City of Wilsonville, Oregon

SOURCE WATER ASSESSMENT REPORT FOR THE SURFACE WATER SUPPLY

September 2002

Prepared For

City of Wilsonville
30000 SW Town Center Loop East
Wilsonville, OR 97070

Prepared By

MWH
671 East Riverpark Lane, Suite 200
Boise, Idaho 83706-4000
(208) 345-5865

TABLE OF CONTENTS

CITY OF WILSONVILLE
SOURCE WATER ASSESSMENT REPORT FOR THE SURFACE WATER SUPPLY

LIST OF TABLES

LIST OF FIGURES

SECTION 1

EXECUTIVE SUMMARY

OVERVIEW

In April 2002, the City of Wilsonville, Oregon began using a water treatment plant (WTP) with a surface intake on the Willamette River. The WTP intake is in the Middle Willamette Subbasin of the Willamette Basin. Treated surface water is now the primary drinking water source for the City, which previously had been provided solely from groundwater from the City's wellfield. This wellfield now serves as a backup and supplemental water source. The public water system serves approximately 15,000 people.

Two Source Water Assessment Reports (SWAR) have been prepared by MWH. This SWAR addresses the assessment of the surface water source area upstream of the new WTP intake. A second SWAR has been prepared to address the groundwater supply source area. The plan was prepared by MWH staff for the City of Wilsonville in accordance with the guidelines and requirements of the Oregon Source Water Assessment Plan, prepared by the Oregon Department of Environmental Quality (DEQ, 1999).

OBJECTIVES

The primary objectives of this SWAR are to:

- Delineate the watershed upstream of the WTP intake
- Delineate the Drinking Water Protection Area within the watershed for the WTP intake
- Within the watershed's Drinking Water Protection Area, delineate sensitive areas requiring special consideration for protecting water quality
- Perform an inventory of existing potential contamination sources (PCSs) within the protection area, with special attention to the sensitive areas
- Assess the susceptibility of the drinking water supply to contamination
- Prepare a document that summarizes the findings and will serve as a foundation for a source area protection plan.

SUMMARY OF FINDINGS

The major findings of this SWAR are listed below:

- The Willamette Valley watershed upstream of the Wilsonville WTP intake encompasses an area of approximately 8,400 square miles.
- Using an 8-hour time of travel (TOT) for surface water, the watershed source area protection zone encompasses an area of 34.4 square miles and reaches 7.85 miles upstream

on the Willamette River. Tributary flows occur from Mission Creek, Champoeq Creek, Case Creek, Yergen Creek, Ryan Creek, Spring Brook, Mill Creek, Jim Tapman Creek, Corral Creek, and several small unnamed intermittent channels.

- The mean water surface elevation of the Willamette River at the WTP intake is approximately 59 feet, and the elevation of the highest point in the watershed source area protection zone is Parrett Mountain at 1,247 feet.
- Sensitive areas include a 1,000-foot buffer zone along each side of the Willamette River and along each side of the tributaries. Additional sensitive areas were identified based on potential for severe erosion, high runoff, high permeability (and therefore higher potential for contaminant transport), and higher landslide/debris flow potential. Most of these sensitive soils areas are along slopes adjacent to the tributaries, especially north of the Willamette River.
- Land uses identified in the Drinking Water Protection Area include agricultural (primarily orchards, tree farms, livestock pasture, and irrigated crops), managed forestry, parks and recreation areas, rural residential, and some urban areas.
- 26 existing PCSs were identified within the Drinking Water Protection Area. Of these, 13 PCSs were identified in the delineated sensitive areas and include underground storage tanks, facilities which handle and store hazardous materials, solid waste transfer, sewage facilities, and a petroleum pipeline crossing under the Willamette River.
- Additional non-point sources for contamination were identified by land use but not quantified or differentiated by site. Each of the land uses identified has potential for non-point source contaminant runoff.
- Sensitive areas within the watershed's source area protection zones are generally moderately susceptible to contamination from erosion of sediments, fuel spills, hazardous material releases, pesticide or nutrient runoff from farmland, and biological contamination from livestock waste. Relatively high erosion potential exists on steeper slopes, particularly when disturbed by human activity and/or during intense precipitation events or flooding. Relatively high runoff potential exists during periods of intense precipitation. Susceptibility to potential contamination from accidental releases, improper management practices, or nonpoint source runoff is moderate except for PCSs involving storage and disbursement of fuel and/or solvents (all UST/LUST sites and the petroleum pipeline crossing).

This Source Water Assessment Report provides a tool for the City of Wilsonville to use in the future to review any potential impacts that might affect water quality and will serve as a foundation for development of a Drinking Water Protection Plan.

SECTION 2

INTRODUCTION

In 1996, Congress amended the Safe Drinking Water Act, implemented some new requirements, and provided resources for state agencies to assist communities in protecting the sources of their public water supplies. The US Environmental Protection Agency (EPA) developed guidelines for implementing the new requirements to conduct "source water assessments" (EPA, 1997). In Oregon, the Oregon Health Division (OHD) and the Department of Environmental Quality (DEQ) are responsible for the source water assessments. The OHD is responsible for source water assessments for groundwater systems, and the DEQ is responsible for surface water assessments.

Moderate to large cities (greater than 10,000 population) are encouraged to participate in preparation of source water assessments. The City of Wilsonville, in an effort to proactively protect its current and future water supplies, has elected to prepare source water assessments for both its existing groundwater supply and its new surface water supply. The new surface water supply, which went online in April 2002, withdraws water from the Willamette River and treats the water for potable use. The City of Wilsonville desires to protect this new and valuable water supply as well as its groundwater supply, even though current regulations do not require preparation of a source area assessment for new water systems brought on line after implementation of the SWAP in 1999. Therefore the city has undertaken preparation of a source water assessment for both the surface and groundwater systems. The groundwater supply wellfield will be maintained as an emergency backup and supplemental system. This source water assessment addresses the source area for the new surface water system. A separate assessment is being prepared for the existing groundwater supply system.

The requirements for source area assessments include delineating the source area supplying the public water system, identifying areas "sensitive" to contamination, and conducting an inventory of potential contamination sources in the area. Using the results of the inventory and sensitive areas, the susceptibility of the public water system is determined.

Sources of information reviewed during this assessment included U.S. Geological Survey (USGS) documents/websites, Natural Resource Conservation Service (formerly Soil Conservation Service) documents/websites, DEQ reports, EPA and DEQ databases, and other readily accessible reports.

The procedures used to conduct and prepare this assessment were based upon State guidelines (Source Water Assessment Plan, 1999). Recognizing that no assessment can identify every potential contaminant source or problem, an effort has been made to identify those areas most sensitive to the possibility of contamination and those potential contaminant sources with the greatest possible impact. The report has been prepared following guidance and examples provided by DEQ (DEQ, 2000) and adapted to match the conditions of the Wilsonville surface water supply system.

Using the results of this assessment and the groundwater system assessment, the City of Wilsonville will voluntarily develop and implement a Drinking Water Protection Plan which will address both surface and groundwater protection. This plan will be designed to protect against potential contamination, raise awareness in the local community of the risks of drinking water contamination, and provide information to them about how they can help protect the system.

BACKGROUND

Wilsonville is located in Clackamas County, Oregon, about 12 miles south of Portland. As of April 2002, an intake on the Willamette River supplies the drinking water for Wilsonville. Prior to the surface water system, a wellfield consisting of 8 production wells provided the City's water supply. The wellfield is currently maintained as an emergency backup and supplemental water supply. The public water system serves approximately 15,000 citizens. The intake is located in the Willamette River watershed in the Middle Willamette sub-basin, Hydrologic Unit Code (HUC) # 17090007. The coordinates for the surface water intake are latitude 45.293611 N, longitude 122.782778 W.

The study area for evaluating the extent of the Wilsonville Drinking Water Protection Area (DWPA) was identified using DEQ's preliminary Geographic Information System (GIS) map of the Wilsonville watershed. US Geological Survey seamless 7 ½ minute quadrangle topographic maps on CD-ROM for the Wilsonville area (USGS, 2001) were used to refine the definition of the watershed.

Site Description

Wilsonville is located immediately north of the Willamette River and is bisected by Interstate 5. Most of the city is located on flat to moderately sloping ground and is adjacent to the Parrott Mountain area immediately to the west. The Willamette River flows on gently sloping river floodplain. South of the Willamette River, the terrain is defined by a flat to gently sloping terrace, with the most prominent relief defined by stream channel gulleys and one small but steep hill associated with the Parrott Mountain system across the Willamette River. The highest point in the subbasin is Parrott Mountain, at an elevation of 1,247 feet above mean sea level (MSL). The mean water elevation at the intake of the new water treatment plant is the lowest unsubmerged point in the subbasin at an elevation of approximately 59 feet MSL.

The climate in the Wilsonville area is characterized by moderate annual temperatures and substantial variation in precipitation. The average annual temperature is 52.1 degrees F for the period of 1961-1990, with a low monthly average of 39.2 degrees F in January and a high monthly average of 66.2 degrees F in August. Winters are cool and wet, with temperatures usually staying above freezing. The area gets an average of 3.2 inches of total snowfall per year, primarily at higher elevations within the watershed, but snowfall rarely accumulates to measurable depths in the lower elevations. Average annual precipitation is 41 inches per year, with most precipitation occurring as rainfall in winter (Oregon Climate Service, 2002).

SECTION 3

DELINEATION OF THE PROTECTION AREA

METHODOLOGY

The Willamette River Watershed incorporates an area of the Willamette Valley in west-central Oregon and includes an area of approximately 8,400 square miles. The Willamette River Watershed is shown in Figure 3-1 (inset).

Although the Willamette River Watershed constitutes the ultimate source area for the Wilsonville surface water system, the area is too large to be effectively managed or under the influence of the City. By agreement with DEQ and in compliance with the guidelines provided in the SWAP, a protection area was delineated by identifying an 8-hour time of travel (TOT) within the source area subbasin.

The 8-hour TOT Drinking Water Protection Area was developed by evaluating historic USGS flow and stage data for the Wilsonville gaging station, HUC 17090007 (USGS, 2002, and unpublished field records). This gaging station is no longer monitored by the USGS but was used from 1948 to 1973. Because this gage is the only gage in this reach of the Willamette River with adequate data to correlate flowrate, channel depth, and streamflow velocity, and because this reach of the river has not been significantly modified since the gaging station was decommissioned, it was considered to be the most representative measure of flow and stage data for this segment of the river. Using USGS reported flowrates and field measurements of water elevation, a stage-flowrate relationship was established for the Wilsonville gaging station. This provided sufficient data to calculate in-stream velocities at various flowrates. Velocities were then plotted against the flowrates and a linear regression curve was developed. At the mean flowrate of 28,585 cfs, the mean velocity of 1.44 ft/sec was identified. The data and graph used to develop the mean velocity are included in Appendix A. Using the mean velocity and an 8-hour TOT, a distance of 7.85 river miles upstream of the surface water intake was determined to be included in the Drinking Water Protection Area.

Tributaries to the Willamette River upstream of the intake within the 8-hour TOT were identified. Because all significant tributaries to the Willamette River on the north side of the river were within a few miles of the intake, the entire subbasin watershed contributing to those tributaries were included in the Drinking Water Protection Area. On the south side, large tributaries with relatively low stream gradients flow into the Willamette River near the upstream end of the 8-hour TOT. These include Mission, Champoeg, and Case Creeks, which coalesce into the Champoeg Creek channel; and Ryan Creek. No direct flow measurement data was available for these tributaries, but stream segment elevations from USGS topographic mapping showed that the slope of these tributary streams was little steeper than this segment of the Willamette River. Assuming therefore that the velocity of the tributary streamflow would not be much greater than flow in the Willamette River, a conservatively high velocity of 2.5 ft/sec was used to estimate the segments of these streams within the 8-hour TOT.

The watershed areas contributing to these 8-hour TOT flows was defined by identifying the topographic divides between tributary drainages within the range contributing to the 8-hour TOT in the stream channels. Areas contributing to runoff for the streamflows within the 8-hour TOT were then included in the Drinking Water Protection Area. The Drinking Water Protection Area falls within the watershed subdivisions defined by the State of Oregon as the fifth-field watersheds of 02 and 03 (i.e. HUCs 1709000702 and 1709000703).

RESULTS

The total area included in the Drinking Water Protection Area is 34.4 square miles. The Drinking Water Protection Area is shown in Figure 3-1.

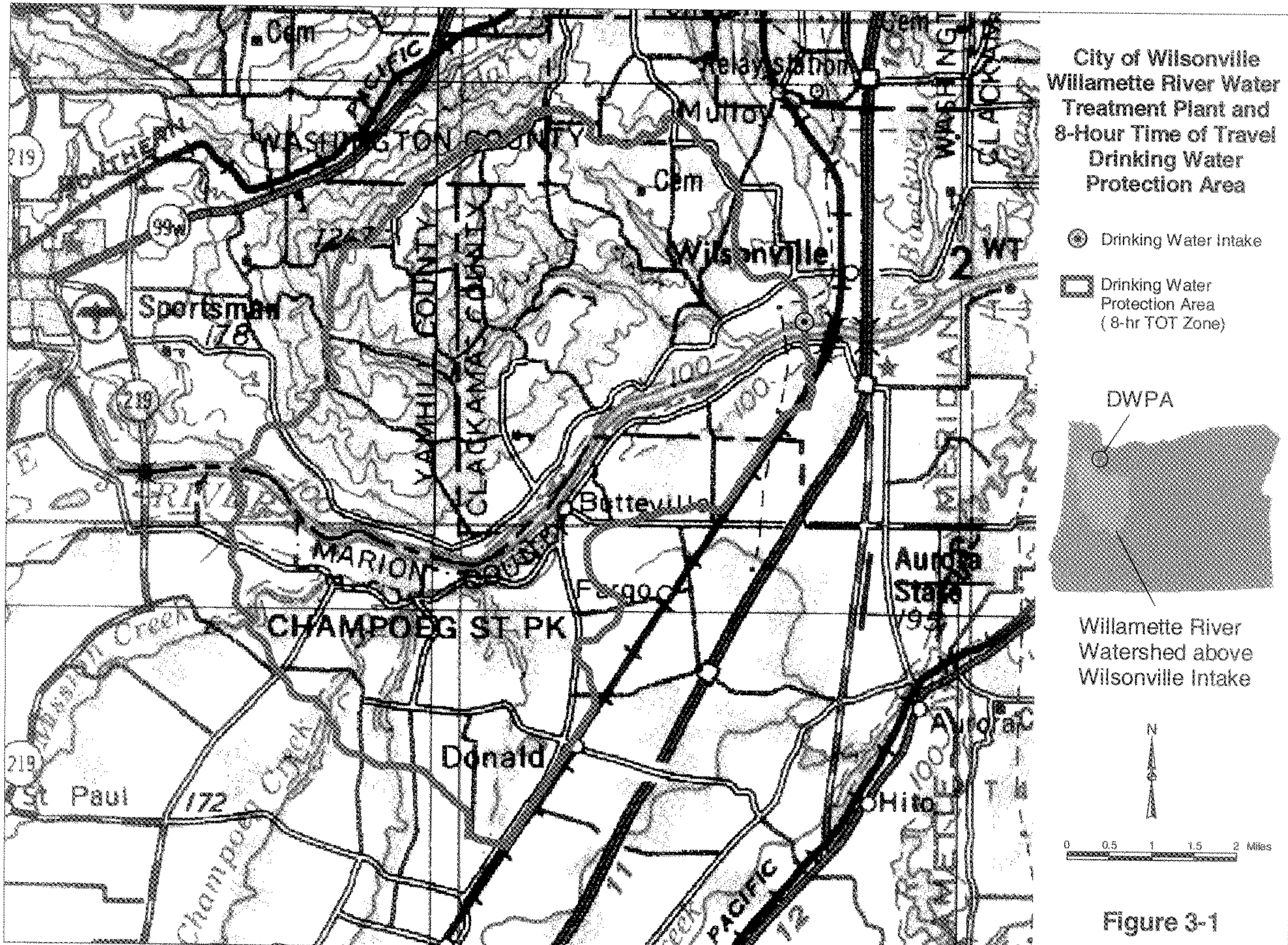

City of Wilsonville
Willamette River Water
Treatment Plant and
8-Hour Time of Travel
Drinking Water
Protection Area
Drinking Water Intake
Drinking Water
Protection Area
(8-hr TOT Zone)
DWPA
Willamette River
Watershed above
Wilsonville Intake
N
0 0.5 1 1.5 2 Miles
Wilsonville
Murray
Relay Station
WASHINGTON COUNTY
YAMHILL COUNTY
CLACKAMAS COUNTY
MARION COUNTY
CHAMPOEG ST PK
Butteville
Fargo
Donald
Aurora
Hito
St Paul
Sportsman
Champoeg Creek
PACIFIC

Figure 3-1

SECTION 4

IDENTIFICATION OF SENSITIVE AREAS

METHODOLOGY

After delineating the watershed Drinking Water Protection Area, the "sensitive areas" within the watershed were identified. The objective in determining the sensitive areas for surface water sources is to provide information to the community and public water system that is useful in developing and prioritizing protection strategies. Sensitive areas were determined using the guidelines developed by the DEQ advisory committee (SWAP, 1999). The sensitive areas within a drinking water watershed include both setbacks (land adjacent to stream) and other natural or manmade factors that increase the risk of contamination of the surface water. The result is an identification of a subset of the entire watershed. The sensitive areas are those where potential contamination sources or land use activities, if present, have a greater potential to impact the water supply.

There are five individual characteristics that determine the sensitivity of areas within the drinking water watersheds in the Source Water Assessment Plan (1999) procedures for Oregon water systems. Brief descriptions of the sensitive area characteristics and the sources of the GIS data are included below.

Sensitive Area Setbacks

The first sensitive area is a 1,000-foot setback from the Willamette River and perennial tributary streams. The sensitive area setbacks are intended to identify those areas where there are higher risks of contamination by spills or other releases, simply due to their proximity to the water body. Although the SWAP requires only a 1,000 foot setback from the centerline of the river, because of the width of the Willamette River in some places, a more conservative setback of 1,000 feet from each river bank was used. For the tributaries, a 1,000-foot setback from centerline was used.

High Soil Erosion Potential

The soil erosion potential is determined by combining the effects of slope and the soil erodibility factor (" K-factor"). Slopes within a watershed are evaluated using Natural Resources Conservation Service soil reports. The K-factor used is a weighted average of only the value for the surface layer of the map unit. In the watershed, only soils with "high" erodibility ratings were mapped as sensitive areas. Soils that classify as "high" include soil both with slopes greater than 30% and K-factors greater than 0.25. This rating system is based on the Revised Universal Soil Loss Equation from the USDA Agricultural Research Service as defined in the Washington's Standard Methodology for Conducting Watershed Analysis (Washington Forest Practices Board, 1993).

High Permeability Soils

Soils within the Drinking Water Protection Area which are identified in NRCS soil survey reports with moderately high permeability or greater are mapped as sensitive areas due to the higher potential for groundwater recharge adjacent to the stream. These areas may be very vulnerable to rapid infiltration of contaminants to groundwater and subsequent discharge to a stream.

High Runoff Potential Soils

The potential for high runoff rates was evaluated using NRCS soil survey reports. Soils classified as Hydrologic Group D soils, which are defined as soils with very slow infiltration rates, were mapped as sensitive areas within the boundaries of the drinking water protection area. Map units are assigned to hydrologic groups based on their majority component. A Group D soil is typified as clayey, has a high water table, or an impervious layer occurs at a shallow depth. Soils with these characteristics would have the potential for rapid runoff and subsequent transport of sediments and possible contaminants to the surface water body supplying the public water system.

Additional Sensitive Areas

The DEQ SWAP makes provision for including other areas within the designated sensitive areas. These designations would be based upon site-specific considerations, such as high landslide potential, high snow runoff snow zones, high-risk land use, high concentrations of potential contaminants adjacent to sensitive area setbacks, or other factors.

An investigation of landslide and debris flow risk was performed by inspecting Oregon Department of Forestry landslide and debris flow maps (Oregon Dept. of Forestry, 2000). The potential for landslide and debris flows within the Drinking Water Protection Area was scanned to identify potential areas of higher risk.

DEQ has provided a land use map which shows primary land uses for the Drinking Water Protection Area. This map was used to investigate areas of potential high-risk land use.

The potential contaminant source survey (see Section 5) was used to identify proximity of high-risk contaminants to potentially sensitive areas. Consideration was given to including areas of higher potential contamination risk within the sensitive areas if they were outside the sensitive area but within close proximity and if other conditions (slope, runoff patterns, etc.) warranted inclusion in the sensitive areas.

The final watershed map for the public water system intake includes a composite of all sensitive areas identified within the watershed. This composite or overlay will enable the communities and responsible agencies to focus future protection efforts in these sensitive areas.

RESULTS

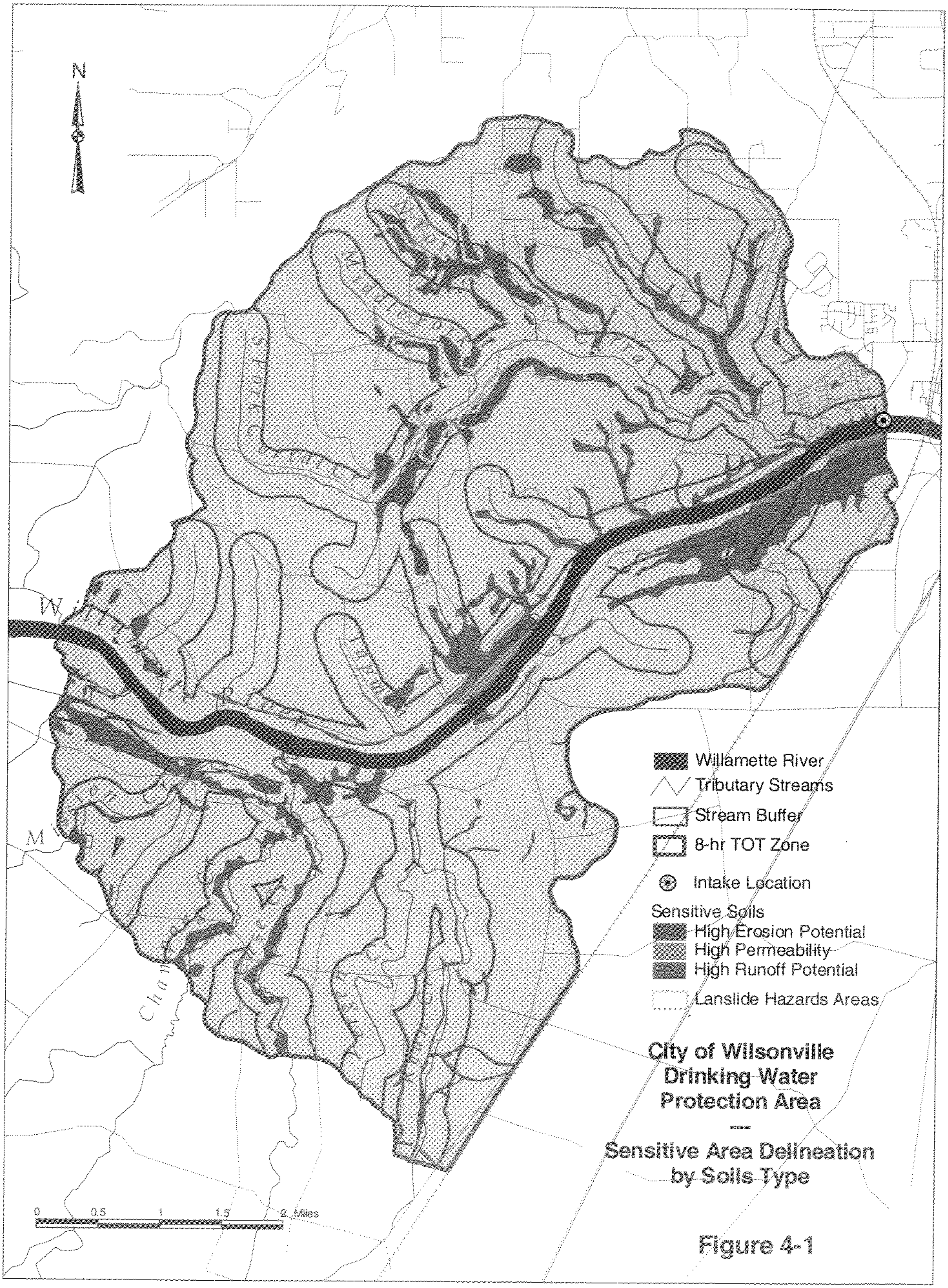
Setbacks of 1,000 feet from each bank of the Willamette River and from the centerline of the tributaries were included as sensitive areas within the Drinking Water Protection Area. Areas where the surface soils were classified as having higher erosion potential, higher permeability, or higher runoff potential were also included in the sensitive areas. A list of these soils is included in Appendix B.

Oregon Climate Service records for the North Willamette Experimental Station for 1961 to 1990 show average annual accumulations of only about 3.2 inches of snow. It is apparent that risks associated with snow runoff are low. No snowpack runoff designations were included in the sensitive areas.

Although some identified land uses have the potential for medium to high risk, the identified land uses (discussed in Section 5) did not appear to warrant special consideration solely on that basis. No areas were included in the sensitive areas on the basis of land use.

The PCS inventory identified potential source areas within and without the designated sensitive areas associated with the other factors identified above. No PCS sites were identified which required modification of sensitive area delineation. The PCS inventory is discussed in greater detail below.

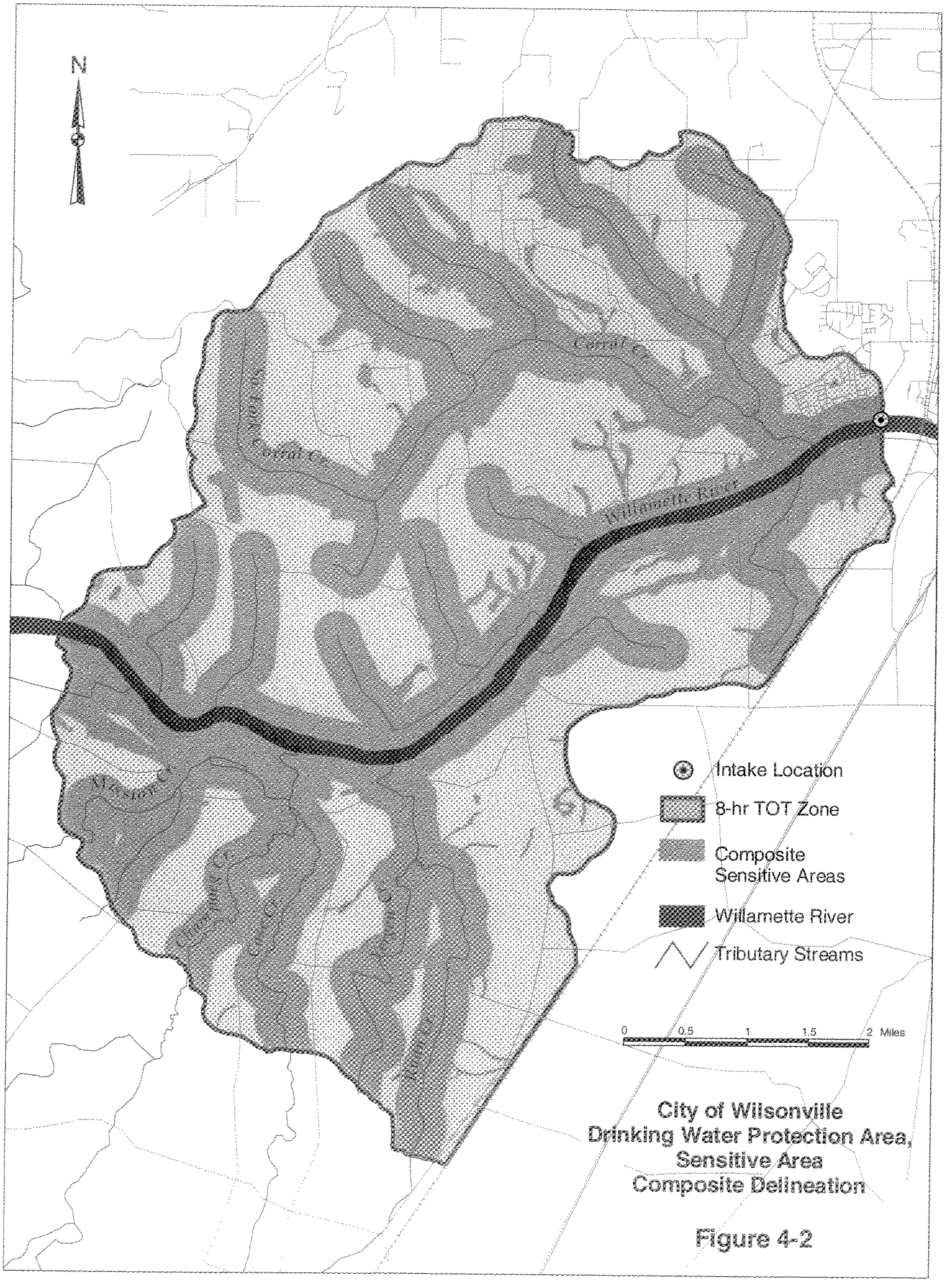
A map showing stream setbacks, sensitive soils, and potential landflow or debris flow areas within the Wilsonville Drinking Water Protection Area is shown in Figure 4-1. A composite map of all sensitive areas is shown on Figure 4-2. These include the setbacks from the main stem and all perennial tributaries, areas with high soil permeability, areas of high soil erosion potential, areas of high runoff potential, and areas of moderate landslide potential.



City of Wilsonville Drinking Water Protection Area

Sensitive Area Delineation by Soils Type

Figure 4-1



City of Wilsonville Drinking Water Protection Area, Sensitive Area Composite Delineation

Figure 4-2

SECTION 5

INVENTORY OF POTENTIAL CONTAMINANT SOURCES

METHODOLOGY

The primary intent of a PCS inventory is to identify and locate significant potential sources of any of the contaminants of concern within the Drinking Water Protection Area. Significant potential sources of contamination can be defined as any facility or activity that stores, uses, or produces the contaminants of concern and has a sufficient likelihood of releasing such contaminants to the environment at levels that could contribute significantly to the concentration of these contaminants in the source waters of the public water supply.

Inventories are focused primarily on the potential sources of contaminants regulated under the Federal Safe Drinking Water Act. This includes contaminants with a maximum contaminant level (MCL), contaminants regulated under the Surface Water Treatment Rule, and the microorganism Cryptosporidium. The sites identified in the PCS inventory were obtained from the DEQ "Facilities" and "Underground Injection Control" databases. The inventory was designed to identify several categories of potential sources of contaminants including micro-organisms (i.e., viruses, *Giardia lambia, Cryptosporidium*, and fecal bacteria); inorganic compounds (i.e., nitrates and metals); organic compounds (i.e., solvents, petroleum compounds and pesticides) and turbidity/sediments. Contaminants can reach a water body (groundwater, rivers, lakes, etc.) from activities occurring on the land surface or below it. Contaminant releases to water bodies can also occur on an area-wide basis or from a single point source.

When identifying potential risks to a public water supply, it is necessary to make some "worst-case" assumptions to identify potential risks, not just probable risks. The worst-case assumption that is made when considering potential risks to water bodies is that the facility or activity is not employing good management practices or pollution prevention. Under today's regulatory standards and environmental awareness, the majority of the identified activities and land uses employ best management practices (BMPs) in handling contaminants or preventing water quality degradation from their operations. It is important to note that while this assessment will list all POTENTIAL risks, many of these do not present actual risks to the water system. Environmental contamination is not likely to occur when contaminants are handled and used properly, or when BMPs are employed. The day-to-day operating practices and environmental (contamination) awareness varies considerably from one facility or land use activity to another. In-depth analysis or research was not completed to assess each specific source's compliance status with local, state and/ or Federal programs or laws. Also, the inventory process did not include an attempt to identify unique contamination risks at individual sites such as facilities (permitted or not) that do not safely store potentially hazardous materials.

No attempt was made to infer possible PCS conditions other than those identified in the DEQ databases. However, the land use survey (discussed in Section 4) identified some land uses which are normally considered potential "non-point sources" for contamination. These land uses include various agricultural operations, managed forestry, rural residential, parks and recreation, and urban activities. Various potential contaminants may be released from these land uses under some conditions. Potential contaminants include fuel spills and releases, solvents for equipment and paints, sediments from surface erosion, pesticides and herbicides, nutrients, and microbiological contaminants, among others.

Potential sources of contaminants were identified through a variety of methods and resources. In completing this inventory, readily available information was used, including review of DEQ, EPA, and other agencies' databases of currently listed sites, interviews with city personnel, and field observation as discussed below. The process for completing the inventory for Wilsonville's drinking water protection area included the following steps:

1. Collected relevant information as of March 2002 from applicable state and federal regulatory databases including the following lists:

   - DEQ Environmental Cleanup Site Information System (ECSI) which includes the U.S. EPA National Priorities List (NPL) and the U.S. EPA Comprehensive Environmental Response, Compensation and Liability Information System (CERCLA) list; -DEQ leaking underground storage tank (LUST) list;
   - DEQ registered underground storage tank (UST) list; -DEQ Active Solid Waste Disposal Permits list;
   - DEQ Dry Cleaners list; -DEQ Site Information System (SIS) which includes Water Pollution Control Facility (WPCF) and National Pollutant Discharge Elimination System (NPDES) permitted facilities;
   - DEQ Solid Waste Management Sites (SWMS) list;
   - DEQ Underground Injection Control (UIC) list.

   Because of the way various state and federal databases are set up, the specific locations of listed sites are not always given or accurate within the database. The presence and approximate location of several PCS sites and land uses within the drinking water protection area were verified by consulting with City of Wilsonville personnel and/or by driving through the area (windshield survey) as discussed below in subsequent inventory steps. Not all sites were located in the field. In these instances, the DEQ locations identified on the DEQ website "facility locator map" were accepted as accurate unless the database contained obvious location errors.

2. Conducted a windshield survey by driving through the Drinking Water Protection Area to field locate and verify major potential contaminant source activities. The windshield survey was conducted primarily in the sensitive areas near the Willamette River and within the City of Wilsonville. Access to outlying areas of the Drinking Water Protection Area was not practical within the constraints of this survey, and not all site locations were field-verified.

3. Assigned high, medium, or low risk ratings to each potential contaminant source based on the Oregon SWAP (1999).

4. Produced final summary of the inventoried sources and the GIS base map, which are presented in this report.

RESULTS

A summary of zoned land uses identified in the Drinking Water Protection Area is provided in Table 5-1. A list of potential contaminant sources by land use is found in Table 5-2. The PCS list in Table 5-2 is from DEQ's SWAP (1999). As shown on the land use map provided in Figure 5-1, most of the Drinking Water Protection Area land use is agriculture, forestry, parks, and rural residential, with much smaller areas where land use consists of urban residential/industrial. Table 5-1 shows various types of possible land uses for each of these general categories, together with the relative risk of each type of land use. As shown in Table 5-2, some higher-risk non-point source land uses are found in the Drinking Water Protection Area. These include (but are not necessarily restricted to) livestock grazing, stables, irrigated crops, and managed forest lands.

TABLE 5-1

SUMMARY OF ZONED LAND USES IN DRINKING WATER PROTECTION AREA

	Description
Agriculture	Irrigated crops; orchards; vineyards; tree farms; nurseries; dairies; livestock pasture and stables
Forestry	Timber growth and harvesting
Rural Residential	Non-urban residential; non-industrial businesses
Parks and Recreation	State parks
Urban	Single-family residential; multi-family residential; public facilities; commercial and industrial businesses

Table 5-3 shows the list of potential contaminant sources identified within the Drinking Water Protection Area. The locations of the potential contaminant sources are shown on Figure 5-2. A total of 26 potential contamination sources were identified from the database. These include underground storage tanks (both leaking and nonleaking), hazardous materials storage, sewage handling, and miscellaneous facilities. In addition, a petroleum pipeline crossing under the Willamette River was observed near the confluence of the Willamette River with Corral Creek.

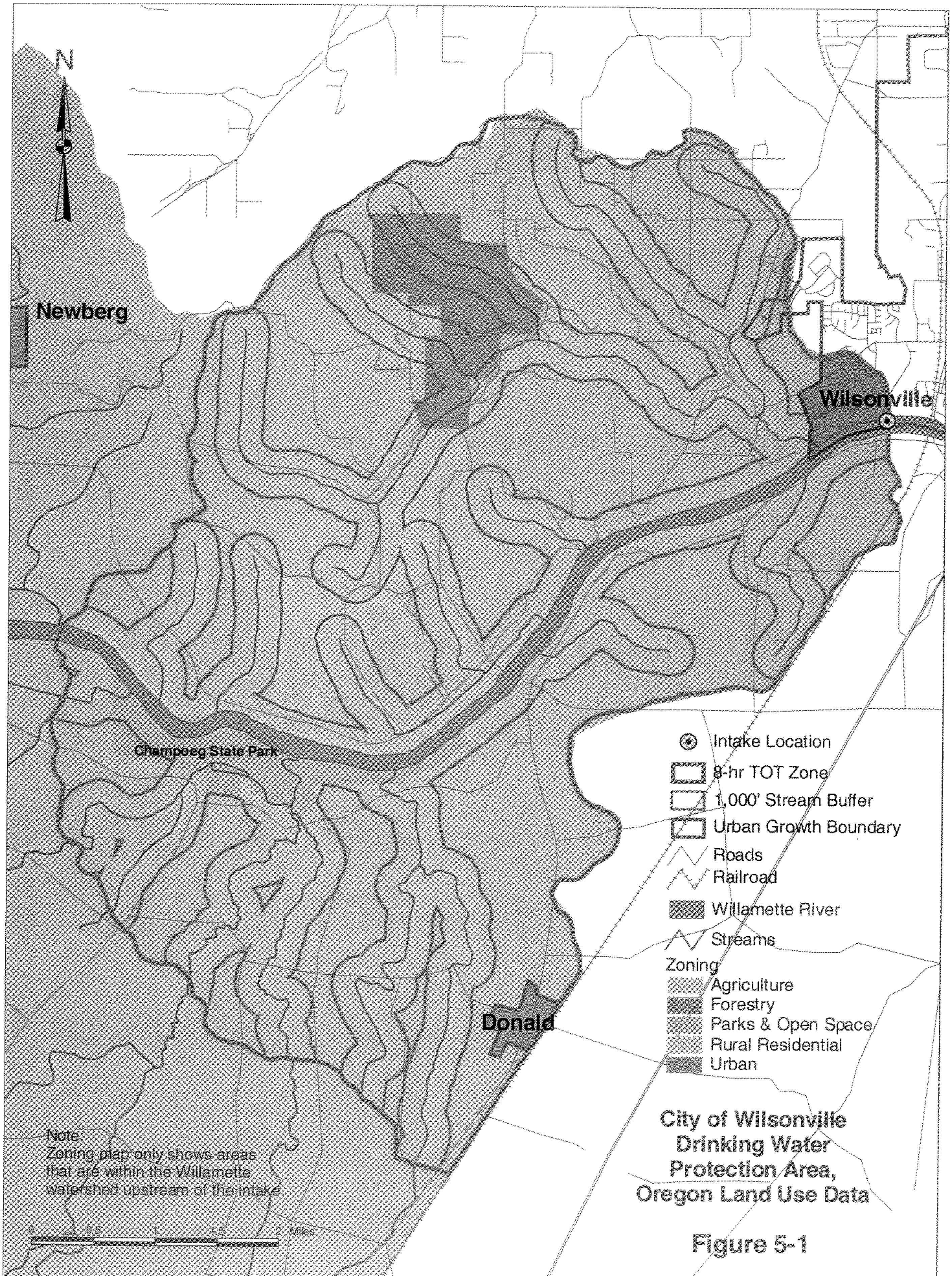
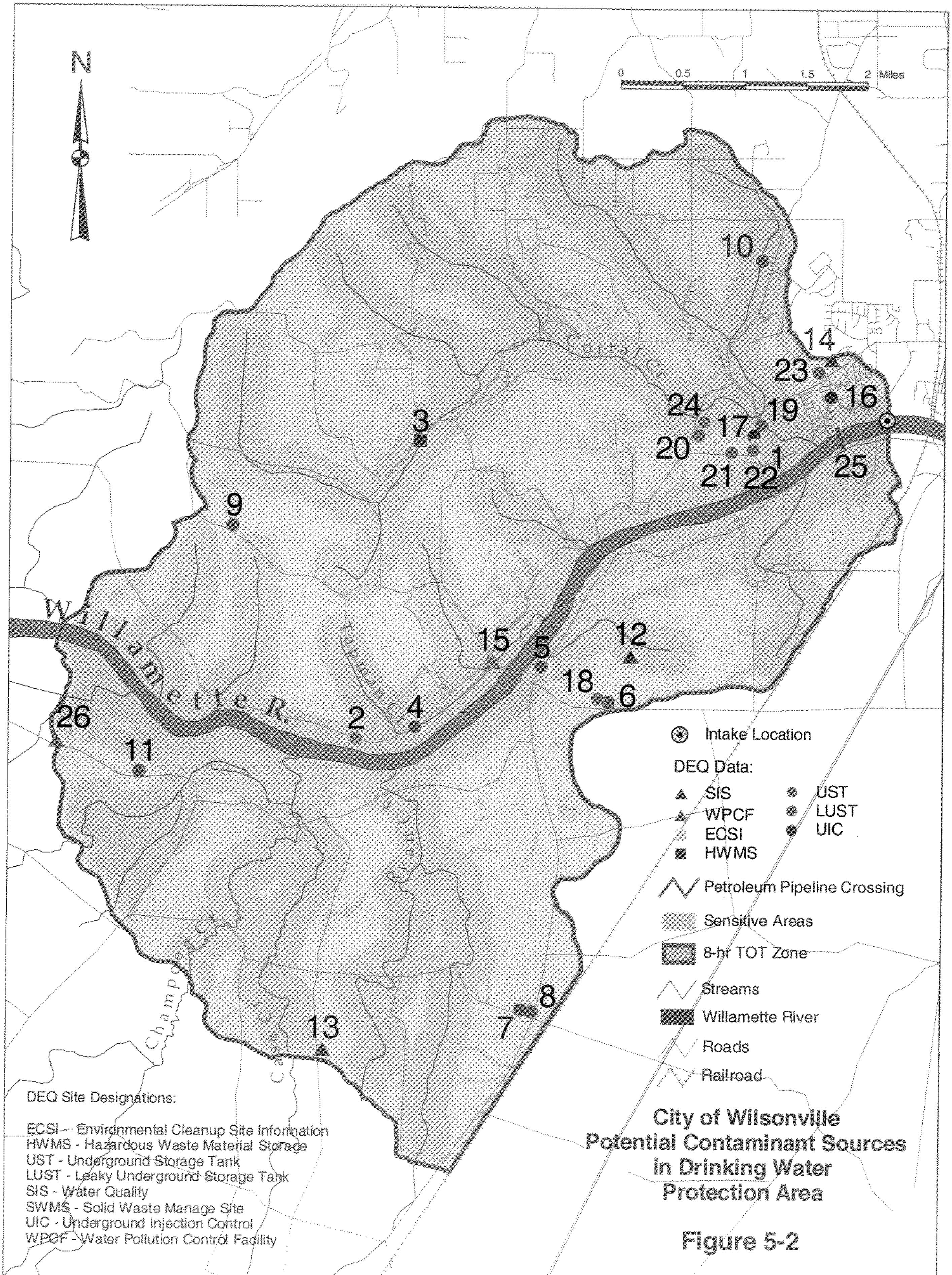

N
Newberg
Wilsonville
Champoeg State Park
Donald
Intake Location
8-hr TOT Zone
1,000' Stream Buffer
Urban Growth Boundary
Roads
Railroad
Willamette River
Streams
Zoning
Agriculture
Forestry
Parks & Open Space
Rural Residential
Urban
Note:
Zoning map only shows areas that are within the Willamette watershed upstream of the intake
0 0.5 1 1.5 2 Miles
City of Wilsonville Drinking Water Protection Area, Oregon Land Use Data

Figure 5-1



City of Wilsonville Potential Contaminant Sources in Drinking Water Protection Area

Figure 5-2

TABLE 5-2

POTENTIAL CONTAMINANT SOURCES BY LAND USES AND ACTIVITIES

RESIDENTIAL / MUNICIPAL LAND USES				
ID	**Type of Activity**	**Potential Water Quality Impacts**	**GW Risk**	**SW Risk**
R01	Airport - Maintenance/Fueling Area	Spills, leaks, or improper handling of fuels, de-icers, and other chemicals during transportation, use, storage and disposal may impact the drinking water supply.	H	M
R02	Apartments and Condominiums	Improper use, storage, and disposal of household and facility maintenance chemicals including cleaners, vehicle maintenance products, pool chemicals, pesticides and fertilizers may impact the drinking water supply. Stormwater run-off or infiltration may carry contaminants to drinking water supply.	L	L
R03	Campgrounds/RV Parks	Leaks or spills of automotive fluids or improperly managed septic systems and wastewater disposal may impact drinking water supply. Heavy usage along edge of waterbody may contribute to erosion, causing turbidity.	L	M
R04	Cemeteries - Pre-1945	Embalming fluids (for example, arsenic) and decomposition by-products may impact drinking water supply.	M	L
R05	Drinking Water Treatment Plants	Treatment chemicals and equipment maintenance materials may impact groundwater or surface water source.	M	M
R06	Fire Station	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply.	L	L
R07	Fire Training Facilities	Improper use of fuels and other chemicals during fire training may impact the drinking water supply.	M	M
R08	Golf Courses	Over-application or improper handling of pesticides or fertilizers may impact drinking water. Excessive irrigation may cause transport of contaminants to groundwater or surface water through runoff.	M	M

RESIDENTIAL / MUNICIPAL LAND USES				
ID	**Type of Activity**	**Potential Water Quality Impacts**	**GW Risk**	**SW Risk**
R09	Housing - High Density - > 1 House/0.5 Acres	Improper use, storage, and disposal of household chemicals including cleaners, vehicle maintenance products, pool chemicals, pesticides and fertilizers may impact the drinking water supply. Stormwater run-off or infiltration may carry contaminants to drinking water supply.	M	M
R10	Landfill/Dumps	Water percolating through the landfill waste material may transport contaminants to groundwater or surface water supply.	H	H
R11	Lawn Care - Highly Maintained Areas	Over-application or improper handling of pesticides or fertilizers may impact drinking water. Excessive irrigation may cause transport of contaminants to groundwater or surface water through runoff.	M	M
R12	Motor Pools	Spills, leaks, or improper handling of fuels and other chemicals from vehicle service and parking areas may impact the drinking water supply. Stormwater run-off or infiltration may carry contaminants to drinking water.	M	M
R13	Parks	Over-application or improper handling of pesticides or fertilizers may impact drinking water. Excessive irrigation may cause transport of contaminants to groundwater or surface water through runoff. Heavy usage along edge of waterbody may contribute to erosion, causing turbidity.	M	M
R14	Railroad Yards/Maintenance/ Fueling Areas	Spills, leaks, or improper handling of fuels and other chemicals during transportation, use, storage and disposal may impact the drinking water supply.	H	H
R15	Schools	Over-application or improper handling of cleaning products, pesticides or fertilizers used on the school grounds may impact drinking water. Vehicle maintenance wastes may contribute contaminants.	L	M
R16	Septic Systems - High Density - >1/Acre	If not properly sited, designed, installed, and maintained, septic systems can impact drinking water. Cumulative effects of multiple systems in an area may impact drinking water supply.	H	M

RESIDENTIAL / MUNICIPAL LAND USES				
ID	**Type of Activity**	**Potential Water Quality Impacts**	**GW Risk**	**SW Risk**
R17	Sewer Lines - Close Proximity to PWS	If not properly designed, installed, and maintained, sewer lines can impact drinking water, especially adjacent to a waterbody or within the 2-year time-of-travel zone for drinking water wells.	H	M
R18	Utility Stations – Maintenance Transformer Storage	Spills, leaks, or improper handling of chemicals and other materials including PCBs during transportation, use, storage and disposal may impact the drinking water supply.	H	H
R19	Waste Transfer/Recycling Stations	Improper management of water contacting waste material may impact the drinking water supply.	M	H
R20	Wastewater Treatment Plants/Collection Stations	Improper management of wastewater, treatment chemicals, or equipment maintenance materials may impact drinking water supply.	M	H
R50	Others (List)	The impacts to this potential contaminant source will be addressed during the enhanced inventory.		

COMMERCIAL / INDUSTRIAL LAND USES				
ID	**Type Of Activity**	**Potential Water Quality Impacts**	**GW Risk**	**SW Risk**
C01	Auto - Body Shops	Improper management of vehicle paints, thinners, and primer products may impact the drinking water supply.	H	M
C02	Auto - Car Washes	Improper management of vehicle wash water may result in soaps, oils, greases, and metals impacting the drinking water supply.	M	M
C03	Auto - Gas Stations	Spills, leaks, or improper handling of fuels and other materials during transportation, transfer, and storage may impact the drinking water supply.	H	M
C04	Auto - Repair Shops	Spills, leaks, or improper handling of automotive fluids, solvents, and repair materials during transportation, use, storage and disposal may impact the drinking water supply.	H	M
C05	Boat Services/Repair/ Refinishing	Spills, leaks, or improper handling of fuels, septage, maintenance chemicals, sandblasting wastes, paints, and other materials during transportation, use, storage and disposal may impact the drinking water supply.	H	H

COMMERCIAL / INDUSTRIAL LAND USES				
ID	**Type Of Activity**	**Potential Water Quality Impacts**	**GW Risk**	**SW Risk**
C06	Cement/Concrete Plants	Spills, leaks, or improper handling of chemicals and high turbidity wastewaters during transportation, use, storage and disposal may impact the drinking water supply.	M	M
C07	Chemical/Petroleum Processing/Storage	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply.	H	H
C08	Dry Cleaners	Spills, leaks, or improper handling of dry cleaning solvents and other chemicals during transportation, use, storage and disposal may impact the drinking water supply.	H	M
C09	Electrical/Electronic Manufacturing	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage, and disposal may impact the drinking water supply.	H	M
C10	Fleet/Trucking/Bus Terminals	Spills, leaks, or improper handling of fuels, grease, solvents, and other materials from vehicle service, fueling, and parking areas may impact the drinking water supply.	H	M
C11	Food Processing	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply.	M	M
C12	Furniture/Lumber/Parts Stores	Spills, leaks, or improper handling of hazardous chemical products and other materials in inventory during transportation, use, storage and disposal may impact the drinking water supply.	M	M
C13	Home Manufacturing (modular)	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply.	H	H
C14	Junk/Scrap/Salvage Yards	Spills, leaks, or improper handling of automotive chemicals, batteries, and other waste materials during storage and disposal may impact the drinking water supply.	H	H
C15	Machine Shops	Spills, leaks, or improper handling of solvents, metals, and other chemicals or materials during transportation, use, storage and disposal may impact the drinking water supply.	H	H
C16	Medical/Vet Offices	Spills, leaks, or improper handling of x-ray, biological, chemical, and radioactive wastes and other materials during transportation, use, storage and disposal may impact the drinking water supply.	M	L

COMMERCIAL / INDUSTRIAL LAND USES				
ID	**Type Of Activity**	**Potential Water Quality Impacts**	**GW Risk**	**SW Risk**
C17	Metal Plating/Finishing/ Fabrication	Spills, leaks, or improper handling of solvents and other chemicals during transportation, use, storage and disposal may impact the drinking water supply.	H	H
C18	Mines/Gravel Pits	Spills, leaks, or improper handling of chemicals and wastes generated in mining operations or from heavy equipment may impact the drinking water supply.	H	H
C19	Office Buildings/Complexes	Spills, leaks, or improper handling of chemicals and other materials stored and used in maintenance or from parking areas may impact the drinking water supply.	L	L
C20	Parking Lots/Malls - > 50 Spaces	Spills and leaks of automotive fluids in parking lots may impact the drinking water supply.	H	H
C21	Photo Processing/Printing	Spills, leaks, or improper handling of photographic chemicals during transportation, use, storage and disposal may impact the drinking water supply.	H	H
C22	Plastic/Synthetics Producer	Spills, leaks, or improper handling of solvents and resins during transportation, use, storage and disposal may impact the drinking water supply.	H	H
C23	Research Laboratories	Spills, leaks, or improper handling of laboratory chemicals and wastes during transportation, use, storage and disposal may impact the drinking water supply.	H	H
C24	RV/Mini Storage	Spills, leaks, or improper handling of automotive fluids and other materials during transportation, storage and disposal may impact the drinking water supply.	L	L
C25	Wood/Pulp/Paper Processing and Mills	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply.	H	H
C26	Wood Preserving/Treating	Spills, leaks, or improper handling of wood preservatives and other chemicals during transportation, use, storage and disposal may impact the drinking water supply.	H	H
C50	Others (List)	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage, and disposal may impact the drinking water supply.		

AGRICULTURAL / FOREST LAND USES				
ID	**Type Of Activity**	**Potential Water Quality Impacts**	**GW Risk**	**SW Risk**
A01	Auction Lots	Improper storage and management of animal wastes and wastewater in areas of concentrated livestock may impact drinking water.	H	H
A02	Boarding Stables	Improper storage and management of animal wastes and wastewater in areas of concentrated livestock may impact drinking water.	M	H
A03	Confined Animal Feeding Operations (CAFOs)	Improper storage and management of animal wastes and wastewater in areas of concentrated livestock may impact drinking water.	H	H
A04	Crops - Irrigated - Berries, Hops, Mint, Orchards, Vineyards/Nurseries, Green Houses, Vegetables, etc.	Over-application or improper handling of pesticides or fertilizers may impact drinking water. Excessive irrigation may cause transport of contaminants or sediments to groundwater/surface water through runoff. NOTE: *Drip-irrigated crops such as vineyards and some vegetables, are considered to be a low risk.	M*	H
A05	Crops - Nonirrigated – Christmas Trees, Grains, Grass Seeds, Hay, Pasture	Over-application or improper handling of pesticides or fertilizers may impact drinking water. Some agricultural practices may result in excess sediments discharging to surface waters, but non-irrigated crops are generally considered to be a low risk to groundwater and surface water.	L	L
A06	Farm Machinery Repair	Spills, leaks, or improper handling of solvents and petroleum products during transportation, use, storage and disposal may impact the drinking water supply.	H	M
A07	Grazing Animals - > 5 Large Animals or Equivalent/Acre	Improper storage and management of animal wastes may impact drinking water supply. Concentrated livestock may contribute to erosion and sedimentation of surface water bodies.	M	H
A08	Lagoons/Liquid Wastes	Improper seepage or overflows of liquid wastes may impact the drinking water supply.	H	H
A09	Land Application Sites	Improper management of sludge and wastewater may impact drinking water supply.	M	H
A10	Managed Forest Lands – Broadcast Fertilized Areas	Over-application or improper handling of pesticides or fertilizers may impact the drinking water source.	L	M
A11	Managed Forest Lands – Clearcut Harvested - < 35 yrs	Cutting and yarding of trees may contribute to increased erosion, resulting in turbidity and chemical changes in drinking water supply. Over-application or improper handling of pesticides or fertilizers may impact drinking water source.	M	H

AGRICULTURAL / FOREST LAND USES				
ID	**Type Of Activity**	**Potential Water Quality Impacts**	**GW Risk**	**SW Risk**
A12	Managed Forest Lands – Partial Harvested - <10 yrs	Cutting and yarding of trees may contribute to increased erosion, resulting in turbidity and chemical changes (ex: nitrates) in drinking water supply. Over-application or improper handling of pesticides or fertilizers may impact drinking water source.	M	H
A13	Managed Forest Lands - Road Density - > 2 mi/sq mi	Road building, maintenance, and usage may contribute to erosion and slope failure causing turbidity in drinking water supply. Vehicle usage increases the risks of leaks or spills of petroleum products and other hazardous materials.	M	H
A14	Pesticide/Fertilizer/ Petroleum Storage, Handling, Mixing, & Cleaning Areas	Leaks, spills and improper handling of pesticides, fertilizers and petroleum products may impact drinking water source.	H	H
A15	Recent Burn Areas - < 10 yrs	Vegetation removal by fire may increase surface erosion and sediment delivery rates, resulting in high turbidity in drinking water source.	L	H
A50	Others (List)	The impacts of this potential contaminant source will be addressed during the enhanced inventory.		

MISCELLANEOUS LAND USES				
ID	**Type Of Activity**	**Potential Water Quality Impacts**	**GW Risk**	**SW Risk**
M01	Above Ground Storage Tanks	Spills, leaks, or improper handling of stored materials may impact the drinking water supply.	M	M
M02	Channel Alterations - Heavy	Construction or maintenance of channel may cause erosion, resulting in increase in turbidity of surface water. Improper stream alterations may also contribute to increase in potential for flooding.	L	H
M03	Combined Sewer Outfalls	Combined sewer overflows contribute untreated wastewater at the outfall.	L	H
M04	Stormwater Outfalls	Stormwater run-off may contain contaminants from residential (homesites and roads), commercial/industrial, and agricultural use areas.	L	H
M05	Composting Facilities	Storage and improper handling of organic material, animal waste, and wastewater may impact drinking water.	M	H

MISCELLANEOUS LAND USES				
ID	Type Of Activity	Potential Water Quality Impacts	GW Risk	SW Risk
M06	Historic Gas Stations	Historic spills, leaks, or improper handling of solvents and petroleum products may impact the drinking water supply. Abandoned underground storage tanks may be present.	H	H
M07	Historic Waste Dumps/Landfills	Water percolating through old landfills or dumpsites may transport contaminants to groundwater or surface water supply.	H	H
M08	Homesteads - Rural - Machine Shops	Spills, leaks, or improper handling of solvents, fuels, and other materials or chemicals during transportation, use, storage and disposal may impact the drinking water supply.	H	H
M09	Homesteads - Rural - Septic Systems <1/Acre	If not properly sited, designed, installed, and maintained, septic systems can impact drinking water. Use of drain cleaners and dumping household hazardous wastes can result in groundwater contamination.	L	L
M10	Injection Wells/Drywells/ Sumps - Class V UICs	Shallow injection wells may transport untreated wastewater (process or storm water) directly into groundwater and impact drinking water.	H	M
M11	Kennels - > 20 Pens	Improper storage, management, and disposal of animal wastes and wastewater in areas of concentrated animals may impact drinking water	L	M
M12	Military Installations	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply. May also contain ordnance or waste landfills/dump sites, as well as other potential contaminant sources.	H	H
M13	Random Dumpsites	Illegal trash and debris containing chemicals and hazardous materials may cause contamination to groundwater or surface water supply.	M	H
M14	River Recreation - Heavy Use	Inadequate disposal of human wastes may contribute bacteria and nutrients to the drinking water supply. Heavy use may contribute to streambank erosion causing turbidity. Fuel spills and emissions may also contribute to contamination of the drinking water supply.	L	M
M15	Sludge Disposal Areas	Improper management of sludge and wastewater may impact drinking water supply.	M	H
M16	Stormwater Retention Basins	Stormwater run-off may contain a wide variety of contaminants from residential, commercial/ industrial, and agricultural use areas.	M	H

MISCELLANEOUS LAND USES				
ID	**Type Of Activity**	**Potential Water Quality Impacts**	**GW Risk**	**SW Risk**
M17	Transmission Lines - Right-of-Ways	Construction and corridor maintenance may contribute to increased erosion and turbidity in drinking water supply. Over-application or improper handling of pesticides or fertilizers may impact drinking water supply.	L	H
M18	Transportation Corridors - Freeways/State Highways	Vehicle usage increases the risks for leaks or spills of fuels and other hazardous materials that may impact drinking water. Road building, maintenance, and usage may contribute to increased erosion and slope failure causing turbidity in drinking water source. Over-application or improper handling of pesticides or fertilizers may impact the drinking water supply.	M	H
M19	Transportation Corridors - Railroads	Rail transport increases the risks for leaks or spills of fuels and other hazardous materials that may impact drinking water. Installation and maintenance of tracks may contribute to increased erosion and slope failure causing turbidity in drinking water source. Over-application or improper handling of pesticides adjacent to tracks may impact the drinking water supply.	M	H
M20	Transportation Corridors - Right-of- Ways - Herbicide Use Areas	Over-application or improper handling of pesticides may impact drinking water supply.	M	H
M21	Transportation Corridors – River Traffic - Heavy	Heavy river usage may contribute to riverbank erosion and increased turbidity in drinking water supply. Fuel and other chemical leaks, spills and emissions may also contribute to drinking water contamination.	L	H
M22	Transportation Corridors – Stream Crossing - Perennial	Road building, maintenance, and usage may contribute to erosion and slope failure causing turbidity in drinking water source. Vehicle usage increases the risks of leaks or spills of fuels and other chemicals in highly sensitive areas. Over application or improper handling of pesticides in right-of-way may also impact drinking water source.	L	H
M23	UST - Confirmed Leaking Tanks - DEQ List	Existing contamination from spills, leaks, or improper handling of stored materials may impact the drinking water supply.	H	M
M24	UST - Decommissioned	Historic spills or leaks may impact the drinking water supply.	L	L
M25	UST - Non-Regulated Tanks - < 1,100 gals	Spills, leaks, or improper handling of stored materials may impact the drinking water supply.	H	M

MISCELLANEOUS LAND USES				
ID	**Type Of Activity**	**Potential Water Quality Impacts**	**GW Risk**	**SW Risk**
M26	UST - Not Yet Upgraded or Registered Tanks	Spills, leaks, or improper handling of stored materials may impact the drinking water supply.	H	M
M27	UST - Upgraded and/or Registered - Active	Spills or improper handling during tank filling or product distribution may impact the drinking water supply.	L	L
M28	UST - Status Unknown	Spills, leaks, or improper handling of stored materials may impact the drinking water supply.	H	M
M29	Upstream Reservoirs	During major storm events, reservoirs may contribute to prolonged turbidity for downstream intakes for drinking water. Construction, fluctuating water levels, and heavy waterside use can increase erosion and turbidity in reservoir/drinking water source.	L	M
M30	Wells/Abandoned Wells	Improperly installed or maintained wells and abandoned wells may provide a direct conduit for contamination to groundwater and drinking water source.	H	M
M31	Large Capacity Septic Systems –Class V UIC (serves >20)	If not properly sited, designed, installed, and maintained, septic systems can impact drinking water.	H	M
M50	Others (List)	The impacts of this potential contaminant source will be addressed during the enhanced inventory.		

TABLE 5-3

CITY OF WILSONVLLE
POTENTIAL CONTAMINANT SOURCE LIST

Site No.	Site Name	Address	Lat	Long	Type[1]	Risk id[2]	Risk Ranking	Remarks
1.	Trojan Enterprises Inc	Wilsonville	45.29050	-122.80450	ECSI	C50	High	Nature of contamination unknown; assume high risk because of cleanup
2.	Snowden, Julie	35960 NE Wilsonville Rd Newberg	45.25556	-122.87056	HOT	M24	Low	Cleanup completed
3.	Ion Control	17817 SW Corral Creek Rd Sherwood	45.29083	-122.86028	HWMS	R19	High	Trucking/garbage collection facility
4.	Bishop, B.	36860 NE Wilsonville Road Wilsonville	45.25694	-122.86083	HOT, LUST	M23	Medium	
5.	Broadacres Store	18536 Butteville Rd NE Aurora	45.26417	-122.84000	LUST	M23	Medium	
6.	Chaffey & Sons, Inc.	23512 Schultz Road NE Aurora	45.26000	-122.82944	LUST	M23	Medium	
7.	Grossen, Gary	10691 Main St NE Donald	45.22361	-122.84194	LUST	M24	Low	Cleanup completed
8.	Judy's Country Store	10650 Main St Donald	45.22361	-122.84250	LUST	M24	Low	Cleanup completed
9.	Porter Farm	33925 NE Kramien Road Newberg	45.28083	-122.89111	HOT, LUST	M23	Medium	Cleanup in process
10.	Task, Steven	12300 SW Moffitt Court Wilsonville	45.29000	-122.76000	LUST	M23	Medium	

Site No.	Site Name	Address	Lat	Long	Type[1]	Risk id[2]	Risk Ranking	Remarks
11.	Thompson, J.	7628 Champoeg Road NE Saint Paul	45.25167	-122.90639	HOT, LUST	M23	Medium	
12.	Century Meadows Sanitary System, Inc.	11570 Blue Heron Lane NE Aurora	45.26556	-122.82528	SIS	R20	High	High risk because of potential for wastewater spill
13.	Milky Way Dairy Inc.	19527 Case Rd. NE Aurora	45.21889	-122.87583	SIS	A07, A08	High	Dairy operation, assumed to have large grazing livestock and wastewater lagoons
14.	Todd Construction	Wilsonville	45.30071	-122.79211	SIS	C50	Medium	Assumed medium risk because nature of site activities unknown
15.	Wil-View Farms	15135 SW Wilsonville Road Wilsonville	45.26472	-122.84806	SIS, LUST	A04	High	Irrigated crops and trees
16.	City Of Wilsonville	30000 SW Town Center Loop E. Wilsonville	45.29403	-122.77561	UIC	M10	Medium	Soccer field
17.	JB Short Stop	JB Short Stop Wilsonville	45.29160	-122.80490	UIC	M10	Medium	
18.	Chaffey & Sons, Inc.	23512 Schultz Road NE Aurora	45.26000	-122.82944	UST, LUST	M23	Medium	
19.	Chevron USA Inc.	1915 SE Harrison Wilsonville	45.29290	-122.80370	UST, LUST	M23	Medium	
20.	Living Enrichment Center	5100 Crater Lake Avenue Wilsonville	45.29298	-122.81396	UST	M27	Low	
21.	T W D Inc	9205 SE Holgate Wilsonville	45.28960	-122.80862	HWMS, UST	R50/M27	Medium	Nature of hazardous materials unknown; assume medium risk

Site No.	Site Name	Address	Lat	Long	Type[1]	Risk id[2]	Risk Ranking	Remarks
22.	Trojan Enterprises Inc	Jewell Wilsonville	45.28990	-122.80510	HWMS, UST	R50/M27	Medium	Nature of hazardous materials unknown; assume medium risk
23.	West Linn Wilsonville School District	11265 SW Wilsonville Road Wilsonville	45.29000	-122.76000	UST	M27	Low	
24.	William A Callahan Center	29500 SW Grahams Ferry Road Wilsonville	45.29306	-122.81389	UST	M24	Low	Release cleanup completed
25.	Northwest Pipeline	Wilsonville					High	Not on DEQ list but included due to location under Willamette River upstream of WTP intake
26.	Oregon Parks & Recreation Department	7679 Champoeg Road, NE Saint Paul	45.25528	-122.92028	WPCF	R03	Medium	RV parks and campsite sewer systems

Notes:

1 Oregon DEQ PCS Inventory Category:

ECSI = Environmental Cleanup Site Information System
HWMS = Hazardous Waste Materials Storage
HOT = Heating Oil Tank
SIS = Water Quality
SWMS = Solid Waste Management Site
UIC = Underground Injection Control
WPCF = Water Pollution Control Facility

2 DEQ Risk Identification Number as identified in Table 5-2.

SECTION 6

SUSCEPTIBILITY ANALYSIS

METHODOLOGY

Susceptibility can be defined as the potential for contamination in the drinking water protection area to reach the intake on the surface water body being used by a public water system for drinking water purposes. Whether or not a particular drinking water source becomes contaminated depends on three major factors: 1) the occurrence of a facility or land use that releases contamination, 2) the location of the release, and 3) the hydrologic and/or soil characteristics in the watershed that allow the transport of the contaminants to the surface water body.

A susceptibility analysis is performed by overlaying the results of the potential contaminant source inventory with the map of the designated sensitive areas. The results of the inventory are analyzed in terms of land uses; the potential contaminant source time-of-travel relationship or proximity to the intake site; and their associated risk rating.

When several high or medium risk sources are located within the sensitive areas, the public water system may also be said to have a high overall susceptibility to contamination. If a public water system's drinking water source is determined to be of high susceptibility, it is recommended that the system identify those condition(s) that lead to the high susceptibility and take steps to protect the resource (e. g., reducing soil erosion, working directly with facility operators to implement sound management practices, etc.). Water systems with a low susceptibility should consider all identified factors that could lead to higher susceptibility in the future and take action to prepare a strategy to protect the resource in the future.

RESULTS

The results of the potential contamination source inventory are combined with the locations of the sensitive areas to determine the most susceptible areas within Wilsonville's Drinking Water Protection Area. The total number and types of potential contaminant sources within the sensitive areas are summarized in Table 6-1.

TABLE 6-1

POTENTIAL CONTAMINANT SOURCES SENSITIVITY BY LOCATION

Description	Number Within Sensitive Areas	Number Outside of Sensitive Areas	Total Number Within Drinking Water Protection Area
Higher and medium risk PCS sites	10	10	20
Higher risk PCS sites	5	1	6
Medium risk PCS sites	5	9	14
Lower risk PCS sites	3	3	6
Total PCS sites identified	13	13	26

Those areas where the moderate-to higher-risk potential contaminant sources fall within the sensitive areas are the most vulnerable. In general, potential contaminant sources within the sensitive areas show that the City of Wilsonville's surface water supply is moderately susceptible to contamination from the identified PCS sites. Six of the 10 medium to high risk PCS sites in the sensitive areas are associated with underground storage tanks. If properly managed, the real risk to surface water quality is relatively small. These sites pose a greater threat to groundwater quality than to surface water quality. Because the dominant soil types in this area are fine-grained, the likelihood that groundwater contaminated from underground storage tank releases would result in surface water contamination is perhaps less than the susceptibility analysis procedure would suggest. Nonetheless, the susceptibility analysis provides the City water system managers with information on where the greatest risk occurs and where to focus resources for protection.

SECTION 7

SUMMARY AND RECOMMENDATIONS

This assessment provides a basis for focusing limited resources within the community to protect the drinking water source. The delineation provides the community with information regarding the location of the land area that directly supplies the surface water intake, i.e., the Drinking Water Protection Area. The sensitive areas are those where potential contamination sources or land use activities, if present, have greater potential to have an impact on the water supply.

The results of this Source Water Assessment and the recommendations based on the results are summarized below.

- The City of Wilsonville's public water system historically produced groundwater from a wellfield. This wellfield now serves as an emergency backup and supplemental water system. A separate Source Water Assessment Report has been prepared for the groundwater supply wellfield.

- The new surface water system draws water from the Wilsonville River. The source of this water is the Willamette River Watershed. Wilsonville's Drinking Water Protection Area extends upstream a total of approximately 7.85 miles to include the area within the estimated 8-hour time of travel to the intake and encompasses a total area of approximately 34.4 square miles. Included in this area are all or portions of a number of tributaries to the main stem, including Corral, Mill, Spring Brook, Champoeg, Mission, Case, Ryan, and Yergen Creeks.

- Within the Wilsonville Drinking Water Protection Area, there are large areas identified as sensitive to contamination. Areas that are adjacent to the streams/river, areas that have high soil erosion potential, high runoff potential, high permeability, moderate to high landslide or debris flow potential, or higher-risk land uses associated with high potential contaminant source risk should all receive special considerations for protection.

- A review of the inventory and the sensitive areas indicates that the Wilsonville public water system has 26 identified potential contaminant sources within its Drinking Water Protection Area and 10 PCS sites identified as high or medium risk sources within the sensitive areas in the Drinking Water Protection Area.

- Due to the streamlined procedures for conducting the source water assessments, the results could potentially create a misperception that the "human activities" within the watersheds are higher risks than natural conditions or disturbances such as landslides and storm events. For example, it would be erroneous for communities to conclude that their source water was not at risk from natural conditions that produce sediments if there were no potential contamination sources identified within their watershed. It is recommended that the community take steps to ensure the natural conditions (both those identified in this assessment and any other additional areas identified by the community) within the watershed are considered when developing strategies for protection.

- The primary intent of this source water assessment is to provide the background information for the community to use in developing a local Drinking Water Protection Plan. The City of Wilsonville intends to assemble a team to assist in the development and implementation of a Drinking Water Protection Plan.

SECTION 8

REFERENCES CITED

Environmental Protection Agency, 1997. State Source Water Assessment and Protection Programs Guidance, US EPA Office of Water, EPA816-R-97-009, August 1997. http://www.epa.gov/ogwdw/swp.html

Natural Resource Conservation Service (NRCS). Soil Survey Geographic Database (SURGGO), National Cartography and Geospatial Center, Fort Worth, Texas. http://www.ftw.nrcs.usda.gov/ssurgo.html

Oregon Climate Service (OCS), 2002. College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, Oregon. http://www.ocs.orst.edu

Oregon Department of Environmental Quality, 2000. Source Water Assessment Report, Seaside Water Department, Oregon.

Oregon Department of Forestry, 2000. Debris Flow Hazard Maps. http://www.odf.state.or.us/gis/debris/html

Source Water Assessment Plan: Implementation of the Safe Drinking Water Act 1996 Amendments, 1999. Sheree Stewart, Oregon Department of Environmental Quality, and Dennis Nelson, Oregon Health Division, February 1999. http://www.waterquality.deq.state.or.us/wq

US Department of Agriculture (USDA) Soil Conservation Service, 1979. Soil Survey of Clackamas County Area, Oregon. Prepared in cooperation with U.S. Department of the Interior, Bureau of Land Management, and the Oregon Agricultural Experiment Station.

USDA Soil Conservation Service, 1972. Soil Survey of the Marion County Area, Oregon. Prepared in cooperation with the Oregon Agricultural Experiment Station.

USDA Soil Conservation Service, 1974. Soil Survey of the Yamhill Area, Oregon. Prepared in cooperation with the Oregon Agricultural Experiment Station.

USDA Soil Conservation Service, 1981. Soil Survey of the Washington County Area, Oregon. Prepared in cooperation with the Oregon Agricultural Experiment Station.

US Geological Survey, Oregon Hydrologic Units. http://oregon.usgs.gov/data_dir/orehuclist.html

US Geological Survey, 2002. Surface water data for Oregon, monthly streamflow data. http://waterdata.usgs.gov/or/nwis/monthly/?site_no=14198000&agency_cd=USGS

Washington Forest Practices Board. 1993. Standard Methodology for Conducting Watershed Analysis, Version 2.0, October 1993.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)
Portland Sub District, Oreg.

File No. { h...tion .... Field 4-1980.00

Rating table for Willamette River at Wilsonville, Oreg.

, from Oct. 1, , 1962, to ...., 19 , from ...., 19 , to ...., 19

Gage height (Feet)	Discharge (Cfs)	Difference (Cfs)	Gage height (Feet)	Discharge (Cfs)	Difference (Cfs)	Gage height (Feet)	Discharge (Cfs)	Difference (Cfs)	Gage height (Feet)	Discharge (Cfs)	Difference (Cfs)	Gage height (Feet)	Discharge (Cfs)	Difference (Cfs)	Gage height (Feet)	Discharge (Cfs)	Difference (Cfs)	Gage height (Feet)	Discharge (Cfs)	Difference (Cfs)
51.00			53.00	6,600	280	55.00	12,700	350	57.00	20,300	410	59.00	29,000	470	61.00	39,000	550	63.00	50,000	600
.10			.10	6,880		.10	13,050	350	.10	20,710		.10	29,470		.10	39,550		.10	50,600	
.20			.20	7,160		.20	13,400	360	.20	21,120		.20	29,940		.20	40,100		.20	51,200	
.30			.30	7,440		.30	13,760	370	.30	21,530		.30	30,410		.30	40,650		.30	51,800	
.40			.40	7,720	280	.40	14,130		.40	21,940	410	.40	30,880	470	.40	41,200		.40	52,400	
.50	3,100	200	.50	8,000	290	.50	14,500		.50	22,350	430	.50	31,350	490	.50	41,750		.50	53,000	
.60	3,300	210	.60	8,290		.60	14,870	370	.60	22,780		.60	31,840		.60	42,300		.60	53,600	
.70	3,510		.70	8,580		.70	15,240	380	.70	23,210		.70	32,330		.70	42,850		.70	54,200	
.80	3,720	210	.80	8,870		.80	15,620		.80	23,640		.80	32,820		.80	43,400		.80	54,800	
.90	3,930	220	.90	9,160	290	.90	16,000		.90	24,070	430	.90	33,310	490	.90	43,950	550	.90	55,400	600
52.00	4,150	230	54.00	9,450	300	56.00	16,380		58.00	24,500	440	60.00	33,800	510	62.00	44,500		64.00	56,000	
.10	4,380	230	.10	9,750	300	.10	16,760	380	.10	24,940		.10	34,310		.10	45,050		.10	56,600	
.20	4,610	240	.20	10,050	310	.20	17,140	390	.20	25,380		.20	34,820		.20	45,600		.20	57,200	
.30	4,850		.30	10,360	320	.30	17,530		.30	25,820		.30	35,330		.30	46,150		.30	57,800	
.40	5,090	240	.40	10,680	320	.40	17,920		.40	26,260	440	.40	35,840	510	.40	46,700		.40	58,400	
.50	5,330	250	.50	11,000	330	.50	18,310	390	.50	26,700	460	.50	36,350	530	.50	47,250		.50	59,000	
.60	5,580		.60	11,330	330	.60	18,700	400	.60	27,160		.60	36,880		.60	47,800		.60	59,600	
.70	5,830	250	.70	11,660	340	.70	19,100		.70	27,620		.70	37,410		.70	48,350		.70	60,200	
.80	6,080	260	.80	12,000	350	.80	19,500		.80	28,080		.80	37,940		.80	48,900		.80	60,800	
.90	6,340	260	.90	12,350	350	.90	19,900	400	.90	28,540	460	.90	38,470	530	.90	49,450	550	.90	61,400	600

This table is applicable for open-channel conditions. It is based on 11 discharge measurements ~~made during~~ 56, 94, 101, 103, 119-123, 127, 128 .... and is .... well defined between .... cfs and .... cfs.

During low-flow periods, stage-discharge relation may be changed artificially by dam, powerplant and boat locks at Oregon City and West Linn.

1 of 2

Comp by Jmf date 2-14-64
Ckd by PM date 3-20-64
Table No. 2

GPO 883782

03/06/02 07:44 503 251 3470 USGS WRD OR DIST → HARZA NORTHWEST 002

UNITED STATES D[illegible]RTMENT OF THE INTERIOR
GEOLOGICAL SURVEY [illegible]TER RESOURCES DIVISION)
Portland Sub District, Oreg.

File No. Was[illegible]on .... Field [illegible] 1980.00

Rating table for Willamette River at Wilsonville, Oreg.

from Oct 1, 1962, to ...., 19...., from ...., 19...., to ...., 19....

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
65.00	62,000	600	67.00	74,500	650	69.00	88,000	750	71.00	103,000	800	73.00	119,000	800	75.00	135,000	800	77.00	151,500	8,500
.10	62,600		.10	75,150		.10	88,750		.10	103,800		.10	119,800		.10	135,800		78.0	160,000	9,000
.20	63,200		.20	75,800		.20	89,500		.20	104,600		.20	120,600		.20	136,600		79.0	169,000	9,000
.30	63,800		.30	76,450		.30	90,250		.30	105,400		.30	121,400		.30	137,400		80.0	178,000	9,000
.40	64,400		.40	77,100		.40	91,000		.40	106,200		.40	122,200		.40	138,200		81.0	187,000	10,000
.50	65,000		.50	77,750		.50	91,750		.50	107,000		.50	123,000		.50	139,000		82.0	197,000	10,000
.60	65,600		.60	78,400		.60	92,500		.60	107,800		.60	123,800		.60	139,800		83.0	207,000	10,000
.70	66,200		.70	79,050		.70	93,250		.70	108,600		.70	124,600		.70	140,600		84.0	217,000	10,000
.80	66,800		.80	79,700		.80	94,000		.80	109,400		.80	125,400		.80	141,400		85.0	227,000	10,000
.90	67,400	600	.90	80,350	650	.90	94,750	750	.90	110,200	800	.90	126,200	800	.90	142,200	800	86.0	237,000	10,000
66.00	68,000	650	68.00	81,000	700	70.00	95,500		72.00	111,000		74.00	127,000		76.00	143,000	850	87.0	247,000	11,000
.10	68,650		.10	81,700		.10	96,250		.10	111,800		.10	127,800		.10	143,850		88.0	258,000	11,000
.20	69,300		.20	82,400		.20	97,000		.20	112,600		.20	128,600		.20	144,700		89.0	269,000	11,000
.30	69,950		.30	83,100		.30	97,750		.30	113,400		.30	129,400		.30	145,550		90.0	280,000	12,000
.40	70,600		.40	83,800		.40	98,500		.40	114,200		.40	130,200		.40	146,400		91.0	292,000	12,000
.50	71,250		.50	84,500		.50	99,250		.50	115,000		.50	131,000		.50	147,250		92.0	304,000	12,000
.60	71,900		.60	85,200		.60	100,000		.60	115,800		.60	131,800		.60	148,100		93.0	316,000	13,000
.70	72,550		.70	85,900		.70	100,750		.70	116,600		.70	132,600		.70	148,950		94.0	329,000	13,000
.80	73,200		.80	86,600		.80	101,500		.80	117,400		.80	133,400		.80	149,800		95.0	342,000	
.90	73,850	650	.90	87,300	700	.90	102,250	750	.90	118,200	800	.90	134,200	800	.90	150,650	850			

This table is applicable for open-channel conditions. It is based on .... discharge measurements made during .... and is .... well defined between .... cfs and .... cfs.

Comp by JMA date 2-14-64
Ckd by PM date 3-20-64
Table No. 2

Extended above 90.0 ft by WAH, 6-2-66
2 of 2

9-207
(Rev. 1-65)

Q = 28,800

KM = 7.85 m.
12,640 m

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

Station 14-1980

Discharge measurements of Willamette River at Wilsonville, Oreg., during the year ending Sept. 30, 1968

No.	Date	Made by—	Width	Area	Mean velocity	Gage height	Discharge	Rating 2 Shift adj.	Percent diff.	Method	Number meas. sections	Gage height change	Time	Meas. rated			REMARKS
	1967		Feet	Sq ft	Fps	Feet	Cfs	Feet				Feet	Hr				
164	Sept. 14	Higbee & Word	665	17,000	0.44	55.64	7,440	-2.30	-1.5	2/.8	27	-.03	1.0	G			
165	Oct. 9	Smith Word	650	16,600	.57	55.16	9,540	-1.10	-0.9	2/.8	27	0	1.6	G/F			
166	Nov. 29	Kraus + Laenen	660	17,900	.97	56.74	17,400	-.50	+0.6	2/.8	27	0	1.7	G/F			cable meas.
167	Nov. 29	Kallio, Higbee Bjork, Kielhorn	720	18,000	.98	56.74	17,600	-.50	+1.7	2/.8	28	0	1.3				Boat meas.
	1968																
168	Jan. 4	Colebank + Higbee	670	18,500	1.37	58.22	25,300	-.20	+2.8	2/.8	27	-.07	1.8	G			
169	Feb. 14	Mollinat Smith	675	18,200	1.16	57.54	21,100	-.30	-0.9	2/.8	27	-.03	1.4	G			
170	Mar. 21	Kraus + Gallino	675	18,400	1.07	57.33	19,600	-.30	-3.9	2/.8	27	-.07	1.8	—			
171	May 8	Kraus Smith	650	16,100	.58	54.26	9,310	-.30	-0.2	2/.8	26	±.01	1.6	G			
172	June 20	Gallino Smith	660	16,200	.45	54.35	7,240	-1.10	-0.8	2/.8	26	0	1.7	F			
173	Aug. 8	Smith & Hart	660	16,100	.40	54.10	6,360	-1.20	+0.3	2/.8	26	-.01	1.6	F			[illegible]
174	Aug. 29	Smith + Lystrom	680	18,200	.90	57.15	16,300	-1.20	+0.6	2/.8	27	-.02	1.5	F			
175	Sept. 18	Kielhorn & Hart	660	17,200	.65	56.00	11,100	-1.50	+0.9	2/.8	27	-.02	1.5	F			
176	Oct. 2	Lystrom & Hart	650	17,300	.76	56.07	13,100	-1.00	+1.6	2/.8	27	+.01	2.0	Q			
177	Oct. 31	B.B. Smith	675	18,600	1.30	58.47	24,200	-.50	-0.8	2/.8	27	-.05	1.5	Q			

Copied by Crew Computed by — Checked by WAH

U.S. GOVERNMENT PRINTING OFFICE : 1965 OF—761-053
917-893

$H \cong 52.673\, e^{0.0804 \cdot V}$ ($R^2 = 0.9836$)

$Q \approx 18557 \cdot V^{1.2072}$ ($R^2 = 0.99$)

9-207 (Rev. ...)

UNITED STATES DE[illegible]TMENT OF THE INTERIOR

GEOLOGICAL SURVE[illegible] (WATER RESOURCES DIVISION)

Portland Sub-district, Oreg.

Station 14-198[illegible]

Discharge measurements of Willamette River at Wilsonville, Oreg., during the year ending Sept. 30, 19[illegible]

No.	Date	Made by—	Width	Area	Mean velocity	Gage height	Discharge	Rating 2 Shift adj.	Percent diff.	Method	Number meas. sections	Gage height change	Time	Meas. rated			REMARKS
	1968		Feet	Sq ft	Fps	Feet	Cfs	Feet				Feet	Hr				
175	Sept.18	Kielhorn + Hart	660	17,200	0.65	56.00	11,100	-1.50	+0.9	.2/.8	27	-.02	1.5	F.			
176	Oct.2	Lystrom + Hart	650	17,300	.76	56.07	13,100	-1.00	+1.6	.2/.8	27	+.01	2.0	G.			
177	Oct.31	Smith	675	18,600	1.30	58.47	24,200	-.50	-0.8	.2/.8	27	-.05	1.5	G.			
178	Dec.6	Hubbard + Hart	715	28,200	3.65	71.63	103,000	-.50	-1.0	.2/.8	29	+.13	2.0	E.			
	1969																
179	Feb.5	Kielhorn & Hart	690	20,700	1.84	60.85	38,100	—	-0.3	.2/.8	28	+.03	1.2	G			
180	Mar.12	Kielhorn & Hart	665	18,100	1.12	57.02	20,300	—	-0.5	.2/.8	28	0	1.0	G			50c - cable
181	Apr.25	Gallino & Hart	660	18,000	1.10	57.04	19,800	—	-3.4	.2/.8	27	-.02	1.2	E			30C
182	June5	G.B. Smith	660	17,600	1.02	56.20	18,000	—	+5	.2/.8	27	-.03	1.4	G.			30C.
183	July16	Gallino + Admasu	660	16,700	.52	55.31	8,640	-1.50	-2.9	.2/.8	27	0	1.2	G.			30C.
184	Aug.29	Gallino + Laenen	655	16,500	.59	54.87	9,750	-.80	+0.9	.2/.8	27	0	1.4	G.			30C.
185																	
185	Oct.8	Hubbard + Hart	650	17,300	.77	55.98	13,400	-.80	+0.8	.2/.8	27	—	—	G.			30C.

Copied by EHS, WAH Computed by EHS, WAH Checked by RLK

U.S. GOVERNMENT PRINTING OFFICE : 1963 OF—761-083 917-893

9-207
(Rev. 1-65)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

Station No. 14-1980

Discharge measurements of Willamette River at Wilsonville, Oreg., during the year ending Sept. 30, 19

No.	Date	Made by—	Width	Area	Mean velocity	Gage height	Discharge	Rating 2 Shift adj.	Rating 2 Percent diff.	Method	Number meas. sections	Gage height change	Time	Meas. rated	REMARKS
	1969		Feet	Sq ft	Fps	Feet	Cfs	Feet				Feet	Hr		
184	Aug. 29	Gallino & Laenen	655	16,500	0.59	54.87	9,750	-.80	+0.9	.2/.8	27	0	1.4	G.	
185	Oct. 8	Hubbard & Hart	650	17,300	.77	55.98	13,400	-.80	+0.8	.2/.8	27	—	—	G.	
186	Nov. 26	Gallino & Smith.	665	17,900	.99	57.11	17,800	-.80	+1.1	.2/.8	27	-.02	1.5	G.	
	1970														
187	JAN. 6	ReMillard & Kielhorn	680	17,800	1.43	58.62	25,400	-.40	-0.4	.2/.8	27	-.03	1.3	G	
188	Feb. 9	Kielhorn Smith	700	24,600	3.25	68.65	79,900	-.80	-1.2	.2/.8	28			G.	Recorders Removed: Bridge Construction.
189	Mar. 27	Gallino Smith	650	15,600	.77		12,000			.2/.8	27		1.3	G	
190	May 13	Hubbard & Smith	685	18400	1.39		25,500			.2/.8	27		1.6	G	
191	June 25	Gallino & Smith	650	15,900	0.40		6,420			.2/.8	26		1.5	F/P	
192	Aug 21	Kielhorn & Smith	660	16,100	.46		7,480			.2/.8	27		1.5	F/P	
193	Sept. 30	Remillard & Smith	665	16,400	.50		8,340			.2/.8	27		1.5	F/P	
194	Nov. 5	G.B. Smith	670	17,400	.77	56.12	13,400			.2/.8	27	.04	2.2	G/F	New site

Copied by........ Computed by........ Checked by........

9-… (R…

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)
Portland Subdistrict, Oregon

Station No. 14-19

Discharge measurements of Willamette River at Wilsonville, Oreg. during the year ending Sept. 30, 1

No.	Date	Made by—	Width (Feet)	Area (Sq ft)	Mean velocity (Fps)	Gage height (Feet)	Discharge (Cfs)	Rating 2: Shift adj. (Feet)	Rating 2: Percent diff.	Method	Number meas. sections	Gage height change (Feet)	Time (Hr)	Meas. rated			REMARKS
	1970																
193	Sept. 30	Smith & ReMillard	665	16,400	0.51	54.96	8,340	-1.3	-1.4	2/.8	27	+.01	3.5	F/P			
194	Nov. 5	Smith	670	17,400	.77	56.12	13,400	-0.9	-0.7	2/.8	27	-.04	2.2	G/F			
195	Dec. 17	Kielhorn & Smith	700	25,100	3.03	67.55	76,000	—	-2.7	2/.8	28	+.08	1.4	G			
	1971																
196	Feb. 4	Gallino & Smith	695	22,500	2.52	63.82	56,600	—	+3.1	2/.8	28	±.02	1.6	G.			H.W.M = 76.13 by hand " = 75.87 on tap
197	Mar. 17	Smith & Curtiss	690	23,800	2.68	65.53	63,900	—	-2.0	2/.8	28	-.12	1.5	G			
198	Apr. 30	Hubbard & Smith	675	19,400	1.38	58.87	26,700	-.30	-1.1	2/.8	27	0	1.2	G.			
199	June 7	Kielhorn & Smith	665	18,100	1.01	56.83	18,100	-.30	-1.6	2/.8	26	-.02	1.3	G.			
200	July 13	Bell & Smith	650	16,000	0.55	54.40	8,770	-.65	+0.6	2/.8	25	+.01	1.7	G/F			
201	July 13	do	650	16,000	0.54	54.39	8,680	-.65	-0.2	2/.8	25	-.01	1.2	G/F			
202	Aug 10	Anderson & Smith	650	16,100	0.43	54.45	6,880	-1.40	+2.1	2/.8	26	+.02	1.6	G/F			
203	Aug 10	do	650	16,100	0.41	54.46	6,560	-1.40	-3.1	2/.8	26	±.02	1.8	G/F			
204	Sept. 1	Curtiss & Smith	670	16,900	0.69	55.71	11,600	-1.20	+5	2/.8	27	0	1.7	G/F			
205	Oct. 6	Anderson & Smith	675	17,300	0.80	56.75	13,900	-1.20	-5	2/.8	27	-.02	1.9	G/F			

Copied by Crew   Computed by G.B.S.   Checked by A.L.

U.S. GOVERNMENT PRINTING OFFICE : 1965 OF—761-053
917-893

FORM [illegible]
(Rev. 11-69)

UNITED STATES DEPARTMENT OF THE INTERIOR

Station N 4-1980

GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)
DISCHARGE MEASUREMENT SUMMARY SHEET

Discharge measurements of Willamette River at Wilsonville, Oreg., during the year ending Sept. 30, 1972

No.	Date 1971	Made by—	Width (Feet)	Area (Sq ft)	Mean velocity (Fps)	Gage height (Feet)	Discharge (Cfs)	Rating V: Shift adj. (Feet)	Rating V: Percent diff.	Method	Number meas. sections	Gage height change (Feet)	Time (Hr)	Meas. rated	Air	H_2O	REMARKS
204	Sept. 1	Curtiss & Smith	670	16,900	0.69	54.76	11,600	—	-2.5	.2/.8	27	0	1.7	G/F	—	—	
205	Oct. 6	Anderson & Smith	675	17,300	.80	56.75	13,900	-1.3	-2.8	.2/.8	27	-.02	1.9	G	—	—	
206	Nov. 23	do	675	18,900	1.32	58.85	24,900	-.8	+0.8	.2/.8	27	+.06	1.6	G	—	—	
207	Dec. 20	do	695	23,300	2.81	65.55	65,400	—	+0.2	.2/.8	27	-.06	1.4	G			H.W.M. = 72.22
208	Feb. 9	do	675	20,800	1.83	60.63	38,100	—	+3.0	.2/.8	27	-.03	1.4	G			H.W.M. = 80.48
209	Mar. 21	Hubbard & Smith	695	24,500	2.78	65.46	68,200	—	+5	.2/.8	27	-.09	1.5	G			
210	Apr. 26	Anderson & Smith	680	20,700	1.83	61.02	37,900	—	-3.1	.2/.8	27	+.04	1.6	G			
211	June 7	Hubbard + Smith	670	18,100	1.11	57.18	20,100	—	-4.3	.2/.8	27	0	1.2	G.			
212	July 20	Anderson + Tippett	650	16,800	.42	55.42	7,110	-2.2	-1.5	.2/.8	27	-.01	1.8	—			
213	Sept. 6	Anderson + Gallino	655	17,200	.66	55.97	11,400	-1.4	+1.8	.2/.8	27	0	1.4	G.			
214	Oct. 20	Bjork, Smith, + Flowers	665	16,800	.57	55.48	9,640	-1.4	-0.5	.2/.8	27	0	1.9	G.			

Copied by Crew Computed by SWA Checked by E.H.S.

U.S. GOVERNMENT PRINTING OFFICE : 1969 OP—761-083
88 4-9118

FORM 9-207
(Rev. 11-69)

UNITED STATES DEPARTMENT OF THE INTERIOR

Station No. [illegible]-1980.0[illegible]

GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)
DISCHARGE MEASUREMENT SUMMARY SHEET

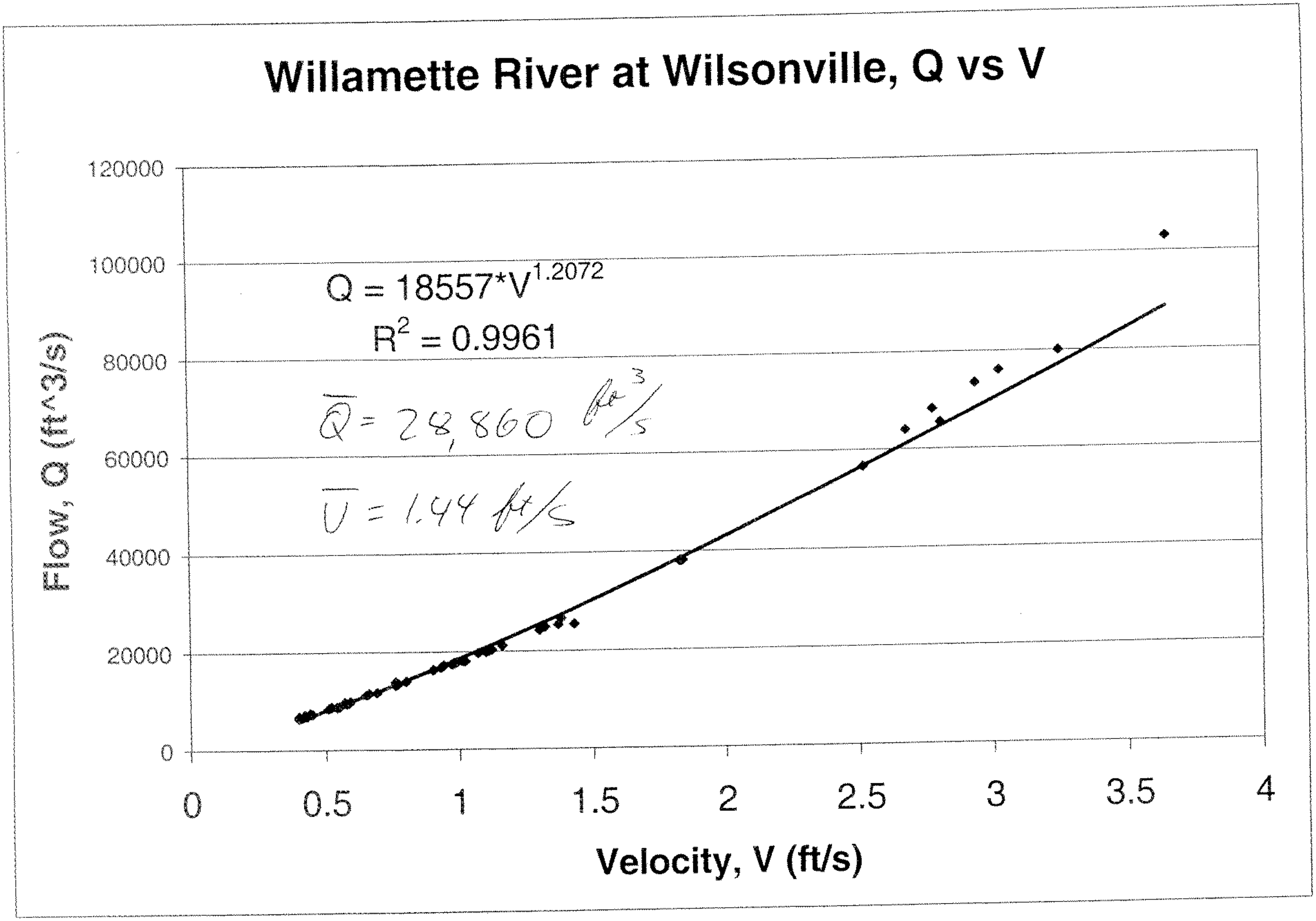
Discharge measurements of Willamette River at Wilsonville, Oreg., during the year ending Sept. 30, 19 73

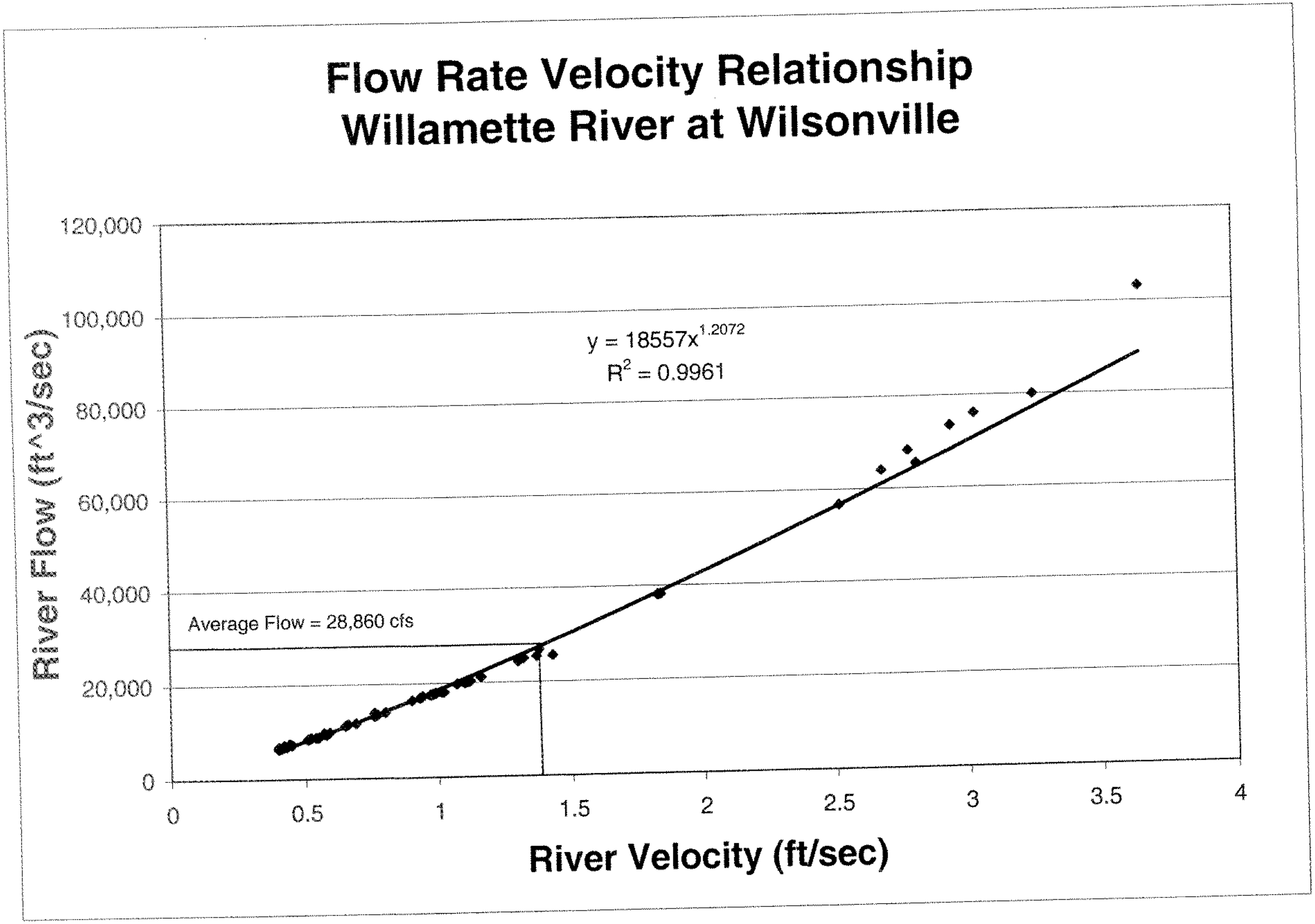
No.	Date	Made by—	Width	Area	Mean velocity	Gage height	Discharge	Rating 2 Shift adj.	Percent diff.	Method	Number meas. sections	Gage height change	Time	Meas. rated	Air	H_2O	REMARKS
	1972		Feet	Sq ft	Fps	Feet	Cfs	Feet				Feet	Hr				
213	Sept. 6	Anderson & Gallino	655	17,200	0.66	55.97	11,400	-1.4	+1.8	.2/.8	27	0	1.4	G			
214	Oct. 20	Flowers Bjork Smith	665	16,800	.57	55.48	9,640	-1.4	-0.5	.2/.8	27	0	1.9	G		54	
215	Dec. 1	Anderson Smith	665	18,100	.76	57.15	13,800	-1.8	-0.7	.2/.8	27	-.03	1.4	G			
216	Jan. 16	Smith & Londe	700	25,000	2.94	67.26	73,400	-0.4	-0.3	.2/.8	27	-.03	1.5	G			OG. H.W.M. = 71.4
217	Mar. 1	do	675	18,000	.93	57.00	16,800	-0.9	0	.2/.8	27	+.03	1.3	G			
218	Apr. 5	do	665	18,100	.94	57.01	17,100	-0.9	+1.8	.2/.8	26	-.02	1.2	G			
219	May 15	Bjork & Smith	660	16,100	.42	54.26	6,840	-1.2	+1.0	.2/.8	27	+.11	1.7	G/F			
220	July 20	Kielhorn & Gallino	660	16,700	.40	54.70	6,760	-1.6	-1.7	.2/.8	27	0	1.4	G.			

Station discontinued July 31, 1973

Copied by .... Computed by .... Checked by ....

U. S. GOVERNMENT PRINTING OFFICE : 1971 O - 441-141


Willamette River at Wilsonville, Q vs V
Q = 18557*V^1.2072
R^2 = 0.9961
Q̄ = 28,860 ft^3/s
Ū = 1.44 ft/s
Flow, Q (ft^3/s)
120000
100000
80000
60000
40000
20000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
Velocity, V (ft/s)



Flow Rate Velocity Relationship
Willamette River at Wilsonville
River Flow (ft^3/sec)
120,000
100,000
80,000
60,000
40,000
20,000
0
y = 18557x^1.2072
R^2 = 0.9961
Average Flow = 28,860 cfs
0
0.5
1
1.5
2
2.5
3
3.5
4
River Velocity (ft/sec)

Sensitive Soils with High Erosion Potential (Sorted by Soil Type)

Soil Type Description	County	Area (m^2)	Area (mi^2)	Area (acre)
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Washington	18,943	0.007	4.68
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Washington	106,571	0.041	26.33
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	64,742	0.025	16.00
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	65,323	0.025	16.14
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	117,249	0.045	28.97
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	39,569	0.015	9.78
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	39,541	0.015	9.77
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	136	-	0.03
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	8,908	0.003	2.20
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	93,745	0.036	23.16
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	195,178	0.075	48.23
LAURELWOOD SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	18,538	0.007	4.58
LAURELWOOD SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	17,808	0.007	4.40
LAURELWOOD SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	248,641	0.096	61.44
LAURELWOOD SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	103,620	0.040	25.60
LAURELWOOD SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	97,058	0.037	23.98
LAURELWOOD SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	32,169	0.012	7.95
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	105,072	0.041	25.96
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	58,137	0.022	14.37
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	146,240	0.056	36.14
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	72,664	0.028	17.96
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	65,467	0.025	16.18
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	50,842	0.020	12.56
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	501,418	0.194	123.90
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	101,817	0.039	25.16
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	71,336	0.028	17.63
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	44	-	0.01
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	109,141	0.042	26.97
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	16,442	0.006	4.06
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	12,528	0.005	3.10
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	28,111	0.011	6.95
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	98,472	0.038	24.33
	Total	**2,705,468**	**1.041**	**668.52**

Sensitive Soils with High Runoff Potential (Sorted by Soil Type)

Soil Type Description	County	Area (m^2)	Area (mi^2)	Area (acre)
COVE SILTY CLAY LOAM	Clackamas	74,095	0.03	18.31
COVE SILTY CLAY LOAM	Clackamas	63,320	0.02	15.65
COVE SILTY CLAY LOAM	Clackamas	546,438	0.21	135.03
COVE SILTY CLAY LOAM	Clackamas	105,371	0.04	26.04
DAYTON SILT LOAM	Clackamas	15,656	0.01	3.87
DAYTON SILT LOAM	Clackamas	44,392	0.02	10.97
AMITY SILT LOAM	Clackamas	5	-	-
AMITY SILT LOAM	Clackamas	279	-	0.07
AMITY SILT LOAM	Clackamas	799	-	0.20
AMITY SILT LOAM	Clackamas	27,530	0.01	6.80
AMITY SILT LOAM	Clackamas	9,412	0.00	2.33
AMITY SILT LOAM	Clackamas	7,598	0.00	1.88
AMITY SILT LOAM	Clackamas	40,469	0.02	10.00
AMITY SILT LOAM	Clackamas	57,519	0.02	14.21
AMITY SILT LOAM	Clackamas	29,660	0.01	7.33
AMITY SILT LOAM	Clackamas	247,627	0.10	61.19
AMITY SILT LOAM	Clackamas	24,094	0.01	5.95
AMITY SILT LOAM	Clackamas	104,083	0.04	25.72
HUBERLY SILT LOAM	Clackamas	56,228	0.02	13.89
HUBERLY SILT LOAM	Clackamas	70,804	0.03	17.50
HUBERLY SILT LOAM	Clackamas	45,632	0.02	11.28
HUMAQUEPTS, PONDED	Clackamas	53,333	0.02	13.18
HUMAQUEPTS, PONDED	Clackamas	181,283	0.07	44.80
HUMAQUEPTS, PONDED	Clackamas	17,346	0.01	4.29
HUMAQUEPTS, PONDED	Clackamas	83,523	0.03	20.64
MCBEE VARIANT LOAM	Clackamas	334,584	0.13	82.68
MCBEE VARIANT LOAM	Clackamas	92,087	0.04	22.76
WAPATO SILTY CLAY LOAM	Clackamas	127,344	0.05	31.47
WAPATO SILTY CLAY LOAM	Clackamas	49,577	0.02	12.25
WAPATO SILTY CLAY LOAM	Clackamas	42,610	0.02	10.53
WAPATO SILTY CLAY LOAM	Clackamas	17,505	0.01	4.33
WAPATO SILTY CLAY LOAM	Clackamas	13,873	0.01	3.43
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	2,071	0.00	0.51
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	778,299	0.30	192.32
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	90,751	0.04	22.43
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	76,708	0.03	18.95
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	40,180	0.02	9.93
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	1,026,375	0.40	253.62
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	111,962	0.04	27.67
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	267,056	0.10	65.99
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	57,905	0.02	14.31
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	143,627	0.06	35.49
AMITY SILT LOAM	Yamhill	20,630	0.01	5.10
AMITY SILT LOAM	Yamhill	21,366	0.01	5.28
AMITY SILT LOAM	Yamhill	49,754	0.02	12.29
AMITY SILT LOAM	Yamhill	12,113	0.01	2.99
BASHAW CLAY	Marion	408,102	0.16	100.84
DAYTON SILT LOAM	Marion	120,521	0.05	29.78
DAYTON SILT LOAM	Marion	40,550	0.02	10.02
DAYTON SILT LOAM	Marion	17,758	0.01	4.39
DAYTON SILT LOAM	Marion	58,731	0.02	14.51
DAYTON SILT LOAM	Marion	6,337	0.00	1.57
DAYTON SILT LOAM	Marion	42,824	0.02	10.58
DAYTON SILT LOAM	Marion	8,350	0.00	2.06
DAYTON SILT LOAM	Marion	13,914	0.01	3.44
DAYTON SILT LOAM	Marion	16,764	0.01	4.14
DAYTON SILT LOAM	Marion	11,553	0.00	2.85
DAYTON SILT LOAM	Marion	22,550	0.01	5.57
DAYTON SILT LOAM	Marion	21,648	0.01	5.35
DAYTON SILT LOAM	Marion	14,319	0.01	3.54
DAYTON SILT LOAM	Marion	136,195	0.05	33.65

Soil Type Description	County	Area (m^2)	Area (mi^2)	Area (acre)
DAYTON SILT LOAM	Marion	8,823	0.00	2.18
DAYTON SILT LOAM	Marion	10,597	0.00	2.62
DAYTON SILT LOAM	Marion	13,297	0.01	3.29
DAYTON SILT LOAM	Marion	1,442	0.00	0.36
HOLCOMB SILT LOAM	Marion	63,279	0.02	15.64
LABISH SILTY CLAY LOAM	Marion	19,946	0.01	4.93
SEMIAHMOO MUCK	Marion	34,483	0.01	8.52
WAPATO SILTY CLAY LOAM	Marion	83,337	0.03	20.59
WAPATO SILTY CLAY LOAM	Marion	27,277	0.01	6.74
WAPATO SILTY CLAY LOAM	Marion	28,309	0.01	7.00
WAPATO SILTY CLAY LOAM	Marion	5,220	0.00	1.29
WAPATO SILTY CLAY LOAM	Marion	6,758	0.00	1.67
WAPATO SILTY CLAY LOAM	Marion	73,636	0.03	18.20
WAPATO SILTY CLAY LOAM	Marion	39,278	0.02	9.71
WAPATO SILTY CLAY LOAM	Marion	52,139	0.02	12.88
WAPATO SILTY CLAY LOAM	Marion	925,644	0.36	228.73
WAPATO SILTY CLAY LOAM	Marion	399,959	0.15	98.83
WAPATO SILTY CLAY LOAM	Marion	55,581	0.02	13.73
WAPATO SILTY CLAY LOAM	Marion	238,801	0.09	59.01
WAPATO SILTY CLAY LOAM	Marion	116,408	0.05	28.76
WAPATO SILTY CLAY LOAM	Marion	214,216	0.08	52.93
WAPATO SILTY CLAY LOAM	Yamhill	5,688	0.00	1.41
WAPATO SILTY CLAY LOAM	Yamhill	54,287	0.02	13.41
WAPATO SILTY CLAY LOAM	Yamhill	131,723	0.05	32.55
	Totals:	8,833,112	3.41	2,182.73

Sensitive Soils with High Permeability

Soil Type Description	County	Area (m^2)	Area (mi^2)	Area (acre)
NEWBERG FINE SANDY LOAM	Clackamas	81,423	0.031	20.12
NEWBERG FINE SANDY LOAM	Clackamas	44,116	0.017	10.90
CANDERLY SANDY LOAM, 0 TO 3 PERCENT SLOPES	Clackamas	172,198	0.066	42.55
	Total:	**297,737**	**0.11**	**73.57**

Areas of Moderate Landslide Hazard (Sorted by Soil Type)

Soil Type Description	County	Area (m^2)	Area (mi^2)	Area (acre)
JORY SILTY CLAY LOAM, 2 TO 7 PERCENT SLOPES	Washington	0.6	0.000	0.00
JORY SILTY CLAY LOAM, 2 TO 7 PERCENT SLOPES	Washington	3,141.0	0.001	0.78
JORY SILTY CLAY LOAM, 7 TO 12 PERCENT SLOPES	Washington	13.4	0.000	0.00
HELVETIA SILT LOAM, 3 TO 8 PERCENT SLOPES	Clackamas	4,098.8	0.002	1.01
HELVETIA SILT LOAM, 3 TO 8 PERCENT SLOPES	Clackamas	1,408.2	0.001	0.35
HELVETIA SILT LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	4,429.3	0.002	1.09
HELVETIA SILT LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	2,190.1	0.001	0.54
HELVETIA SILT LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	52,120.3	0.020	12.88
HELVETIA SILT LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	4,462.2	0.002	1.10
HELVETIA SILT LOAM, 15 TO 30 PERCENT SLOPES	Clackamas	3,644.9	0.001	0.90
JORY SILTY CLAY LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	37,153.2	0.014	9.18
JORY SILTY CLAY LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	30,379.4	0.012	7.51
JORY SILTY CLAY LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	13,368.8	0.005	3.30
JORY SILTY CLAY LOAM, 15 TO 30 PERCENT SLOPES	Clackamas	222.5	0.000	0.05
JORY SILTY CLAY LOAM, 15 TO 30 PERCENT SLOPES	Clackamas	16,367.6	0.006	4.04
JORY SILTY CLAY LOAM, 15 TO 30 PERCENT SLOPES	Clackamas	0.4	0.000	0.00
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	64,742.3	0.025	16.00
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	117,248.7	0.045	28.97
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	39,569.1	0.015	9.78
JORY SILTY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	135.9	0.000	0.03
LAURELWOOD SILT LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	1,585.5	0.001	0.39
LAURELWOOD SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	18,538.3	0.007	4.58
LAURELWOOD SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	248,640.6	0.096	61.44
LAURELWOOD SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	103,619.9	0.040	25.60
NEKIA SILTY CLAY LOAM, 2 TO 8 PERCENT SLOPES	Clackamas	17,151.0	0.007	4.24
NEKIA SILTY CLAY LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	13,184.2	0.005	3.26
NEKIA SILTY CLAY LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	65,379.8	0.025	16.16
SALEM SILT LOAM, 0 TO 7 PERCENT SLOPES	Clackamas	2,787.0	0.001	0.69
SAUM SILT LOAM, 3 TO 8 PERCENT SLOPES	Clackamas	11,136.3	0.004	2.75
SAUM SILT LOAM, 3 TO 8 PERCENT SLOPES	Clackamas	3,451.0	0.001	0.85
SAUM SILT LOAM, 3 TO 8 PERCENT SLOPES	Clackamas	12,651.0	0.005	3.13
SAUM SILT LOAM, 3 TO 8 PERCENT SLOPES	Clackamas	26,367.9	0.010	6.52
SAUM SILT LOAM, 3 TO 8 PERCENT SLOPES	Clackamas	3,603.9	0.001	0.89
SAUM SILT LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	10,155.5	0.004	2.51
SAUM SILT LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	44,232.4	0.017	10.93
SAUM SILT LOAM, 8 TO 15 PERCENT SLOPES	Clackamas	36,411.2	0.014	9.00
SAUM SILT LOAM, 15 TO 30 PERCENT SLOPES	Clackamas	9,584.0	0.004	2.37
SAUM SILT LOAM, 15 TO 30 PERCENT SLOPES	Clackamas	474.3	0.000	0.12
SAUM SILT LOAM, 15 TO 30 PERCENT SLOPES	Clackamas	213.4	0.000	0.05
SAUM SILT LOAM, 15 TO 30 PERCENT SLOPES	Clackamas	135,149.0	0.052	33.40
SAUM SILT LOAM, 15 TO 30 PERCENT SLOPES	Clackamas	4,586.1	0.002	1.13
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	58,136.6	0.022	14.37
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	72,663.5	0.028	17.96
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	65,467.2	0.025	16.18
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	50,842.3	0.020	12.56
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	71,335.9	0.028	17.63
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	44.0	0.000	0.01
SAUM SILT LOAM, 30 TO 60 PERCENT SLOPES	Clackamas	16,441.7	0.006	4.06
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	2,071.0	0.001	0.51
XEROCHREPTS AND HAPLOXEROLLS, VERY STEEP	Clackamas	76,707.7	0.030	18.95
JORY CLAY LOAM, 2 TO 7 PERCENT SLOPES	Yamhill	2,198.1	0.001	0.54
JORY CLAY LOAM, 2 TO 7 PERCENT SLOPES	Yamhill	31,249.0	0.012	7.72
JORY CLAY LOAM, 2 TO 7 PERCENT SLOPES	Yamhill	37,377.2	0.014	9.24
JORY CLAY LOAM, 2 TO 7 PERCENT SLOPES	Yamhill	637.3	0.000	0.16
JORY CLAY LOAM, 2 TO 7 PERCENT SLOPES	Yamhill	2,462.4	0.001	0.61
JORY CLAY LOAM, 2 TO 7 PERCENT SLOPES	Yamhill	8,734.9	0.003	2.16
JORY CLAY LOAM, 2 TO 7 PERCENT SLOPES	Yamhill	1,674.5	0.001	0.41
JORY CLAY LOAM, 2 TO 7 PERCENT SLOPES	Yamhill	10,819.4	0.004	2.67
JORY CLAY LOAM, 7 TO 12 PERCENT SLOPES	Yamhill	14,891.3	0.006	3.68
JORY CLAY LOAM, 7 TO 12 PERCENT SLOPES	Yamhill	613.5	0.000	0.15

Soil Type Description	County	Area (m^2)	Area (mi^2)	Area (acre)
JORY CLAY LOAM, 7 TO 12 PERCENT SLOPES	Yamhill	10,475.7	0.004	2.59
JORY CLAY LOAM, 7 TO 12 PERCENT SLOPES	Yamhill	4,356.8	0.002	1.08
JORY CLAY LOAM, 7 TO 12 PERCENT SLOPES	Yamhill	941.0	0.000	0.23
JORY CLAY LOAM, 7 TO 12 PERCENT SLOPES	Yamhill	423.7	0.000	0.10
JORY CLAY LOAM, 7 TO 12 PERCENT SLOPES	Yamhill	3,278.4	0.001	0.81
JORY CLAY LOAM, 7 TO 12 PERCENT SLOPES	Yamhill	1,207.5	0.000	0.30
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	26,742.9	0.010	6.61
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	35,781.7	0.014	8.84
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	1,055.5	0.000	0.26
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	26,334.9	0.010	6.51
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	952.3	0.000	0.24
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	8,826.8	0.003	2.18
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	15,811.0	0.006	3.91
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	42,487.9	0.016	10.50
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	4,297.8	0.002	1.06
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	7,996.2	0.003	1.98
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	22,978.7	0.009	5.68
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	6,433.7	0.002	1.59
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	635.0	0.000	0.16
JORY CLAY LOAM, 12 TO 20 PERCENT SLOPES	Yamhill	11,887.8	0.005	2.94
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	1,758.7	0.001	0.43
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	13,272.8	0.005	3.28
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	3.7	0.000	0.00
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	19,492.7	0.008	4.82
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	35,589.7	0.014	8.79
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	7,067.6	0.003	1.75
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	810.7	0.000	0.20
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	20,801.3	0.008	5.14
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	23,367.4	0.009	5.77
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	7,998.3	0.003	1.98
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	7,656.2	0.003	1.89
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	1,549.7	0.001	0.38
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	4.3	0.000	0.00
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	8,851.7	0.003	2.19
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	1,796.1	0.001	0.44
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	39,868.0	0.015	9.85
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	7,678.3	0.003	1.90
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	14,195.3	0.005	3.51
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	1,249.4	0.000	0.31
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	5,939.0	0.002	1.47
JORY CLAY LOAM, 20 TO 30 PERCENT SLOPES	Yamhill	6,874.7	0.003	1.70
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	141,072.0	0.054	34.86
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	208.7	0.000	0.05
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	345,414.2	0.133	85.35
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	103.4	0.000	0.03
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	4,356.3	0.002	1.08
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	47,693.8	0.018	11.79
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	101,030.3	0.039	24.97
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	141,777.3	0.055	35.03
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	103,894.0	0.040	25.67
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	53,044.0	0.020	13.11
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	3,017.6	0.001	0.75
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	3,303.6	0.001	0.82
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	11,531.9	0.004	2.85
JORY CLAY LOAM, 30 TO 60 PERCENT SLOPES	Yamhill	68,390.6	0.026	16.90
MCBEE SILTY CLAY LOAM	Marion	30,037.9	0.012	7.42
NEKIA CLAY LOAM, 2 TO 7 PERCENT SLOPES	Yamhill	3,263.5	0.001	0.81
NEKIA CLAY LOAM, 2 TO 7 PERCENT SLOPES	Yamhill	4,961.4	0.002	1.23
NEKIA CLAY LOAM, 7 TO 20 PERCENT SLOPES	Yamhill	26,752.1	0.010	6.61
NEKIA CLAY LOAM, 7 TO 20 PERCENT SLOPES	Yamhill	16,783.0	0.006	4.15
NEKIA CLAY LOAM, 7 TO 20 PERCENT SLOPES	Yamhill	14,349.5	0.006	3.55
NEKIA CLAY LOAM, 7 TO 20 PERCENT SLOPES	Yamhill	80,404.2	0.031	19.87
NEKIA CLAY LOAM, 7 TO 20 PERCENT SLOPES	Yamhill	66,818.2	0.026	16.51

Soil Type Description	County	Area (m^2)	Area (mi^2)	Area (acre)
NEKIA CLAY LOAM, 7 TO 20 PERCENT SLOPES	Yamhill	17,541.3	0.007	4.33
NEKIA CLAY LOAM, 7 TO 20 PERCENT SLOPES	Yamhill	4,824.5	0.002	1.19
NEKIA CLAY LOAM, 7 TO 20 PERCENT SLOPES	Yamhill	8,345.7	0.003	2.06
NEKIA CLAY LOAM, 7 TO 20 PERCENT SLOPES	Yamhill	8,095.4	0.003	2.00
STONY LAND	Yamhill	230.8	0.000	0.06
STONY LAND	Yamhill	177.5	0.000	0.04
STONY LAND	Yamhill	22,237.4	0.009	5.49
STONY LAND	Yamhill	14,377.0	0.006	3.55
STONY LAND	Yamhill	8,669.8	0.003	2.14
TERRACE ESCARPMENTS	Marion	151,327.2	0.058	37.39
WAPATO SILTY CLAY LOAM	Marion	6,758.1	0.003	1.67
WOODBURN SILT LOAM, 3 TO 12 PERCENT SLOPES	Marion	2,786.0	0.001	0.69
WOODBURN SILT LOAM, 12 TO 20 PERCENT SLOPES	Marion	64.2	0.000	0.02
WOODBURN SILT LOAM, 12 TO 20 PERCENT SLOPES	Marion	54,006.1	0.021	13.35
YAMHILL SILT LOAM, MODERATELY SHALLOW, 7 TO 20 PERCENT SLOPES	Yamhill	770.5	0.000	0.19
	Total Area:	**3,715,116.4**	**1.43**	**918.04**