoff, reservoir depth, reservoir storage and watershed area.

Intrinsic characteristics for ground water sources are mainly related to unconfined aquifers. Higher leakance values for unconfined aquifers indicate the source is more susceptible to contamination due to increased contaminant transport rates through soil. A low land surface slope value indicates a source in an unconfined aquifer is more susceptible since runoff has longer residence times on low land surface slopes, allowing higher recharge.

Surface waters are susceptible to the following area-weighted intrinsic characteristics: high runoff to precipitation ratios (increases contaminant transport rates), high soil erodibility values (erodible soils carry contaminants adsorbed to their surface), low mean reservoir depth to mean annual runoff ratios (contaminant is likely to travel through reservoir in a short amount of time or may be easily re-suspended into the water column from the sediments), low total reservoir storage to mean annual runoff ratios (contaminant is likely to travel through reservoir in a short amount of time), and low watershed area to slope ratios (increases contaminant transport rates by lowering the time of travel of the contaminant).

2.4 Non-point Source

For surface water assessment, equations were developed for 63 of the 227 contaminants using logistic regression statistical analysis to predict the probability of detection of a contaminant above TCEQ established thresholds (see Appendix A) by basin characteristics including land use class, soil type, population density, agricultural chemical use, manure production and land and stream physiography. During the assessment, the delineated assessment area for the water source was overlaid on a land use spatial data layer and percentages of each basin characteristic within that area were tallied. Using the

developed predictive equations, the probability of detecting selected contaminants above the threshold value was calculated. A non-point source susceptibility rating was then assigned to those contaminants based on probability of detection. For groundwater, the non-point source component statistical models were able to be developed for Aluminum, Manganese, Nitrate, Nitrite, Nitrate+Nitrite and Sulfate. For the 164 contaminants that were not statistically modeled due to lack of sufficient monitoring data, a statewide probability of occurrence from non-point sources was assigned to each based on the relative frequency of detection based on sample data.

When an unconfined well is assessed and there is a high percentage of land uses that have contaminants associated with them (e.g. urban and agricultural) or there is a high density of transportation and/or pipelines, sources may be highly susceptible to many different contaminants.

2.5 Point Source

In order to determine a susceptibility rating to contamination from potential sources of contamination (PSOC) that are point sources, SWAP staff developed a database of over 800,000 PSOC locations and their associated contaminants for the state of Texas. Potential sources of contamination (Table 2.1) are categorized by type and subtype. Contaminants were assigned to each PSOC using two techniques: 1) contaminants were assigned based on known sampling or reporting of contaminants at a specific site or 2) contaminants were assigned based on established contaminant relationships to PSOC subtype (Shineldecker, 1992).

An important factor in determining the susceptibility to point sources for ground water is if the PSOC is known to penetrate the confining unit or if the PSOC is located at a depth below the confining unit or the soils zone. Potential sources of contamination occurring at the ground surface that overly a confined aquifer protected by at least 30 feet of clay or shale, are not assumed to present a contamination threat to a water well. If the PSOC penetrates the confining unit (clay layer) of the aquifer, then the contaminants associated with that PSOC are assumed to enter the aquifer with no vertical attenuation. However, since contaminants released from point sources entering ground water as solutes may undergo physical, chemical, and biochemical processes that lower their concentrations, an attenuation factor for those contaminants is applied depending on contaminant occurrence in the soil zone, vadose zone or aquifer matrix and time of travel from contaminant source to the water well. The attenuation factor is based on a model of physical contaminant attenuation using first order decay equations (the rate of decrease of the contaminant is proportional to the concentration of the contaminant) and selected aquifer properties related to the physical processes of sorption, decay, volatilization, advection, dispersion or dilution. Once applied, the attenuation factor may reduce the ground water point source susceptibility rating from a high to a medium or low susceptibility rating.

The proximity of a surface water intake to PSOCs, point source discharges, potentially threatening land usages, major transportation corridors or pipelines can result in the source water being susceptible to contamination. The relatively short time of travel of a chemical spill, continuous release, or runoff to the intake minimizes the opportunity for reducing a contaminant's concentration or converting or degrading a contaminant to a less threatening form. Point source susceptibility ratings are applied for a surface water source based on (1) the presence and density of contaminants associated to PSOCs and potentially threatening land usage areas within the area-of-primary influence (API) and (2) point sources from permitted dischargers upstream of the intake. An API-based point source susceptibility rating is determined by calculating the density of PSOCs and potentially threatening land use activities within the API. For contaminants from permitted dischargers, a point source susceptibility rating is determined using the mean two-year flood velocity time of travel to the PWS intake and an estimated in-stream contaminant decay rate.

2.6 Area of Primary Influence

The Area Of Primary Influence (API) component applies to surface water systems. This procedure determines the density or count of threatening activities and associated contaminants within the 2 hour upstream time of travel and 1000 foot buffer area around the water source. The API watershed is delineated using regional equations to predict time of travel at the estimated 2-year flood velocity along the main channel based on observations at USGS gaging stations. The relative susceptibility of the PWS to contaminants associated with activities within the API is determined based on human and domestic animal population density, pipeline density, oil/gas well density, transportation density, the count of permitted effluent discharge sites, and the density of PSOCs.

The proximity of a surface-water intake to a point source discharge, threatening land usage, transportation corridor, or pipeline can result in the source water being susceptible to contamination. The relatively short time-of-travel of a chemical spill, continuous release, or runoff to the intake minimizes the opportunity for reducing a contaminant's concentration or converting or degrading a contaminant to a less threatening form. Activity density or counts are used to determine the rating for associated contaminants under this component. Higher density or counts indicate increased susceptibility to activity-associated contaminants.

2.7 Contaminant Occurrence

Any detection above threshold values (see appendix A or the list of contaminants and the threshold values) from chemical monitoring stations located at or near the PWS source indicates the PWS is susceptible to that contaminant. Water quality data from monitoring wells within the well's capture zone and screened within the same unit as the assessed PWS' water well or water quality data from monitoring stations within the contributing watershed area of a surface water intake are checked to determine if contaminants have been detected above threshold values (see Appendix A). If the contaminant has been detected, then the well or surface water source is susceptible to the contaminant regardless of the results of other assessment components. This analysis is critical in the evaluation of susceptibility since many natural, historical, or undocumented sources of contamination may not exist in the PSOC data sets.

Table 2.1 Potential Sources of Contamination (PSOCs) are classified as a general type and a specific subtype. A list of chemicals assigned to each subtype is too extensive to be included in this report.

Table 2.1 Potential Sources of Contamination

PSOC TYPE	PSOC SUBTYPE			
BUSINESS	AUTO PARTS BUSINESS; AUTO REPAIR, SALES, SALVAGE, TOWING; BATTERY MFG., SALES; BOAT STORAGE; COTTON GIN; DRY CLEANER; FERTILIZER MFG, SALE, APPLICATION; FIREWORKS BUSINESS;	GOLF COURSE; GRAIN ELEVATOR; INORGANIC CHEMICAL INDUSTRY; METAL PLATING BUSINESS; MILITARY ARMORY; NEW OR USED OIL SITE; NUCLEAR POWER PLANT; OIL AND GAS PRODUCTION TANKS;	ORGANIC CHEMICAL INDUSTRY; PAINT SHOP; PESTICIDE MFG, SALE, APPLICATION; PESTICIDE, FERTILIZER MFG, SALE, APPLICATION; PETROLEUM CHEMICAL INDUSTRY; PETROLEUM STORAGE TANK;	PHOTO PROCESS BUSINESS; PLASTIC MFG, SALE; PULP OR PAPER MILL; RADIOCHEMICAL SITE; SUGAR REFINING; TIRE SALES, REPAIR BUSINESS; WOOD PRESERVING
CEMETERY	CEMETERY			
CHEMICAL PIPELINE	CRUDE OIL; HIGHLY VOLATILE LIQUIDS; NATURAL GAS LIQUIDS; PETROLEUM PUMP STATION; PIPELINE;		PRODUCT - GASOLINE, DIESEL, JET FUEL	
CHEMICAL STORAGE	CHEMICAL MIXING SITE; CHEMICAL STORAGE;		DRUM, SMALL CONTAINERS, BAGS; TRANSFORMER	
CLASS I INJECTION WELL	CLASS 1 INJECTION WELL			

Table 2.1 Potential Sources of Contamination				
PSOC TYPE	**PSOC SUBTYPE**			
CLASS II INJECTION WELL	CLASS 2 INJECTION WELL			
CLASS III INJECTION WELL	BRINE; CLASS 3 INJECTION WELL;		SODIUM SULPHATE; SULFUR; URANIUM	
CLASS V INJECTION WELL	AGRICULTURAL DRAINAGE; AUTO REPAIR FLOOR DRAIN; CESSPOOL; CLASS 5 INJECTION WELL; SEPTIC DRAIN FIELD;		SEPTIC UNDIFFERENTIATED; STORM DRAINAGE; TRASH BURNING WELL; UNTREATED SEWAGE	
GUN RANGE	GUN RANGE; MILITARY; PUBLIC OR PRIVATE			
NATURAL RESOURCE PRODUCTION	MINED LAND: ACTIVE OR ABANDONED; MINERAL EXPLORATION HOLE:	ABANDONED; NATURAL RESOURCE PRODUCTION; OIL OR GAS WELL - ABANDONED;	OIL OR GAS WELL - PLUGGED; OIL OR GAS WELL - PRODUCTION; OIL OR GAS WELL - UNDERGROUND STORAGE;	WATER WELL; WATER WELL: ABANDONED
TRANSPORTATION	AIRPORT; BOAT RAMP; HELIPORT; HIGHWAY; LANDING STRIP;		MARINA; MILITARY AIR BASE; RAILROAD; TRANSPORTATION	
WASTE	CARBAMATE SITE; CATTLE DIPPING VAT; COKING TAR SLUDGE SITE; CONFINED ANIMAL FEEDING OPERATION; CORRECTIVE ACTION SITE - TCEQ; DOMESTIC TRASH OR BURN PILE;	GROUNDWATER CONTAMINATION SITE; INDUSTRIAL HAZARDOUS WASTE TSD; LIVESTOCK OR ANIMAL PENS; MUNICIPAL SOLID WASTE - ABANDONED OR ACTIVE;	OILFIELD SLUDGE DISPOSAL; PERCHLORATE SITE; RECYCLING FACILITY; SALT WATER DISPOSAL PIT; SITE DISCOVERY - TCEQ; SOLVENT SITE; SUPERFUND SITE - TCEQ;	TOXIC RELEASE INVENTORY; TRANSFER STATION; VOLUNTARY CLEANUP - TCEQ; WASTE; WASTE REGISTRATION - TCEQ
WASTEWATER	AGRICULTURAL WASTEWATER OUTFALL; CESSPOOL; HOLDING POND;	HOLDING TANK; INDUSTRIAL WASTEWATER OUTFALL; LAND APPLICATION SLUDGE;	LIFT STATION; MUNICIPAL WASTEWATER OUTFALL; PIPELINE; PRIVATE WASTEWATER OUTFALL;	SEPTIC SYSTEM; TREATMENT PLANT; WASTEWATER

2.8 Susceptibility Summary

The source water susceptibility assessments (SWSA) produce both a source susceptibility summary and a system susceptibility summary. For PWS systems with one source, the source and system susceptibility summary results are identical. Numerical susceptibility ratings are generated for each contaminant under each of the assessment components. Refer to Sections 2.1 - 2.6 for more detailed information on each of the assessment components. Numerical susceptibility ratings range from 0 to 3 and are interpreted as follows: low if rating is ≤ 1.66; medium if rating is > 1.66 and < 2.33; and high if rating is ≥ 2.33. Raw scores for each of the assessment components are not presented within this report.

For PWS systems with multiple sources, individual water source scores (with the exception of the contaminant occurrence component) are weighted by the capacity (pumpage) of each source and then summed to obtain the numerical susceptibility ratings for the entire system. This capacity weighting for multiple sources takes into account the relative contribution to the system from each water source. When no capacity is available for water sources, individual component scores for each source are averaged to obtain the system component susceptibility ratings. In this case, each source carries equal weight.

Components are included in the summary rating only if applicable. The structural integrity component requires compliance with 30 TAC Chapter 290 Subchapter D §290.41 rules, a cemented casing for a well, and no PSOCs penetrating the ground surface within the capture zone. For sources that meet the structural integrity requirements, the structural integrity column in the source summary will not include

susceptibility ratings for any contaminant. For wells screened within confined aquifers, the intrinsic and non-point source components are not applicable since it is assumed the well is isolated from the influence of surface contaminants by the very nature of the aquifer. Components may also lack ratings when a contaminant is not associated with the component or there is insufficient information about a contaminant's susceptibility for that component.

Both the source and system susceptibility summary ratings are calculated by taking the maximum susceptibility rating from each applicable component. Because some components are not applicable in certain situations, several equations are used to determine susceptibility summary (SS) ratings.

Note that if a contaminant has been detected under the source contaminant occurrence component, then the source will be rated highly susceptible to that contaminant, regardless of any other component susceptibility rating.

Source Susceptibility Summary Equations

For groundwater sources screened within an unconfined or unknown aquifer, where structural integrity requirements are not met, and where there is no contaminant occurrence, then the source susceptibility summary (SS) rating for each contaminant is equal to the highest value of the following two equations:

SS Rating = (Structural Integrity Rating + Intrinsic Rating + Non-point Source Rating) / 2 OR

SS Rating = (Structural Integrity Rating + Intrinsic Rating + Point Source Rating) / 2

For groundwater sources screened within an unconfined or unknown aquifer, where structural integrity requirements are not met, and where there is no contaminant occurrence, then the source susceptibility summary (SS) rating for each contaminant is equal to the highest value of the following two equations:

SS Rating = (Intrinsic Rating + Non-point Source Rating) / 2 OR

SS Rating = (Intrinsic Rating + Point Source Rating) / 2

For groundwater sources screened within a confined aquifer setting and where there is no contaminant occurrence, only the structural integrity and point source components are applicable. The source susceptibility summary (SS) rating is:

SS Rating = Structural Integrity Rating + Point Source Rating

For surface water sources, where intake integrity requirements are not met and where there is no contaminant occurrence, then the source susceptibility summary (SS) rating for each contaminant is equal to the highest value of the following three equations:

SS Rating = (Intake Integrity Rating + Intrinsic Rating + Non-point Source Rating) / 2 OR

SS Rating = (Intake Integrity Rating + Intrinsic Rating + Point Source Rating) / 2 OR

SS Rating = (Intake Integrity + Intrinsic Rating + Area of Primary Influence Rating) / 2

For surface water sources, where intake integrity requirements are met and where there is no contaminant occurrence, then the source susceptibility summary (SS) rating is equal to the highest value of the following three equations:

SS Rating = (Intrinsic Rating + Non-point Source Rating) / 2 OR

SS Rating = (Intrinsic Rating + Point Source Rating) / 2 OR

SS Rating = (Intrinsic Rating + Area of Primary Influence Rating) / 2

System Susceptibility Summary Equations

The system susceptibility summary component determines the system susceptibility to contamination, based on the ratings from all assessed sources. The system susceptibility summary is calculated by weighting each assessment component, with the exception of the contaminant occurrence component, by a capacity or pumpage factor (in gallons per minute). This methodology allows the system to account for the relative proportion of water from each source. Where the capacity (pumpage) is unknown, then the system susceptibility summary is calculated by averaging the individual source component ratings, with the exception of the contaminant occurrence component.

Note that if a contaminant has been detected under the contaminant occurrence component of any source, then the system susceptibility summary rating will always default to high, regardless of any other system component susceptibility rating.

The capacity factor (CF) is calculated as follows:

$$CF = \frac{\text{Individual source capacity (pumpage) in gallons per minute (GPM)}}{\text{Overall capacity of system (GPM)}}$$

Weighted source component rating = (source component numerical rating)(CF)

For example, in a system with two sources: Well A with a capacity of 80 GPM and Well B with a capacity of 20 GPM, the capacity factors are 0.80 and 0.20, respectively:

$$CF_{\text{Well A}} = 80/100 = 0.80$$
$$CF_{\text{Well B}} = 20/100 = 0.20$$

The weighted component susceptibility ratings are then summed for system component ratings. The summary is then determined as the maximum value among all applicable components.

3. Assessment Results

First, **a high susceptibility does not mean there is a health threat or a maximum contaminant level (MCL) violation.** The assessments are designed to identify the activities and the related contaminants that may affect the water system. A MCL violation will result in a high susceptibility score because that contaminant has already been found in the drinking water and the public should have already been made aware through required reporting procedures and the CCRs.

A description of all the 227 contaminants and the threshold values used by the assessment can be found in Appendix A. Some of these contaminants are identified as being related to the treatment process or distribution system. Appendix A is standard for all water systems receiving an assessment.

A description of the specific PWS system and water sources is given in Appendix B. Water wells require certain information in order to be accurately assessed. If one or more critical elements (well location, screened interval, or pump rate) is lacking, wells are assessed using conservative assumptions and the well may receive a high susceptibility rating for each contaminant. Refer to §290.41 of TCEQ's Rules and Regulations for Public Water Systems 30 TAC Chapter 290 Subchapter D for ground water source requirements. The rules and regulations may be obtained by contacting the Public Drinking Water Section of TCEQ or viewed over the internet from the Texas Administrative Code website: http://info.sos.state.tx.us/pub/plsql/readtac$ext.viewtac by navigating to Title 30, Part 1, Chapter 290, Subchapter D.

The results of the source water susceptibility assessments are contained within Appendices C through I. Listed within Appendices C and D are contaminants for which the PWS system has received an overall susceptibility rating of high and medium, respectively, along with values of low, medium and high for each assessment component. The overall susceptibility rating is an average of the susceptibility ratings for all water sources for a system and is given for each of the 227 drinking water contaminants listed in Appendix A. Refer to Section 2.7 for the equation used to calculate summary susceptibility ratings from component susceptibility ratings. Appendices E and F include raw scores for component and summary susceptibility ratings for each of the PWS system's water sources for high (Appendix E) and medium (Appendix F) susceptibility rated contaminants. These appendices may be used to identify which of the water sources may be more susceptible to identified contaminants. If there is no rating under an assessment component heading within appendices C through F, the component was not used in the assessment and therefore no data was generated. Susceptibility ratings are not generated for the intrinsic (aquifer / watershed properties) and non-point source components for confined aquifers since the confining unit (clay layer) presents a barrier to the transport of contaminants. A high susceptibility rating for a contaminant means that there is a contaminant source located in close proximity to the water source and that the intrinsic characteristics of the watershed or ground water capture zone are such that if the contaminant were released into the environment, there is a high potential for the water source to become contaminated. A high susceptibility rating does not, however, imply there is an immediate threat to the water system.

Contaminants identified as having a high, medium or low susceptibility within this assessment were generated based on the presence of PSOCs within the assessment area or a detection of contaminants above threshold concentrations (see appendix A, for threshold values) under the contaminant occurrence component. The number of each PSOC type located within the various times of travel zones for water wells or located within the API and watershed of surface water sources are listed within Appendix G. Each

of the 227 contaminants listed in Appendix A may be associated with multiple PSOC types. By referring to Appendix I, which includes maps of each source and PSOCs located within the assessment area, the approximate source of the high or medium rated contaminant may be identified (refer to Appendix H for map legend and topographic map symbology). For ground water sources, the various times of travel may assist in identifying the PSOCs that generated the high or medium susceptibility, keeping in mind that the closer a PSOC is to a source, the shorter the time of travel of a contaminant. Due to the properties of ground water systems that may attenuate contaminants, many of the contaminants associated with PSOCs will be attenuated. The shorter the distance between source and PSOC, the less likely attenuation will be effective in lowering the concentration of the contaminant to below TCEQ threshold levels.

If no PSOCs or potentially threatening land uses associated with high or medium susceptibility rated contaminants are located within the assessment area, the contaminant received a high or medium susceptibility rating from the contaminant occurrence component. The presence of a contaminant and lack of an associated PSOC within the assessment area may indicate one of three possibilities: 1) the contaminant is naturally occurring in the assessment area; 2) there is a PSOC within the assessment area that is unidentified within the database used in the assessments; or 3) the contaminant resulted as a part of the water treatment process (as may be the case for Aluminum in Aluminum-lined storage tanks).

3.1 Purchase Water Assessments

It should be noted that any purchased treated water contracts that a system may have are not part of this source water assessment. The assessments are based solely on the raw water sources that the public water system maintains as part of their regular water supply. The assessments are based on sources owned and operated by the system identified as operational, demand, emergency, or test. Any treated water purchased from another water system is not included in this assessment. Contact the system from which the treated water is purchased in order to receive the results of their assessment or contact the TCEQ Source Water Assessment & Protection program to receive a copy of the results from the system selling the treated water.

There has been an effort, however, to include raw water purchases in the source water assessments. In cases where a water system takes water from a canal, an assessment will be calculated at the point water enters the canal system even though the pumps at this location is not directly owned by the water system.

4. How to Use Assessment Information

The source water assessments are designed to assist water systems manage their source water resources and inform the system and the public of activities near their source waters that may affect drinking water quality. Results of the assessments may help the system make treatment decisions or plan for new treatment options for the future. Some systems have already independently developed local ordinances or other activities to better protect their source waters. With this new source water assessment information, these protective measures will be more informed and better applied to the potential concerns.

Some ideas for interpreting and prioritizing the results are:

1. Determine which contaminants are not potential health concerns such as TDS and inorganic compounds such as sulfate. These contaminants may be related to naturally occurring compounds and there may be very little a system can do other than modify treatment or use different sources.
2. Determine the contaminants that received a high susceptibility score based on the Point Source component. Water systems should verify the locations of these point sources and determine their operational status (i.e. is an oil well operational or is it plugged). If the location or the status is different than reflected in the report, notify the SWAP program in writing, of the changes.
3. Determine if the highly susceptible contaminants associated with the Point Source component have also been detected in the Contaminant Occurrence component of the report. This indicates that there are point sources that could be contributing a contaminant and there has been a detect of that contaminant in the source water. This scenario should be considered a strong candidate for additional research of the point sources and possible source water protection measures.
4. Determine which contaminants originate from the Nonpoint Source (NPS) component. These are important possible contaminants but the nature of this component can lead to a larger number of highly susceptible contaminants than the Point Source component. When possible the NPS component uses statistical equations to determine susceptibility. When there is insufficient data for equations, statewide probability of occurrence from non-point sources was assigned to each based on the relative frequency of detection based on sample data.

Additional tools and ideas for source water protection are available through the TCEQ. This is a voluntary program with many resources available for interested water systems and communities. Some of these resources include more detail relating to the results of the assessments that could not be included in this report. Many PWS systems are already enrolled in TCEQ's source water protection (SWP) program, which provides water systems with the tools necessary to effectively protect their source water from contamination. Visit our website for current information and additional protection ideas and best management practices (BMPs) http://www.tnrcc.state.tx.us/permitting/waterperm/pdw/swap/swap.html.

Historically, there were four steps to complete in order to become enrolled members of the source water protection program: 1) delineation of the source water protection zone, 2) a physical inventory of the protection zone for PSOCs, 3) production of a source water protection report (reporting the results of the

delineation and the inventory) and 4) documentation of possible best management practices within the source water protection zone for identified PSOCs.

With the completion of the source water assessments, all public water systems have a delineated source water protection area and a list of potential sources of contaminants. All that is required of the system to participate in the source water protection program now consists of determining the accuracy of PSOC locations, documenting existing protection measures or best management practices (BMPs), and locating new PSOCs which may not have been included in the source water assessment. All of this is done through a ground inventory of the capture zone or watershed/API which are also the source water protection areas.

In order for a PWS system to protect their source waters and complete the requirements to become a member of source water protection, the SWAP program must be contacted. The SWAP program will provide the Source Water Protection guidance document to assist in the inventory, report writing and BMP establishment portions of the project. Once the PWS has submitted all required documents to the SWAP program, the PWS is considered a member of the SWP program and will be eligible for Drinking Water State Revolving Funds for implementation of protective measures known as best management practices (BMPs).

Best management practices are established for most of the PSOCs and threatening land uses identified, and are included in the source water protection guidance document. In order to facilitate BMP implementation, funds are available through the Drinking Water State Revolving Fund (DWSRF). The DWSRF funds are available as low-interest loans and may be used to implement BMPs within the protection zone, make land purchases, and/or modify or improve PWS infrastructure.

Incentives for a PWS to establish a source water protection program and have a current membership in the TCEQ SWP program include:

- **Prevention of increased treatment costs associated with source water contamination.** Contamination of source waters is a serious matter that may affect public health. Once a source water is contaminated it is difficult or impossible to remediate. Prevention of source water contamination is far easier and less expensive than acquiring specialized treatment equipment or new sources of water that will increase costs for the PWS.
- **Public relations**. Systems who have completed all the requirements for membership in the SWP program may advertise their membership by posting signs along roadways and in printed text on the consumer confidence reports (CCRs).
- **Best management practices implemented may modify the susceptibility rating of the PWS.** Future assessments may incorporate data obtained in source water protection efforts. Future assessments may consider the positive effects of BMPs for the PSOCs identified in initial assessments, potentially lowering the susceptibility ratings for many of the contaminants. PWS systems must first identify or implement BMPs for PSOCs identified within their protection zones.
- **Ground truth data used in the SWSA**. Systems who choose to participate in the SWP program conduct an inventory of the assessment area and in the process may find additional sources of contaminants, and verify or correct the locations of PSOCs or water source locations (water wells or surface water intakes) identified in this source water assessment. Improving the quality of data will improve the quality of future source water susceptibility assessments.

- **Access to funds to implement best management practices, acquire land, and modify infrastructure**. As mentioned previously, funds are available through the Drinking Water State Revolving Fund (DWSRF) for land acquisitions or construction of BMPs within source water contributing areas or to make PWS infrastructure improvements. In addition, grant monies are also available through state and federal programs, particularly for non-point source pollutant management (For example, Clean Water Act Section 319(h) funds are provided only to designated state and tribal agencies to implement their approved non-point source management programs).

4.1 Consumer Confidence Reports (CCR)

As required by rule, requirements for reporting the results of the source water assessments in the Consumer Confidence Reports will be included in the CCR template and guidance beginning in the spring/summer of 2004. The requirement for 2003 will consist of notifying consumers that a source water assessment has been completed and provided to the system in May 2003. Additional guidance on how to summarize the information in the assessments will follow in 2004. Through open records requests, consumers will have access to the full information of the source water assessments except for the detailed locations of well or intake locations in order to protect drinking water sources from malicious intent.

As mentioned before, using the CCRs to report the assessment results is ideal because consumers can compare the results of the assessments with the monitoring results of the system. The water system should be familiar with the results of the source water assessment and be able to provide additional information to consumers. Systems involved in source water protection activities should also be prepared to share with consumers the efforts that are planned, or are in place, to protect the source waters of the system.

Source Water Protection Contact Information:

Texas Commission on Environmental Quality

Source Water Assessment and Protection Program

P. O. Box 13087 MC - 155

Austin, Texas 78711-3087

http://www.tnrcc.state.tx.us/permitting/waterperm/pdw/swap/swap.html

5. Acknowledgments

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7. Definitions

Acre-foot

A volume of water that covers one acre to a depth of one foot, or 43,560 cubic feet (1233.5 cubic meters).

Adsorption

The process by which chemicals are held on the surface of a mineral or soil particle.

Alluvium

Sediments deposited by flowing rivers.

Aquifer

A rock unit that will yield water in a usable quantity to a well or spring.

Area of Primary Influence

The area within 1,000 feet of a reservoir, and for all streams discharging directly to the reservoir, the area within 1,000 feet of the center of the stream channel for an estimated 2 hour time-of-travel immediately upstream of the reservoir. For intakes on streams, the area of primary influence is the area within 1,000 feet of the estimated 2 hour time-of-travel upstream from the intake. Contaminants located within the area of primary influence are those that the PWS may be most susceptible to due to their proximity to the intake.

Available Water Content (AWC)

The available water content of a soil, a function of total pore space and pore size distribution. Available water content is an attribute in the SWSA ground water intrinsic component and is expressed as a volume fraction in inches per inch of soil, for example, if the available water content has a value of 0.20, a 10 inch zone then contains 2 inches of available water.

Best Management Practices (BMPs)

The most effective practice or combinations of practices to control point or nonpoint source pollution. Best management practices (BMPs) may either be structural or nonstructural. Structural BMPs are designed to capture surface runoff and remove pollutants through settling or other processes including, but not limited to, water diversions, retention devices, detention basins, or filter systems. Nonstructural BMPs take advantage of land's natural features to remove pollutants, nonstructural BMPs might include wetlands, grassed waterways and buffer zones.

Capture Zone

The delineated ground water contributing area characterized such that only the horizontal movement of water to the well is approximated assuming the contributing area to the well in an unconfined aquifer is the area directly above the flowpaths for a specified time of travel (2, 5, 10, 20 and 100 years). In a confined aquifer, the contributing area is that area within the aforementioned times of travel or terminating at the outcrop of the aquifer.

Chemical Abstracts Service (CAS) Registration Number

A number assigned by the Chemical Abstracts Service to identify a chemical.

Chloramines

Compounds formed by the reaction of hypochlorous acid (or aqueous chlorine) with ammonia.

Clay

One type of soil particle with a diameter of approximately one ten-thousandth of an inch.

Coliform Organism

Microorganisms found in the intestinal tract of humans and animals, their presence in water indicates fecal pollution and potentially dangerous contamination by disease-causing microorganisms.

Community Water System

A public water system which has a potential to serve at least 15 residential service connections on a year-round basis or serves at least 25 residents on a year-round basis.

Confined Aquifer

An aquifer overlain by a confining bed and under pressure that is significantly greater than atmospheric pressure. Also known as an artesian aquifer.

Confining Bed

A rock unit having a very low hydraulic conductivity that restricts the movement of ground water either into or out of adjacent aquifers.

Connection

A single family residential unit or each commercial or industrial establishment to which drinking water is supplied from the system. See §290.38(9) of TCEQ's Rules and Regulations for Public Water Systems 30 TAC Chapter 290 Subchapter D for a more detailed definition. The rules and regulations may be obtained by contacting the Public Drinking Water Section of TCEQ or viewed over the internet from the Texas Administrative Code website: http://info.sos.state.tx.us/pub/plsql/readtac$ext.viewtac by navigating to Title 30, Part 1, Chapter 290, Subchapter D.

Contaminant

Any physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water, or soil. For TCEQ susceptibility assessment purposes a contaminant is any of the 227 substances listed in Appendix A that may pollute drinking water sources.

Contributing Watershed Area

The watershed for the reservoir on which a surface water intake is located or the watershed upstream of a surface water intake located on a stream excluding all non-PWS reservoirs with normal storage capacity greater than 1,000 acre-feet.

Drinking Water

All water distributed by any agency or individual, public or private, for the purpose of human consumption or which may be used in the preparation of foods or beverages or for the cleaning of any utensil or article used in the course of preparation or consumption of food or beverages for human beings. The term "Drinking Water" shall also include all water supplied for human consumption or used by any institution catering to the public.

Drainage Basin

This is another term commonly used to describe a watershed.

Effluent

Water or some other liquid – raw, partially or completely treated – flowing from a reservoir, basin, treatment process or treatment plant.

Entry Point (EP)

An entry point to the distribution of a public water supply, it is any point where freshly treated water enters the distribution system. Entry points to the the distribution system may include points where chlorinated well water, treated surface water, rechlorinated water from storage, or water purchased from another supplier enters the distribution system.

Geographic Information System (GIS)

An organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information.

Ground Water

Water in that area below land surface in which all pore spaces and voids are filled with water (called the zone of saturation) and from which wells, springs, and seeps are supplied.

Heavy Metals

Metallic elements with high atomic weights, e.g., mercury, chromium, cadmium, arsenic, and lead. They can damage living organisms at low concentrations and tend to accumulate in the food chain.

Herbicide

A compound, usually a man-made organic chemical, used to kill or control plant growth.

Hydraulic Conductivity

A coefficient of proportionality describing the rate at which water can move through a permeable medium. Clay usually has a hydraulic conductivity of less than .00005 cm/sec while the hydraulic conductivity of gravel may range from 1 to 100 cm/sec.

Hydrology

The study of the occurrence, distribution, and chemistry of waters of the Earth.

Hydrogeology

The geology of ground water, with particular emphasis on the chemistry and movement of water.

Hydrologic Region

The largest hydrologic unit classification, identified by a two digit hydrologic unit code (HUC). The code identifies one of twenty one major geographic areas, or regions that contain either the drainage of a major river or series of rivers. Texas falls within three hydrologic regions, region 11 (Arkansas-White-Red Region) including the drainage of the Red River basin in Texas, region 12 (Texas Gulf Region) includes the drainage that discharges into the Gulf of Mexico from Sabine Pass to the Rio Grande Basin boundary, and region 13 (Rio Grande Region) which includes the Rio Grande River drainage. (Seaber, Kapinos, & Knapp, 1987)

Hydrologic Unit Code (HUC)

A two to eight digit unique code based on four levels of classification within the hydrologic unit system (divisions and subdivisions of the United States into successively smaller hydrologic units: regions, sub-regions, accounting units, and cataloging units). An eight-digit code uniquely identifies each of the four levels of classification within four two-digit fields. The first two digits identify the region; the first four digits identify the sub-region; the first six digits identify the accounting unit, and the addition of two more digits for the cataloging unit completes the eight-digit code. (Seaber, Kapinos, & Knapp, 1987)

Insecticide

Any substance or chemical formulated to kill or control insects.

Inorganic

Material such as sand, salt, iron, calcium salts and other mineral materials. Inorganic substances are of mineral origin, whereas organic substances are usually of animal or plant origin. See Organic.

Karst

A region made up of porous limestone containing deep fissures and sinkholes and characterized by underground caves and streams.

Leakance

Ratio of soil permeability to soil thickness.

Maximum Contaminant Level (MCL)

The maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

Noncommunity Water System

Any public water system which is not a community system.

Non-point Source

Pollution sources without a specific point of origin, usually due to storm water runoff from urban areas or agriculture/rangeland.

Nontransient Noncommunity Water System

A public water system that is not a community water system and regularly serves at least 25 of the same persons at least six months out of the year.

Operational Status Code

A code assigned to each PWS water source indicating its use or status by the system. Water source operational statuses codes are: A (abandoned source), C (capped water well), D (demand, source used only for peak demand periods), E (emergency, used only for emergencies), F (former PWS source, not used by the system), N (well used for non-drinking water uses), O (Operational), P (plugged water well), T (test, well in development).

Organic

Substances that come from animal or plant sources or man-made chemical compounds containing carbon. Organic substances always contain carbon.

Pathogen

Any organism able to cause a disease such as bacteria, viruses and the protozoans *Cryptosporidium parvum* and *Giardia lamblia*.

Pesticide

Any substance or chemical designed or formulated to kill or control weeds or animal pests. Also see herbicide, insecticide.

Point Source

A stationery location or fixed facility from which pollutants might be discharged or emitted.

Porosity

The ratio of openings (voids) to the total volume of a soil or rock. Porosity is an indication of the capacity of the material to hold water. Expressed as percentages, clays have a porosity of 50% while gravels have a porosity of 20%

Potential Source of Contamination (PSOC)

A point source from which contaminants may leak or be discharged.

Potentiometric Surface

A surface that represents the level to which water will rise in tightly cased wells in a confined aquifer. In an unconfined aquifer, the potentiometric surface is the water table.

Precipitation

1) The process by which atmospheric moisture falls onto a land or water surface as rain, snow, hail, or other forms of moisture. 2) The chemical transformation of a substance in solution into an insoluble form (precipitate).

Public Water System (PWS)

A system for the provision to the public of water for human consumption through pipes or other constructed conveyances, which includes all uses described under the definition for drinking water. Such a system must have at least 15 service connections or serve at least 25 individuals at least 60 days out of the year. This term includes: any collection, treatment, storage, and distribution facilities under the control of the operator of such system and used primarily in connection with such system, and any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. Two or more systems with each having a potential to serve less than 15 connections or less than 25 individuals but owned by the same person, firm, or corporation and located on adjacent land will be considered a public water system when the total potential service connections in the combined systems are 15 or greater or if the total number of individuals served by the combined systems total 25 or greater at least 60 days out of the year. Without excluding other means of the terms "individual" or "served," an individual shall be deemed to be served by a water system if he lives in, uses as his place of employment, or works in a place to which drinking water is supplied from the system.

Public Water System Identification Number (PWS ID)

A unique seven digit identification number assigned to each public water supply system in Texas.

Radionuclide

Any man-made or natural element that emits radiation in the form of alpha or beta particles, or as gamma rays.

Reservoir

Any natural or artificial holding area used to store, regulate or control water.

Reservoir Depth : Mean Annual Runoff Ratio

An attribute used in calculating surface water intrinsic susceptibility to contamination. Contaminant movement in an aqueous environment will be higher when reservoir depth : annual runoff ratios are low since the potential for resuspension of contaminants is higher in shallow reservoirs and time of travel of a contaminant through the reservoir would be shorter.

River Basin

The entire land area drained by a river, also known as a watershed.

Runoff

That part of precipitation, snow melt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into surface waters.

Runoff : Precipitation Ratio

An attribute used in calculating surface water intrinsic susceptibility to contamination. Contaminant movement in an aqueous environment will be higher when runoff : precipitation ratios are high. For example, when runoff is high in relation to the amount of precipitation falling on the watershed, contaminants will be more likely to be carried to the receiving water body than when runoff is low in relation to precipitation.

Safe Drinking Water Act (SDWA)

A statute enacted by the U.S. Congress in 1974. The Act establishes a cooperative program among local, State and Federal agencies to insure safe drinking water for consumers.

Saturated Zone

The zone in a soil profile or geologic formation in which all pore spaces are filled with water.

Saturated Thickness

The height or thickness of the saturated zone.

Screened Interval

That part of a completed water well with openings which allow water to enter the well bore. The screened interval includes the zone completed as an open hole in a competent geologic unit such as limestone or dolomite.

Slope

The inclination of the land surface from the horizontal. The percentage of slope is the vertical distance divided by the horizontal distance, for example, a slope of 20 % is a drop of 20 feet in 100 feet of horizontal distance. Percent land surface slope is an attribute used to determine susceptibility under the ground water intrinsic component. A low percent slope indicates water is more likely to recharge into ground water rather than becoming runoff.

Soil Bulk Density

A ratio of the mass of soil to its total volume (solids and pores together). Mean soil bulk density is an attribute used in determining the susceptibility in the ground water intrinsic component.

Soil Clay Content

Percent of clays in soil. Mean soil clay content is an attribute used to determine susceptibility in the ground water intrinsic component. Water does not move easily through clay deposits, therefore, the higher the percentage of clay, the less likely contaminants will be able move through the aquifer matrix.

Soil Erodibility

A measure of the soil's susceptibility to raindrop impact, runoff and other erosional processes. Soil erodibility is an attribute used in calculating surface water intrinsic susceptibility to contamination. Contaminants may adsorb to soils, where soil erodibility is high, contaminants-adsorbed soils may be transported into receiving waters during rainfall events.

Soil Hydrologic Group (HSG)

A classification of soils based on similarities in runoff potential under similar storm and cover conditions. Soils within the United States are placed into four groups (A, B, C and D) and three dual classes (A/D, B/D, and C/D). Class A soils have a high infiltration rate (rate at which water enters the soil) and high rate of transmission (rate at which water moves in the soil) and therefore a low runoff potential; Class B soils have a moderate infiltration rate and rate of water transmission; Class C soils have a slow infiltration rate and rate of water transmission; Class D soils have a very slow infiltration rate and water transmission and therefore a high runoff potential.

Dual hydrologic groups are given for certain wet soils that can be adequately drained, the first letter applies to the drained condition, the second to the undrained. The mean soil hydrologic group is an attribute in the ground water intrinsic component, soil hydrologic groups were classified using the Natural Resource Conservation Service's Curve Number Method where class placement is based on the minimum annual steady ponded infiltration rate for a bare ground surface.

Soil Total Organic Materials

Percent organic matter (plant and animal residue in various stages of decomposition) contained within soils. Organic matter adsorbs most chemicals, therefore the higher the organic matter of the soil, the less mobile contaminants would be. Mean soil total organic materials is an attribute used in determining susceptibility under the ground water intrinsic component.

Soil Zone

Extends from the land surface to a maximum depth of a meter or two and is the zone that supports plant growth. The porosity and permeability of the soils zone tends to be higher than those of the underlying materials.

Source Water Assessment and Protection (SWAP)

Established in 1997 after the TCEQ's Wellhead Protection and Vulnerability Assessment Programs were merged. SWAP assists local communities in developing drinking water protection programs and assesses susceptibility of the state's public drinking water supply sources.

Spring

A surface water body created by the natural emergence of ground water to the Earth's surface.

Surface Water

Water which remains on the land surface and contributes to lakes, streams and reservoirs.

Susceptibility

The quality or state of being easily affected or influenced. For assessment purposes, susceptibility is defined as the potential for a PWS to withdraw water which has been exposed to a listed contaminant(s) at a concentration that would pose a health concern.

Time of Travel

The distance a molecule of water (and therefore any associated contaminant) could travel within a specified time period or the time a molecule of water would travel within a particular distance. For surface water sources, a 2 hour time of travel is the distance a molecule of water would travel within 2 hours under the average flow conditions of the stream. Ground water capture zones include time of travel zones, each specifying a distance a molecule of water may travel in 2, 5, 10, 20 and 100 years.

Total Reservoir Storage : Mean Annual Runoff Ratio

An attribute used in calculating surface water intrinsic susceptibility to contamination. Contaminant movement in an aqueous environment will be higher when total reservoir storage : mean annual runoff ratios are low since the travel time of the contaminant to the surface water intake would be shorter and natural attenuation rates (biological, chemical or sedimentary) would be lower as well.

Toxic

A substance that is poisonous to an organism.

Transmissivity

A measure of the rate at which water will move through an aquifer. Transmissivity incorporates the hydraulic conductivity of the aquifer, aquifer thickness, water temperature and fluid properties to describe water movement.

Transient Noncommunity Water System

A public water system that is not a community water system and serves at least 25 persons at least 60 days out of the year, yet by its characteristics, does not meet the definition of a nontransient noncommunity water system.

Trihalomethane (THM)

One of a family of organic compounds named as derivatives of methane. THMs are generally the by-product from chlorination of drinking water that contains organic material. The resulting compounds (THMs) are suspected of causing cancer.

Unconfined Aquifer

Where water only partly fills an aquifer, the upper surface of the saturated zone is free to rise and decline. Unconfined aquifers are also referred to as water-table aquifers.

Vadose Zone

The unsaturated zone between the ground surface and the fully saturated zone.

Volatile

Readily vaporizable at a relatively low temperature.

Water Source Code

A unique code that TCEQ uses to distinguish between sources of drinking water. The first letter of the TCEQ source identification number specifies the type of source, the letter "G" indicates a groundwater well while the letter "S" is used to indicate a surface water intake, the following 7 digits are the PWS system identification number, while the last one or two letters of the water source code specifies the order the well or intake came online or was entered into the TCEQ database. Example: G0150018AC.

Water Table

Level of ground water; the upper surface of the zone of saturation of ground water above an impermeable layer of soil or rock (through which water cannot move) as in an unconfined aquifer. This level can be very near the surface of the ground or far below it. Mean seasonal high water table depth is an attribute within the ground water intrinsic component of the SWSA.

Watershed

The land area that drains into a stream. An area of land that contributes runoff to one specific delivery point.

Watershed Slope : Watershed Area Ratio

An attribute used in calculating surface water intrinsic susceptibility to contamination. Contaminant movement will be higher when watershed slope : watershed area ratios are low since the time of travel of a contaminant through a larger watershed with a low slope is longer than a similarly sized watershed with a higher slope. The longer time of travel allows for natural attenuation of the contaminant before reaching the surface water intake.

8. Acronyms

API	Area of Primary Influence
BMP	Best Management Practice
CAS	Chemical Abstracts Service
CCR	Consumer Confidence Report
DEM	Digital Elevation Model
GIS	Geographic Information System
GPM	Gallons Per Minute
HUC	Hydrologic Unit Code
MCL	Maximum Contaminant Level
NPS	Non-Point Source
PAH	Polycyclic Aromatic Hydrocarbons
PDW	Public Drinking Water
PSOC	Potential Source of Contamination
PWS	Public Water Supply
SDWA	Safe Drinking Water Act
SOC	Synthetic Organic Chemicals
SWAP	Source Water Assessment and Protection
SWSA	Source Water Susceptibility Assessment
TAMU	Texas A&M University
TEEX	Texas Engineering Extension Service
TCEQ	Texas Commission on Environmental Quality
TWDB	Texas Water Development Board
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound

Appendix A Contaminant List

List of regulated and unregulated assessed contaminants grouped by contaminant class. TCEQ Chapter 290 Subchapter F rules are cited for each drinking water standard (secondary drinking water standards are italicized). The TCEQ threshold limit is the concentration used within the contaminant occurrence component to determine if a detection of the chemical was found during water quality monitoring activities. The chemical abstract service (CAS) number is a unique identifier for each chemical. Numbers superscripted above contaminants indicate the general uses of each contaminant: 1 Agricultural cropland; 2 Agricultural (livestock, feedlots); 3 Industrial; 4 Domestic Effluent; 5 Pipeline Associated; 6 Transportation; 7 Human density; 8 Water Contaminant; 9 No Longer Produced. Contaminants marked with an asterisk may be generated * as part of the water treatment process, ** within the distribution system, or *** both.

Inorganics: Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
[3,4,7] * ALUMINUM	*0.05* MG/L	§290.113	0.05 MG/L	14903-36-7
[3] ANTIMONY	0.006 MG/L	§290.103(1)	0.003 MG/L	64924-52-3
[3] ARSENIC	0.05 MG/L	§290.103(1)	0.01 MG/L	15584-04-0
[4,7] ** ASBESTOS	7 MF/L		7 MF/L	1332-21-4
[3,5] BARIUM	2 MG/L	§290.103(1)	1 MG/L	16541-35-8
[3] BERYLLIUM	0.004 MG/L	§290.103(1)	0.002 MG/L	14701-08-7
[3] CADMIUM	0.005 MG/L	§290.103(1)	0.0025 MG/L	22537-48-0
[3] CHLORIDE	*300* MG/L	§290.113	150 MG/L	16887-00-6
[3] CHROMIUM	0.1 MG/L	§290.103(1)	0.05 MG/L	11104-59-9
[3,6,7] COPPER	*1* MG/L	§290.120	0.5 MG/L	17493-86-6
[3] CYANIDE	0.2 MG/L	§290.103(1)	0.00001 MG/L	57-12-5
[7] FLUORIDE	*2* MG/L	§290.103(1)	2 MG/L	16984-48-8
[7] HYDROGEN SULFIDE	*0.05* MG/L	§290.113	0.05 MG/L	15035-72-0
[3] ** IRON	*0.3* MG/L	§290.113	0.3 MG/L	15438-31-0
[3,7] ** LEAD		§290.120	0.0075 MG/L	14701-27-0
[3,7] MANGANESE	*0.05* MG/L	§290.113	0.05 MG/L	14333-14-3
[3,7] MERCURY	0.002 MG/L	§290.103(1)	0.001 MG/L	14302-87-5

[1] NITRATE	10 MG/L	§290.103(1)	5 MG/L	14797-55-8
[1,7] NITRATE+NITRITE	10 MG/L	§290.103(1)	5 MG/L	none
[7] NITRITE	1 MG/L	§290.103(1)	0.5 MG/L	14797-65-0
[3,7] SELENIUM	0.05 MG/L	§290.103(1)	0.025 MG/L	7782-49-2
[3,4,7] SILVER	*0.1* MG/L	§290.113	0.05 MG/L	14701-21-4
[3,7] SULFATE	*300* MG/L	§290.113	150 MG/L	14808-79-8
TDS	*1500* MG/L	§290.113	500 MG/L	-9999
[3] THALLIUM	0.002 MG/L	§290.103(1)	0.001 MG/L	7440-28-0
[3,7] *** ZINC	*5* MG/L	§290.113	2.5 MG/L	15176-26-8

Inorganics: Un-Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
ALKALINITY				-9999
BICARBONATE			1000 MG/L	71-52-3
[3] BORON			0.01 MG/L	11113-50-1
[3] BROMIDE			50 MG/L	
[3] CALCIUM			1000 MG/L	14102-48-8
CARBONATE			1000 MG/L	3812-32-6
[3,7] MAGNESIUM			1000 MG/L	14581-92-1
[3] NICKEL		§290.103(1)	0.001 MG/L	14701-22-5
[3] PERCHLORATE			0.001 MG/L	14797-73-0
[3] SODIUM			1000 MG/L	17341-25-2

Radiochemical: Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
GROSS ALPHA	15 PCI/L	§290.110	7.5 PCI/L	-9999
GROSS BETA	4 MREM	§290.110	50 PCI/L	-9999

3,7 RADIUM-226	5 PCI/L	§290.110	2.5 PCI/L	13982-63-3
3,7 RADIUM-228	5 PCI/L	§290.110	2.5 PCI/L	15262-20-1
3 STRONTIUM-90	4 MREM	§290.110	0.5 PCI/L	10098-97-2
3 TRITIUM	4 MREM	§290.110	1 PCI/L	15086-10-9

Radiochemical: Un-Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
3 RADON			0.5 PCI/L	10043-92-2
3 STRONTIUM-89			0.5 PCI/L	14701-18-9
3,7 TOTAL ALPHA EMITTING RADIUM		§290.110	5 PCI/L	
3 URANIUM			0.001 MG/L	none

Volatile Organic Contaminant: Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
1,2,7 1,1,1-TRICHLOROETHANE	0.2 MG/L	§290.103(3)(B)	0.0001 MG/L	71-55-6
1,2,7 1,1,2-TRICHLOROETHANE	0.005 MG/L	§290.103(3)(B)	0.0001 MG/L	79-00-5
1,3 1,1-DICHLOROETHYLENE	0.007 MG/L	§290.103(3)(B)	0.0001 MG/L	75-35-4
1,3,4,7,8 1,2,4-TRICHLOROBENZENE	0.07 MG/L	§290.103(3)(B)	0.0001 MG/L	120-82-1
1,3 1,2-DICHLOROETHANE	0.005 MG/L	§290.103(3)(B)	0.0001 MG/L	107-06-2
3,5 1,2-DICHLOROPROPANE	0.005 MG/L	§290.103(3)(B)	0.0001 MG/L	78-87-5
3,5,6,7 BENZENE	0.005 MG/L	§290.103(3)(B)	0.0001 MG/L	71-43-2
1,5 CARBON TETRACHLORIDE	0.005 MG/L	§290.103(3)(B)	0.0001 MG/L	56-23-5
1,3,7 CHLOROBENZENE (MONOCHLORBENZE			0.0001 MG/L	108-90-7
3 CIS-1,2-DICHLOROETHYLENE	0.07 MG/L	§290.103(3)(B)	0.0001 MG/L	156-59-2
3 DICHLOROMETHANE	0.005 MG/L	§290.103(3)(B)	0.0001 MG/L	75-09-2
3,4,5,7 ETHYLBENZENE	0.7 MG/L	§290.103(3)(B)	0.0001 MG/L	100-41-4
3 MONOCHLOROBENZENE (CHLOROBENZ	0.1 MG/L	§290.103(3)(B)	0.0001 MG/L	108-90-7

3,7 ORTHO-1,2-DICHLOROBENZENE	0.6 MG/L	§290.103(3)(B)	0.0001 MG/L	95-50-1
3,4,7 PARA-1,4-DICHLOROBENZENE	0.075 MG/L	§290.103(3)(B)	0.0001 MG/L	106-46-7
3,7 STYRENE	0.1 MG/L	§290.103(3)(B)	0.0001 MG/L	100-42-5
3,7 TETRACHLOROETHYLENE	0.005 MG/L	§290.103(3)(B)	0.0001 MG/L	127-18-4
3,5,6,7 TOLUENE	1 MG/L	§290.103(3)(B)	0.0001 MG/L	108-88-3
3 TRANS-1,2-DICHLOROETHYLENE	0.1 MG/L	§290.103(3)(B)	0.0001 MG/L	156-60-5
3,7 TRICHLOROETHYLENE	0.005 MG/L	§290.103(3)(B)	0.0001 MG/L	79-01-6
3 VINYL CHLORIDE	0.002 MG/L	§290.103(3)(B)	0.0001 MG/L	75-01-4
3,5,6,7 XYLENES (TOTAL)	10 MG/L	§290.103(3)(B)	0.0001 MG/L	none

Volatile Organic Contaminant: Un-Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
4,7 1,1,1,2-TETRACHLOROETHANE			0.0001 MG/L	630-20-6
4,7 1,1,2,2-TETRACHLOROETHANE			0.0001 MG/L	79-34-5
3 1,1-DICHLOROETHANE			0.0001 MG/L	75-34-3
2,3 1,1-DICHLOROPROPENE			0.0001 MG/L	563-58-6
3 1,2,3-TRICHLOROBENZENE			0.0001 MG/L	87-61-6
3 1,2,3-TRICHLOROPROPANE			0.0001 MG/L	96-18-4
3,4,5 1,2,4-TRIMETHYLBENZENE			0.0001 MG/L	95-63-6
3 1,2-DIPHENYLHYDRAZINE			0.0001 MG/L	122-66-7
3,4 1,3,5-TRIMETHYLBENZENE			0.0001 MG/L	108-67-8
3,4,7 1,3-DICHLOROBENZENE			0.0001 MG/L	541-73-1
1 1,3-DICHLOROPROPANE			0.0001 MG/L	142-28-9
1,3 1,3-DICHLOROPROPENE			0.0001 MG/L	542-75-6
2,2-DICHLOROPROPANE			0.0001 MG/L	594-20-7
3 2,4,6-TRICHLOROPHENOL			0.02 MG/L	88-06-2

[1,3] 2,4-DICHLOROPHENOL	0.02	MG/L	120-83-2
[1] 2,4-DINITROPHENOL	0.02	MG/L	51-28-5
[3] 2,4-DINITROTOLUENE	0.005	MG/L	121-14-2
[3] 2,6-DINITROTOLUENE	0.005	MG/L	606-20-2
[3] 2-CHLOROTOLUENE	0.0001	MG/L	95-49-8
[3] 2-HEXANONE	0.0001	MG/L	591-78-6
[3,4] 2-METHYLPHENOL	0.005	MG/L	95-48-7
[3] 4-CHLOROTOLUENE	0.0001	MG/L	106-43-4
[3,5,7] 4-ISOPROPYLTOLUENE	0.0001	MG/L	99-87-6
[3,4,7] 4-METHYL-2-PENTANONE (MIBK)	0.0001	MG/L	108-10-1
[1] ACETOCHLOR	0.00001	MG/L	34256-82-1
[3,4,7] ACETONE	0.7	MG/L	67-64-1
[3,4] ACRYLONITRILE	0.0001	MG/L	107-13-1
BROMOBENZENE	0.0001	MG/L	108-86-1
[1,3,4,7] CARBON DISULFIDE	0.0001	MG/L	75-15-0
[3,4,7] CHLOROETHANE	0.0001	MG/L	75-00-3
[3] CHLOROMETHANE	0.0001	MG/L	74-87-3
[1,3] CIS-1,3-DICHLOROPROPENE	0.0001	MG/L	10061-01-5
[3,7] DIBROMOMETHANE	0.0001	MG/L	74-95-3
[3] DICHLORODIFLUOROMETHANE	0.0001	MG/L	75-71-8
[3] ETHYL METHACRYLATE	0.0001	MG/L	97-63-2
[3,7] HEXACHLOROBUTADIENE	0.0001	MG/L	87-68-3
[3] ISOPROPYLBENZENE	0.0001	MG/L	98-82-8
[3,4,5,6,7] M + P XYLENE	0.0001	MG/L	106-42-3
[3,7] METHYL ETHYL KETONE	0.0001	MG/L	78-93-3

[1] METHYL IODIDE (IODOMETHANE)			0.0001 MG/L	74-88-4
[3] METHYL METHACRYLATE			0.0001 MG/L	80-62-6
[3,5,7] METHYL-T-BUTYL ETHER			0.0001 MG/L	1634-04-4
[3,5,7] M-XYLENE			0.0001 MG/L	108-38-3
[3,5,6,7] NAPHTHALENE			0.0001 MG/L	91-20-3
N-BUTYLBENZENE			0.0001 MG/L	104-51-8
[3,5,7] NITROBENZENE			0.0001 MG/L	98-95-3
[5] N-PROPYLBENZENE			0.0001 MG/L	103-65-1
[3] ORGANOTINS			0 MG/L	
[3,5,6,7] O-XYLENE		§290.103(3)(B)	0.0001 MG/L	95-47-6
[3,5,6,7] P-XYLENE		§290.103(3)(B)	0.0001 MG/L	106-42-3
[3,5,6,7] S-BUTYLBENZENE			0.0001 MG/L	135-98-8
[5] T-BUTYLBENZENE			0.0001 MG/L	98-06-6
[3] TETRAHYDROFURAN			0.0001 MG/L	109-99-9
[1,3] TRANS-1,3-DICHLOROPROPENE			0.0001 MG/L	10061-02-6
[3,7] TRICHLOROFLUOROMETHANE			0.0001 MG/L	75-69-4
[3] VINYL ACETATE			0.0001 MG/L	108-05-4

Synthetic Organic Contaminant: Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
[6] 2,3,7,8-TCDD	3E-08 MG/L	§290.103(3)(A)	0.0001 MG/L	1746-01-6
[1,8] 2,4,5-TP	0.05 MG/L	§290.103(3)(A)	0.00005 MG/L	93-72-1
[1,6] 2,4-D	0.07 MG/L	§290.103(3)(A)	0.00015 MG/L	94-75-7
[1] ALACHLOR	0.002 MG/L	§290.103(3)(A)	0.00001 MG/L	15972-60-8
[1] ATRAZINE	0.003 MG/L	§290.103(3)(A)	0.00001 MG/L	1912-24-9
[3,6] BENZO(A)PYRENE	0.0002 MG/L	§290.103(3)(A)	0.0002 MG/L	50-32-8

[1] CARBOFURAN	0.04	MG/L	§290.103(3)(A)	0.00001 MG/L	1563-66-2
[1,7] CHLORDANE	0.002	MG/L	§290.103(3)(A)	0.0001 MG/L	57-74-9
[1,7] DALAPON	0.2	MG/L	§290.103(3)(A)	0.00005 MG/L	75-99-0
[3] DI-(2-ETHYLHEXYL)ADIPATE	0.4	MG/L	§290.103(3)(A)	0.005 MG/L	103-23-1
[3] DI-(2-ETHYLHEXYL)PHTHALATE	0.006	MG/L	§290.103(3)(A)	0.005 MG/L	117-81-7
[1] DIBROMOCHLOROPROPANE	0.0002	MG/L	§290.103(3)(A)	0.0001 MG/L	67708-83-2
[1] DINOSEB	0.007	MG/L	§290.103(3)(A)	0.00005 MG/L	88-85-7
[1] DIQUAT	0.02		§290.103(3)(A)	0.00005 MG/L	2764-72-9
[1] ENDOTHALL	0.1	MG/L	§290.103(3)(A)	0.00005 MG/L	145-73-3
[1] ENDRIN	0.002	MG/L	§290.103(3)(A)	0.00005 MG/L	72-20-8
[5,6,7] ETHYLENE DIBROMIDE	0.00005	MG/L	§290.103(3)(A)	0.00005 MG/L	106-93-4
[1,7] GLYPHOSATE	0.7	MG/L	§290.103(3)(A)	0.00005 MG/L	1071-83-6
[7] HEPTACHLOR	0.0004	MG/L	§290.103(3)(A)	0.0001 MG/L	76-44-8
[7] HEPTACHLOR EPOXIDE	0.0002	MG/L	§290.103(3)(A)	0.0001 MG/L	1024-57-3
[1,3,9] HEXACHLOROBENZENE	0.001	MG/L	§290.103(3)(A)	0.001 MG/L	118-74-1
[1,3] HEXACHLOROCYCLOPENTADIENE	0.05	MG/L	§290.103(3)(A)	0.005 MG/L	77-47-4
[1,7] LINDANE	0.0002	MG/L	§290.103(3)(A)	0.00001 MG/L	58-89-9
[1] METHOXYCHLOR	0.04	MG/L	§290.103(3)(A)	0.00005 MG/L	72-43-5
[1] OXAMYL	0.2	MG/L	§290.103(3)(A)	0.00005 MG/L	23135-22-0
[6,7] PCBs	0.0005	MG/L	§290.103(3)(A)	0.0001 MG/L	53469-21-9
[6,7] PENTACHLOROPHENOL	0.001	MG/L	§290.103(3)(A)	0.03 MG/L	87-86-5
[1] PICLORAM	0.5	MG/L	§290.103(3)(A)	0.00005 MG/L	1918-02-1
[1,2] SIMAZINE	0.004	MG/L		0.00001 MG/L	122-34-9
[1,9] TOXAPHENE	0.003	MG/L	§290.103(3)(A)	0.002 MG/L	8001-35-2

Synthetic Organic Contaminant: Un-Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
[1] 2,4,5-T			0.00005 MG/L	93-76-5
3-HYDROXYCARBOFURAN			0.00005 MG/L	16655-82-6
[1,3,5] ACENAPHTHENE			0.005 MG/L	83-32-9
[3,6] ACENAPHTHYLENE			0.005 MG/L	208-96-8
[1] ALDICARB		§290.103(3)(A)	0.00055 MG/L	116-06-3
[1] ALDICARB SULFONE		§290.103(3)(A)	0.0001 MG/L	1646-88-4
[1] ALDICARB SULFOXIDE		§290.103(3)(A)	0.00005 MG/L	1646-87-3
[1] ALDRIN			0.0001 MG/L	309-00-2
[3] ANTHRACENE			0.005 MG/L	120-12-7
AROCLOR (PCB)			0.00005 MG/L	53469-21-9
[1] BENTAZON			0.00005 MG/L	25057-89-0
[7] BENZO[A]ANTHRACENE			0.01 MG/L	56-55-3
[3] BENZO[B]FLUORANTHENE			0.01 MG/L	205-99-2
[3,5,6,7] BENZO[G,H,I]PERYLENE			0.01 MG/L	191-24-2
[7] BENZO[K]FLUORANTHENE			0.01 MG/L	207-08-9
[7] BROMACIL			0.00005 MG/L	314-40-9
[1] BUTACHLOR			0.00005 MG/L	23184-66-9
[3] BUTYL BENZYL PHTHALATE	*0*		0.005 MG/L	85-68-7
[1,2] CARBARYL			0.00001 MG/L	63-25-2
[1,7] CHLORDANE (ALPHA-CHLORDANE)		§290.103(3)(A)	0.0001 MG/L	5103-71-9
[1,7] CHLORDANE (GAMMA-CHLORDANE)		§290.103(3)(A)	0.0001 MG/L	12789-03-6
[1,7] CHLORDANE (TRANS-NONACHLOR)		§290.103(3)(A)	0.0001 MG/L	39765-80-5
[3,7] CHRYSENE			0.0001 MG/L	218-01-9

[1,7] CYANAZINE	0.00001	MG/L	21725-46-2
DCPA DI-ACID DEGRADATE	0.00003	MG/L	2136-79-0
DCPA MONO-ACID DEGRADATE	0.00003	MG/L	887-54-7
[1,9] DDE	0.00001	MG/L	72-55-9
[1] DIAZINON	0.00001	MG/L	333-41-5
[5,6] DIBENZ[A,H]ANTHRACENE	0.01	MG/L	53-70-3
[1] DICAMBA	0.00005	MG/L	1918-00-9
[1] DIELDRIN	0.00001	MG/L	60-57-1
[3,7] DIETHYL PHTHALATE	0.005	MG/L	84-66-2
[3] DIMETHYL PHTHALATE	0.005	MG/L	131-11-3
[3] DI-N-BUTYL PHTHALATE	0.005	MG/L	84-74-2
[1] DISULFOTON	0.00001	MG/L	298-04-4
[1] DIURON	0.00005	MG/L	330-54-1
[1] EPTC	0.00001	MG/L	759-94-4
[3] FLUORENE	0.0001	MG/L	86-73-7
[1,4,7] FONOFOS	0.00001	MG/L	944-22-9
[5,7] INDENO[1,2,3,CD]PYRENE	0.01	MG/L	193-39-5
[1] LAMBAST	0.00005	MG/L	845-52-3
[1] LINURON	0.00001	MG/L	330-55-2
[1] METHIOCARB	0.00005	MG/L	2032-65-7
[1] METHOMYL	0.00005	MG/L	16752-77-5
[1] METOLACHLOR	0.00001	MG/L	51218-45-2
[1] METRIBUZIN	0.00001	MG/L	21087-64-9
[1] MOLINATE	0.00001	MG/L	2212-67-1
[3,5] PHENANTHRENE	0.005	MG/L	85-01-8

6,7 PROMETON	0.00001 MG/L		1610-18-0
1 PROPACHLOR	0.00001 MG/L		1918-16-7
1 PROPAZINE	0.00001 MG/L		139-40-2
3 PYRENE	0.0001 MG/L		129-00-0
3 RDX	0.0001 MG/L		121-82-4
1,7 TERBACIL	0.00001 MG/L		5902-51-2
1 TERBUFOS	0.00001 MG/L		13071-79-9
1 TRIAZINES	0 MG/L		
1,7 TRIFLURALIN	0.00001 MG/L		1582-09-8

Physical Parameter: Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
pH	7 PH	§290.113		-9999

Physical Parameter: Un-Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
HARDNESS				-9999
P-ALKALINITY				
SPECIFIC CONDUCTANCE				-9999

Disinfection By-Product: Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
7 TOTAL TRIHALOMETHANE	0.08 MG/L	§290.116	0.08 MG/L	-9999

Disinfection By-Product: Un-Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
7 * BROMOCHLOROMETHANE			0.08 MG/L	74-97-5
4,7 * BROMODICHLOROMETHANE		§290.116	0.08 MG/L	75-27-4
3,4,7 * BROMOFORM		§290.116	0.08 MG/L	75-25-2

1,7 * BROMOMETHANE			0.08 MG/L	74-83-9
3 * CHLOROFORM		§290.116	0.08 MG/L	67-66-3
4,7 DIBROMOCHLOROMETHANE		§290.116	0.08 MG/L	124-48-1

Microbial Organism: Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
1,7 TOTAL COLIFORM				

Microbial Organism: Un-Regulated

Contaminant	Drinking Water Standard	PWS Rule	TCEQ Threshold	CAS Number
2 CRYPTOSPORIDIUM PARVUM			1 OOCIST	
2 ESCHERICHIA COLI				
2 FECAL VIRUSES				
4 GIARDIA LAMBLIA				

Appendix B Description of the Public Drinking Water System and Water Supply Sources

Brief description of the Public Water Supply (PWS) system and its water sources organized by TCEQ's water source identification number. Description of water source includes the system's name for the source, the water source's operational status, TCEQ entry point number and for ground water wells, selected well properties and the aquifer from which the well pumps.

0470015 UPPER LEON RIVER MWD

PWS System Information

Address: PO BOX 67
COMANCHE TX 7644267

Telephone: (254) 879-2258 County: COMANCHE

PWS Type: COMMUNITY Population Served 13300

Total Production: 6.732 million gallons per da Number Connections 4895

Ground Water Sources

Water Source ID	PWS System Name for Source

Surface Water Sources

Water Source ID	PWS System Name for Source
S0470015A	LAKE PROCTOR 1 - 4

Operational Status	Entry Point	Surface Waterbody Name	GPM
OPERATIONAL	001	PROCTOR LAKE	9811

Appendix C PWS System Susceptibility Summary: Contaminants with HIGH Susceptibility

Each water source receives an attribute rating for each contaminant under each of the six components (see raw scores for waters sources under Appendices E and F). For systems with multiple sources, component attribute ratings are averaged and a contaminant susceptibility rating is calculated for an overall system susceptibility (see Sec. 2.7). Listed below are contaminants for which the system has received a high susceptibility rating as well as their component susceptibility ratings. If this page is empty then there are no susceptibility issues for this category.

0470015 UPPER LEON RIVER MWD

Inorganics: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
ALUMINUM	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
ARSENIC	-----	LOW	LOW	-----	HIGH	HIGH	HIGH
BARIUM	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH
BERYLLIUM	-----	LOW	MEDIUM	-----	HIGH	HIGH	HIGH
CADMIUM	-----	LOW	MEDIUM	-----	HIGH	HIGH	HIGH
CHLORIDE	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
CHROMIUM	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH
COPPER	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH
IRON	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
LEAD	-----	LOW	MEDIUM	-----	HIGH	HIGH	HIGH
MANGANESE	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
MERCURY	-----	LOW	MEDIUM	-----	HIGH	HIGH	HIGH
SELENIUM	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
SILVER	-----	LOW	HIGH	-----	LOW	HIGH	HIGH
SULFATE	-----	LOW	LOW	-----	HIGH	HIGH	HIGH
TDS	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
ZINC	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH

Inorganics: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
NICKEL	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH

Volatile Organic Contaminant: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
BENZENE	-----	LOW	LOW	-----	HIGH	HIGH	HIGH
CIS-1,2-DICHLOROETHYLENE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DICHLOROMETHANE	-----	LOW	LOW	-----	HIGH	HIGH	HIGH
ETHYLBENZENE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
TOLUENE	-----	LOW	LOW	-----	HIGH	HIGH	HIGH
VINYL CHLORIDE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
XYLENES (TOTAL)	-----	LOW	LOW	-----	LOW	HIGH	HIGH

Volatile Organic Contaminant: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
ACETOCHLOR	-----	LOW	LOW	-----	LOW	HIGH	HIGH
CARBON DISULFIDE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
M + P XYLENE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METHYL ETHYL KETONE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METHYL-T-BUTYL ETHER	-----	LOW	HIGH	-----	LOW	HIGH	HIGH

Synthetic Organic Contaminant: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
2,4,5-TP	-----	LOW	LOW	-----	LOW	HIGH	HIGH
2,4-D	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH

ALACHLOR	-----	LOW	LOW	-----	LOW	HIGH	HIGH
ATRAZINE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
CARBOFURAN	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DINOSEB	-----	LOW	LOW	-----	LOW	HIGH	HIGH
LINDANE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
OXAMYL	-----	LOW	LOW	-----	LOW	HIGH	HIGH
SIMAZINE	-----	LOW	LOW	-----	LOW	HIGH	HIGH

Synthetic Organic Contaminant: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
2,4,5-T	-----	LOW	LOW	-----	LOW	HIGH	HIGH
3-HYDROXYCARBOFURAN	-----	LOW	LOW	-----	LOW	HIGH	HIGH
ALDICARB	-----	LOW	LOW	-----	LOW	HIGH	HIGH
ALDICARB SULFONE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
ALDICARB SULFOXIDE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
BENTAZON	-----	LOW	LOW	-----	LOW	HIGH	HIGH
BROMACIL	-----	LOW	LOW	-----	LOW	HIGH	HIGH
CARBARYL	-----	LOW	LOW	-----	LOW	HIGH	HIGH
CYANAZINE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DDE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DIAZINON	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DICAMBA	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH
DIELDRIN	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DI-N-BUTYL PHTHALATE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DISULFOTON	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DIURON	-----	LOW	HIGH	-----	LOW	HIGH	HIGH
EPTC	-----	LOW	LOW	-----	LOW	HIGH	HIGH
FONOFOS	-----	LOW	LOW	-----	LOW	HIGH	HIGH

LINURON	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METHIOCARB	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METHOMYL	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METOLACHLOR	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METRIBUZIN	-----	LOW	LOW	-----	LOW	HIGH	HIGH
MOLINATE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
PROMETON	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH
PROPACHLOR	-----	LOW	LOW	-----	LOW	HIGH	HIGH
TERBACIL	-----	LOW	LOW	-----	LOW	HIGH	HIGH
TERBUFOS	-----	LOW	LOW	-----	LOW	HIGH	HIGH
TRIFLURALIN	-----	LOW	LOW	-----	LOW	HIGH	HIGH

Appendix D PWS System Susceptibility Summary: Contaminants with MEDIUM Susceptibility

Each water source receives an attribute rating for each contaminant under each of the six components (see raw scores for waters sources under Appendices E and F). For systems with multiple sources, component attribute ratings are averaged and a contaminant susceptibility rating is calculated for an overall system susceptibility (see Sec. 2.7). Listed below are contaminants for which the system has received a medium susceptibility rating as well as their component susceptibility ratings. If this page is empty then there are no susceptibility issues for this category.

0470015 UPPER LEON RIVER MWD

Inorganics: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
ANTIMONY	-----	LOW	MEDIUM	-----	HIGH	-----	MEDIUM
FLUORIDE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
NITRATE	-----	LOW	MEDIUM	-----	HIGH	-----	MEDIUM
NITRATE+NITRITE	-----	LOW	MEDIUM	-----	HIGH	-----	MEDIUM
NITRITE	-----	LOW	MEDIUM	-----	HIGH	-----	MEDIUM

Inorganics: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
BORON	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
CALCIUM	-----	LOW	HIGH	-----	HIGH	-----	MEDIUM
MAGNESIUM	-----	LOW	HIGH	-----	LOW	-----	MEDIUM
SODIUM	-----	LOW	HIGH	-----	HIGH	-----	MEDIUM

Volatile Organic Contaminant: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
1,1,1-TRICHLOROETHANE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
TRICHLOROETHYLENE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Volatile Organic Contaminant: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
2,4,6-TRICHLOROPHENOL	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
NAPHTHALENE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Synthetic Organic Contaminant: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
PCBs	-----	LOW	MEDIUM	-----	LOW	-----	MEDIUM

Synthetic Organic Contaminant: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
ALDRIN	-----	LOW	MEDIUM	-----	LOW	-----	MEDIUM
DIETHYL PHTHALATE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
DIMETHYL PHTHALATE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Disinfection By-Product: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
BROMODICHLOROMETHANE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
BROMOFORM	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
CHLOROFORM	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Microbial Organism: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY
TOTAL COLIFORM	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Microbial Organism: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	Area Primary Influence	Contaminant Occurrence	SUMMARY

CRYPTOSPORIDIUM PARVUM	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
ESCHERICHIA COLI	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
FECAL VIRUSES	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
GIARDIA LAMBLIA	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Appendix E High Susceptibility Contaminants by Source

Each water source receives component attribute ratings and a susceptibility summary determination for contaminants. The overall susceptibility rating for the system averages the individual component scores, producing a susceptibility determination for contaminants for the system as a whole. Listed below are component attribute rating scores and summary susceptibility determinations for each water source for those contaminants for which the water source has received a high susceptibility ranking. If this page is empty then there are no susceptibility issues for this category.

0470015 UPPER LEON RIVER MWD

S0470015A

Inorganics: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
ALUMINUM	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
ARSENIC	-----	LOW	LOW	-----	HIGH	HIGH	HIGH
BARIUM	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH
BERYLLIUM	-----	LOW	MEDIUM	-----	HIGH	HIGH	HIGH
CADMIUM	-----	LOW	MEDIUM	-----	HIGH	HIGH	HIGH
CHLORIDE	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
CHROMIUM	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH
COPPER	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH
IRON	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
LEAD	-----	LOW	MEDIUM	-----	HIGH	HIGH	HIGH
MANGANESE	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
MERCURY	-----	LOW	MEDIUM	-----	HIGH	HIGH	HIGH
SELENIUM	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
SILVER	-----	LOW	HIGH	-----	LOW	HIGH	HIGH
SULFATE	-----	LOW	LOW	-----	HIGH	HIGH	HIGH
TDS	-----	LOW	HIGH	-----	HIGH	HIGH	HIGH
ZINC	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH

Inorganics: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
NICKEL	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH

Volatile Organic Contaminant: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
BENZENE	-----	LOW	LOW	-----	HIGH	HIGH	HIGH
CIS-1,2-DICHLOROETHYLENE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DICHLOROMETHANE	-----	LOW	LOW	-----	HIGH	HIGH	HIGH
ETHYLBENZENE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
TOLUENE	-----	LOW	LOW	-----	HIGH	HIGH	HIGH
VINYL CHLORIDE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
XYLENES (TOTAL)	-----	LOW	LOW	-----	LOW	HIGH	HIGH

Volatile Organic Contaminant: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
ACETOCHLOR	-----	LOW	LOW	-----	LOW	HIGH	HIGH
CARBON DISULFIDE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
M + P XYLENE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METHYL ETHYL KETONE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METHYL-T-BUTYL ETHER	-----	LOW	HIGH	-----	LOW	HIGH	HIGH

Synthetic Organic Contaminant: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
2,4,5-TP	-----	LOW	LOW	-----	LOW	HIGH	HIGH
2,4-D	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH
ALACHLOR	-----	LOW	LOW	-----	LOW	HIGH	HIGH
ATRAZINE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
CARBOFURAN	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DINOSEB	-----	LOW	LOW	-----	LOW	HIGH	HIGH

LINDANE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
OXAMYL	-----	LOW	LOW	-----	LOW	HIGH	HIGH
SIMAZINE	-----	LOW	LOW	-----	LOW	HIGH	HIGH

Synthetic Organic Contaminant: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
2,4,5-T	-----	LOW	LOW	-----	LOW	HIGH	HIGH
3-HYDROXYCARBOFURAN	-----	LOW	LOW	-----	LOW	HIGH	HIGH
ALDICARB	-----	LOW	LOW	-----	LOW	HIGH	HIGH
ALDICARB SULFONE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
ALDICARB SULFOXIDE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
BENTAZON	-----	LOW	LOW	-----	LOW	HIGH	HIGH
BROMACIL	-----	LOW	LOW	-----	LOW	HIGH	HIGH
CARBARYL	-----	LOW	LOW	-----	LOW	HIGH	HIGH
CYANAZINE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DDE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DIAZINON	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DICAMBA	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH
DIELDRIN	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DI-N-BUTYL PHTHALATE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DISULFOTON	-----	LOW	LOW	-----	LOW	HIGH	HIGH
DIURON	-----	LOW	HIGH	-----	LOW	HIGH	HIGH
EPTC	-----	LOW	LOW	-----	LOW	HIGH	HIGH
FONOFOS	-----	LOW	LOW	-----	LOW	HIGH	HIGH
LINURON	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METHIOCARB	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METHOMYL	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METOLACHLOR	-----	LOW	LOW	-----	LOW	HIGH	HIGH
METRIBUZIN	-----	LOW	LOW	-----	LOW	HIGH	HIGH
MOLINATE	-----	LOW	LOW	-----	LOW	HIGH	HIGH
PROMETON	-----	LOW	MEDIUM	-----	LOW	HIGH	HIGH
PROPACHLOR	-----	LOW	LOW	-----	LOW	HIGH	HIGH
TERBACIL	-----	LOW	LOW	-----	LOW	HIGH	HIGH

TERBUFOS	-----	LOW	LOW	-----	LOW	HIGH	HIGH
TRIFLURALIN	-----	LOW	LOW	-----	LOW	HIGH	HIGH

Appendix F Medium Susceptibility Contaminants by Source

Each water source receives component attribute ratings and a susceptibility summary determination for contaminants. The overall susceptibility rating for the system averages the individual component scores, producing a susceptibility determination for contaminants for the system as a whole. Listed below are component attribute rating scores and summary susceptibility determinations for each water source for those contaminants for which the water source has received a medium susceptibility ranking. If this page is empty then there are no susceptibility issues for this category.

0470015 UPPER LEON RIVER MWD

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Inorganics: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
ANTIMONY	-----	LOW	MEDIUM	-----	HIGH	-----	MEDIUM
FLUORIDE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
NITRATE	-----	LOW	MEDIUM	-----	HIGH	-----	MEDIUM
NITRATE+NITRITE	-----	LOW	MEDIUM	-----	HIGH	-----	MEDIUM
NITRITE	-----	LOW	MEDIUM	-----	HIGH	-----	MEDIUM

Inorganics: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
BORON	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
CALCIUM	-----	LOW	HIGH	-----	HIGH	-----	MEDIUM
MAGNESIUM	-----	LOW	HIGH	-----	LOW	-----	MEDIUM
SODIUM	-----	LOW	HIGH	-----	HIGH	-----	MEDIUM

Volatile Organic Contaminant: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY

1,1,1-TRICHLOROETHANE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
TRICHLOROETHYLENE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Volatile Organic Contaminant: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
2,4,6-TRICHLOROPHENOL	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
NAPHTHALENE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Synthetic Organic Contaminant: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
PCBs	-----	LOW	MEDIUM	-----	LOW	-----	MEDIUM

Synthetic Organic Contaminant: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
ALDRIN	-----	LOW	MEDIUM	-----	LOW	-----	MEDIUM
DIETHYL PHTHALATE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
DIMETHYL PHTHALATE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Disinfection By-Product: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
BROMODICHLOROMETHANE	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
BROMOFORM	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
CHLOROFORM	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Microbial Organism: Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY
TOTAL COLIFORM	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Microbial Organism: Un-Regulated

Contaminant Name	Structural Integrity	Aquifer \ Watershed Properties	Nonpoint Source	Point Source	API	Contaminant Occurrence	SUMMARY

CRYPTOSPORIDIUM PARVUM	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
ESCHERICHIA COLI	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
FECAL VIRUSES	-----	LOW	LOW	-----	HIGH	-----	MEDIUM
GIARDIA LAMBLIA	-----	LOW	LOW	-----	HIGH	-----	MEDIUM

Appendix G Counts of Potential Sources of Contamination by Source

Contaminant susceptibility is based on the presence of potential sources of contamination (PSOCs) within the assessed area. For water wells, the PSOCs are located within times of travel which range from 2 to 100 years while PSOCs located within surface water assessment areas may be located within the area of primary influence (API) or the contributing watershed. Listed below are the number of PSOCs located within the various assessment zones for each water source grouped by PSOC type and subtype (refer to Table 2.2 for brief descriptions of PSOC types). If this page is empty then there are no known psocs intersecting the contributing areas.

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S0470015A

BUSINESS

AUTO PARTS BUSINESS (NEW, USED)

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	1

AUTO REPAIR, SALES, SALVAGE, TOWING

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	1

DRY CLEANER

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	1

PESTICIDE, FERTILIZER MFG, SALE, APPLICATION

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	2

PETROLEUM STORAGE TANK

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	9

CEMETERY

CEMETERY

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	2

NATURAL RESOURCE PRODUCTION

MINED LAND: ACTIVE OR ABANDONED

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	1

TRANSPORTATION

BOAT RAMP

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	5

WASTE

MUNICIPAL SOLID WASTE - ABANDONED

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	2

SITE DISCOVERY - TNRCC

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	3

VOLUNTARY CLEANUP - TNRCC

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	1

WASTE REGISTRATION - TNRCC

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	4

WASTEWATER

AGRICULTURAL WASTEWATER OUTFALL

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	1

MUNICIPAL WASTEWATER OUTFALL

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	1

WASTEWATER

Time of Travel in Years (Capture Zones)	Number of PSOC sites
n/a	1

Appendix H Map Legend and Topographic Map Symbology

See Table 2.2 for examples of PSOC subtypes. Topographic map symbology included in this appendix was modified for clarity after the USGS publication: "Topographic Map Symbols". Information on how to interpret a topographic map may be found at http://mac.usgs.gov/mac/isb/pubs/booklets/symbols/reading.html.

Map Legend:

- Ground Water Well
- Surface Water Intake

Surface Water

- Watershed Boundary
- Truncated Watershed Boundary
- Area of Primary Influence (API)

Ground Water Capture Zone Travel Times

Years

- 50 to 100
- 20 to 50
- 10 to 20
- 5 to 10
- 2 to 5
- 0 to 2

PSOC Type

- Golf Course
- Radiochemical Site
- Grain Elevator
- Tire Sales, Repair Business
- Nuclear Power Plant
- Inorganic Chemical Industry
- New or Used Oil Site
- Organic Chemical Industry
- Metal Plating Industry
- Wood Preserving
- Paint Shop
- Battery Mfg., Sales
- Pesticide Mfg., Sales, Application
- Boat Storage
- Pesticide, Fertilizer Mfg., Sales Application
- Petroleum Storage Tank
- Military Armory
- Photo Process Business
- Sugar Refining
- Plastic Mfg., Sales
- Pulp or Paper Mill
- Auto Parts (New or Used)
- Auto Repair, Sales, Salvage
- Cotton Gin
- Dry Cleaner
- Fertilzer Mfg., Sales, Application
- Cemetery
- Chemical Storage
- Drum, Small Containers, Bags
- Chemical Mixing Site

- Oil/Gas Production Tanks
- Petroleum Chemical Industry
- Fireworks (Mfg/Retail)
- Transformer
- Class I Injection Well
- Class II Injection Well
- Class III Inj. Well (Brine)
- Class III Inj. Well (Sodium Sulphate)
- Class III Inj. Well (Sulfur)
- Class III Inj. Well (Uranium)
- Class V Injection Well
  - Untreated Sewage
  - Agricultural Drainage
  - Cesspool
  - Storm Drainage
  - Septic Undifferentiated
  - Septic Drainfield
  - Auto Repair Floor Drain
- Gun Range
- Gun Range (Public/Private)
- Gun Range (Military)
- Water Well
- Mined Land: Active/Abandoned
- Natural Resource Production
- Oil/Gas Well - Plugged
- Oil/Gas Well - Production
- Oil/Gas Well - Underground Storage
- Septic System
- Muni. Wastewater Outfall
- Treatment Plant
- Agri. Wastewater Outfall
- Priv. Wastewater Outfall
- Cesspool
- Wastewater
- Holding Pond
- Holding Tank
- Ind. Wastewater Outfall
- Land Application Sludge
- Lift Station
- Pipeline
- Airport
- Boat Ramp
- Heliport
- Landing Strip
- Marina
- Military Air Base
- Cattle Dipping Vat
- Livestock/Animal Pens
- Site Discovery - TCEQ
- Waste
- Groundwater Contamination
- Salt Water Dispossal Pit
- Superfund - TCEQ
- Confined Animal Feeding Operation
- Corrective Action - TCEQ
- Waste Transfer Station
- Domestic Waste or Burn Pile
- Voluntary Cleanup - TCEQ
- Industrial Hazardous Waste TSD - TCEQ
- Waste Registration - TCEQ
- Municipal Solid Waste - Abandoned - TCEQ
- Oilfield Sludge Disposal
- Municipal Solid Waste - Active - TCEQ
- Perchlorate Site

Pipelines

- Anhydrous Ammonia
- Carbon Dioxide
- Crude Oil
- Empty
- Hydrogen Gas
- Highly Volatile Liquids
- Liquid Petroleum Gas
- Natural Gas
- Natural Gas Liquids
- Product - Gasoline, Diesel, Jet Fuel

Topographic Map Symbology:

CONTROL DATA AND MONUMENTS

Aerial photograph roll and frame number* 3-20

Horizontal control

- Third order or better, permanent mark — Neace
- With third order or better elevation — BM 45.1
- Checked spot elevation — 19.5
- Coincident with section corner — Cactus
- Unmonumented*

Vertical control

- Third order or better, with tablet — BM 16.3
- Third order or better, recoverable mark — 120.0
- Bench mark at found section corner — BM 16.6
- Spot elevation — 5.3

Boundary monument

- With tablet — BM 21.6
- Without tablet — 171.3
- With number and elevation — 67 301.1

U.S. mineral or location monument

CONTOURS

Topographic

- Intermediate
- Index
- Supplementary
- Depression
- Cut; fill

Bathymetric

- Intermediate
- Index
- Primary
- Index Primary
- Supplementary

BOUNDARIES

- National
- State or territorial
- County or equivalent
- Civil township or equivalent
- Incorporated city or equivalent
- Park, reservation, or monument
- Small park

LAND SURVEY SYSTEMS

U.S. Public Land Survey System

- Township or range line
- Location doubtful
- Section line
- Location doubtful
- Found section corner; found closing corner
- Witness corner; meander corner — WC, MC

Other land surveys

- Township or range line
- Section line
- Land grant or mining claim; monument
- Fence line

SURFACE FEATURES

- Levee
- Sand or mud area, dunes, or shifting sand — Sand
- Intricate surface area — Strip Mine
- Gravel beach or glacial moraine — Gravel
- Tailings pond — Tailings Pond

MINES AND CAVES

- Quarry or open pit mine
- Gravel, sand, clay, or borrow pit
- Mine tunnel or cave entrance
- Prospect; mine shaft
- Mine dump — Mine dump
- Tailings — Tailings

VEGETATION

- Woods
- Scrub
- Orchard
- Vineyard
- Mangrove — Mangrove

MARINE SHORELINE

Topographic maps

- Approximate mean high water
- Indefinite or unsurveyed

Topographic-bathymetric maps

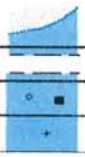
- Mean high water
- Apparent (edge of vegetation)

COASTAL FEATURES

- Foreshore flat
- Rock or coral reef
- Rock bare or awash
- Group of rocks bare or awash
- Exposed wreck
- Depth curve; sounding
- Breakwater, pier, jetty, or wharf
- Seawall

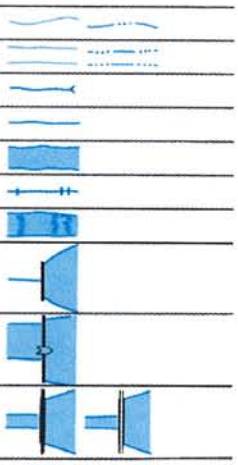
BATHYMETRIC FEATURES

- Area exposed at mean low tide; sounding datum
- Channel
- Offshore oil or gas: well; platform
- Sunken rock

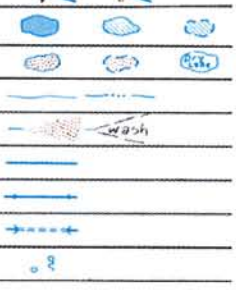


RIVERS, LAKES, AND CANALS

- Intermittent stream
- Intermittent river
- Disappearing stream
- Perennial stream
- Perennial river
- Small falls; small rapids
- Large falls; large rapids
- Masonry dam
- Dam with lock
- Dam carrying road

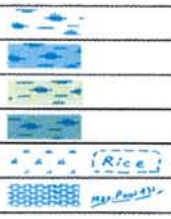


- Perennial lake; Intermittent lake or pond
- Dry lake
- Narrow wash
- Wide wash
- Canal, flume, or aqueduct with lock
- Elevated aqueduct, flume, or conduit
- Aqueduct tunnel
- Well or spring; spring or seep



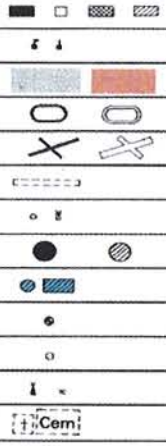
SUBMERGED AREAS AND BOGS

- Marsh or swamp
- Submerged marsh or swamp
- Wooded marsh or swamp
- Submerged wooded marsh or swamp
- Rice field
- Land subject to inundation



BUILDINGS AND RELATED FEATURES

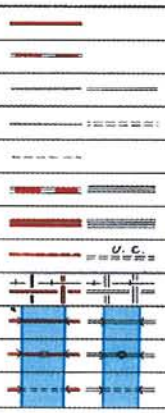
- Building
- School; church
- Built-up Area
- Racetrack
- Airport
- Landing strip
- Well (other than water); windmill
- Tanks
- Covered reservoir
- Gaging station
- Landmark object (feature as labeled)
- Campground; picnic area
- Cemetery: small; large



ROADS AND RELATED FEATURES

Roads on Provisional edition maps are not classified as primary, secondary, or light duty. They are all symbolized as light duty roads.

- Primary highway
- Secondary highway
- Light duty road
- Unimproved road
- Trail
- Dual highway
- Dual highway with median strip
- Road under construction
- Underpass; overpass
- Bridge
- Drawbridge
- Tunnel

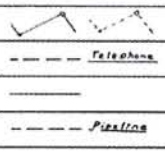


RAILROADS AND RELATED FEATURES

- Standard gauge single track; station
- Standard gauge multiple track
- Abandoned
- Under construction
- Narrow gauge single track
- Narrow gauge multiple track
- Railroad in street
- Juxtaposition
- Roundhouse and turntable

TRANSMISSION LINES AND PIPELINES

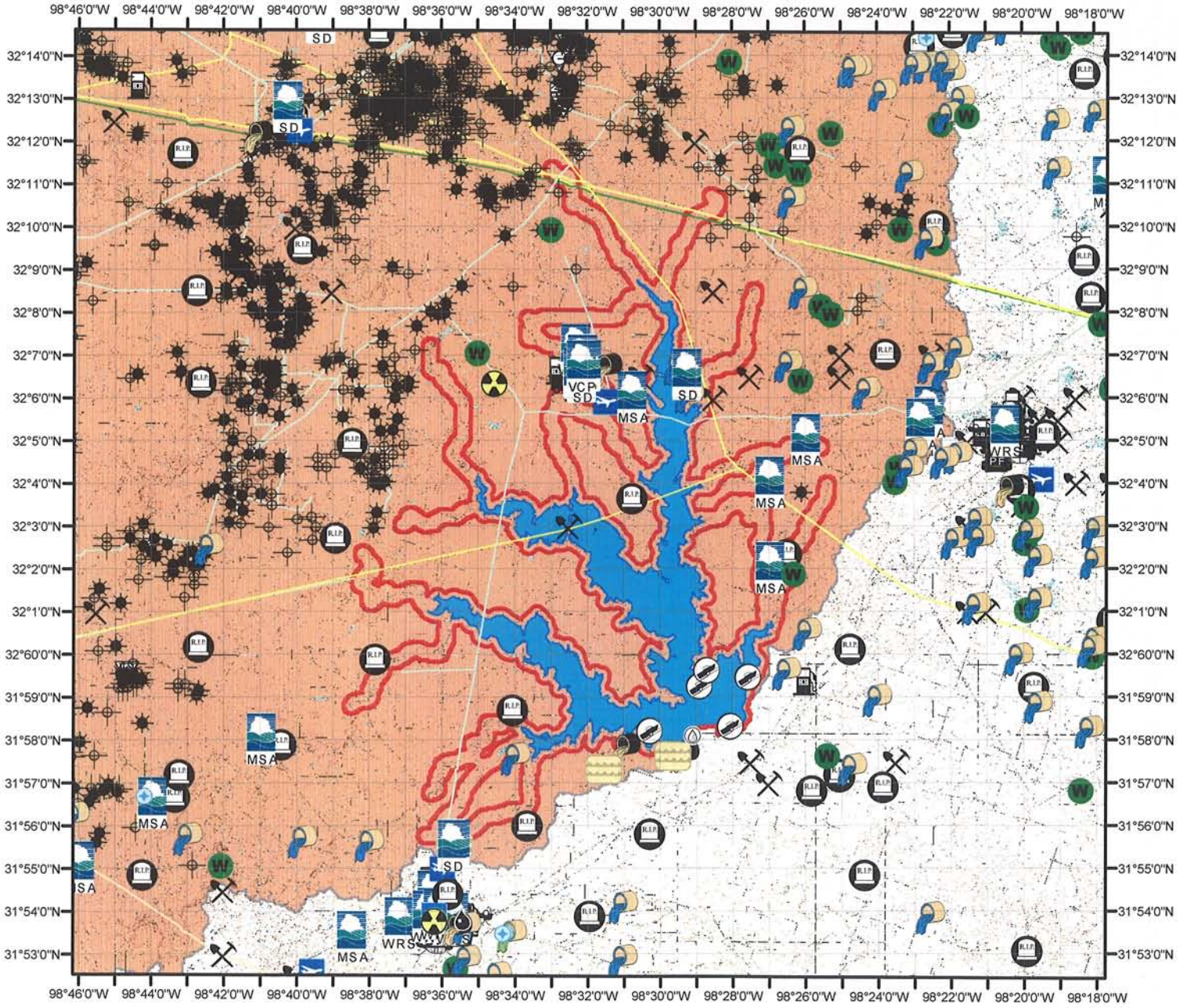
- Power transmission line: pole; tower
- Telephone line
- Aboveground oil or gas pipeline
- Underground oil or gas pipeline



Symbols shown in purple revised by the USGS from aerial photographs.

Appendix I Water Source and Potential Sources of Contaminants Map(s)

0470015 UPPER LEON RIVER MWD S0470015A



1:256,698

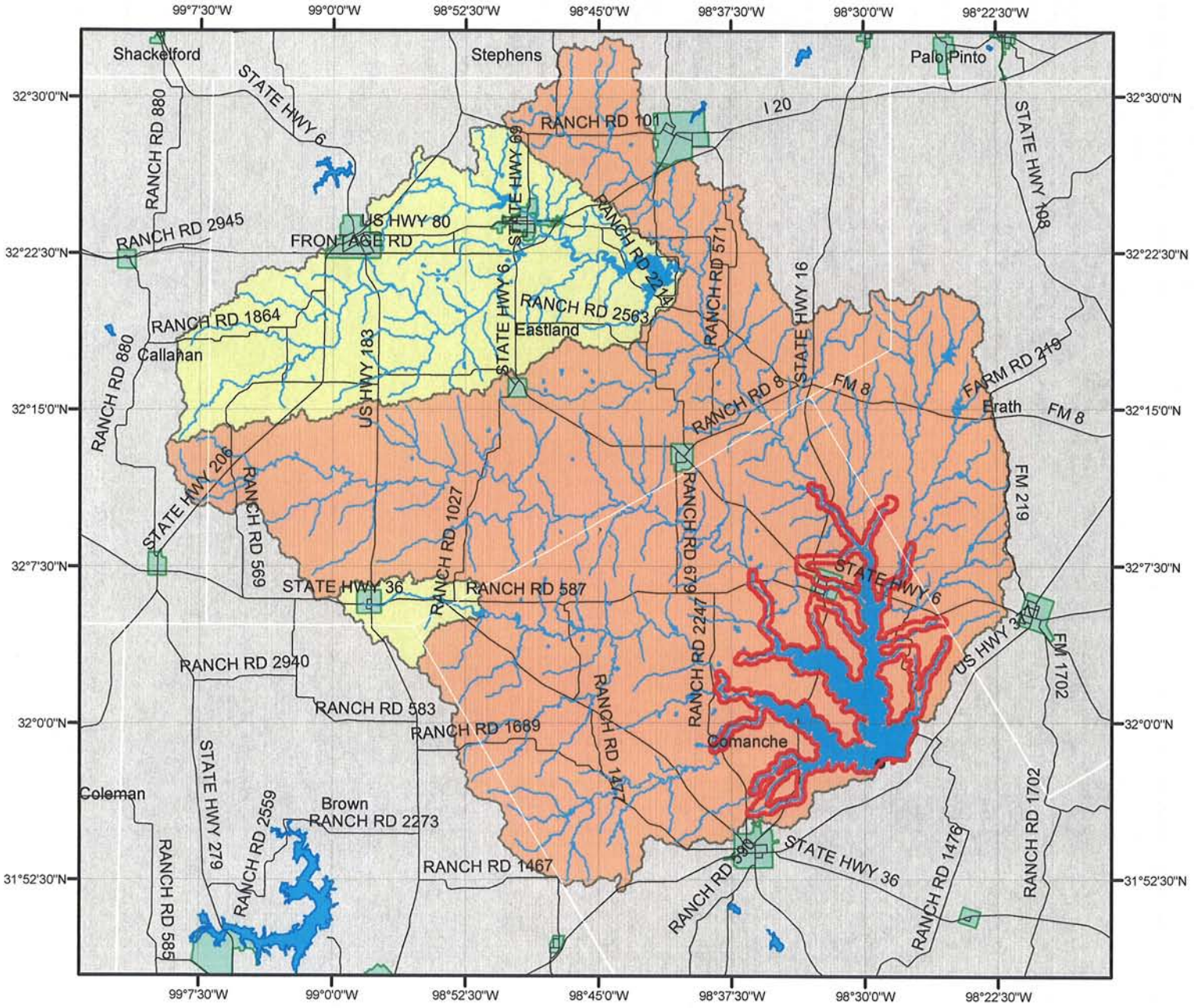
0 2.5 5 7.5 10 Miles

N W E S

See Appendix H Generalized Legend

Appendix I Water Source and Potential Sources of Contaminants Map(s)

0470015 UPPER LEON RIVER MWD



1:525,721

0 4 8 12 16 Miles

N
W E
S

See Appendix H Generalized Legend