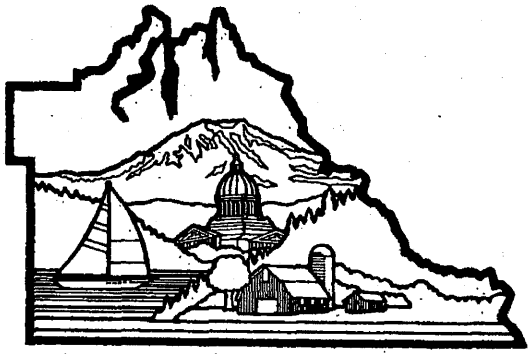
McAllister Springs Geologically Sensitive Area

Resource Protection Report

DRAFT

June 1990



THURSTON COUNTY

WASHINGTON

Since 1852

Prepared by:

Thurston County
Department of Public Health
and Social Services
Environmental Health Division

and

Thurston County
Office of Water Quality and
Resource Management

PLEASE NOTE THESE CORRECTIONS IN THE McALLISTER RESOURCE PROTECTION REPORT

PAGE NUMBER	PARAGRAPH	ITEM
ES-2	ITEM 3 UNDER VULNERABILITY	"fill" should be changed to "till"
45	PARAGRAPH 2 UNDER BOUNDARIES	FIGURE 12 should be FIGURE 13
BIBLIOGRAPHY	ADD THESE REFERENCES	Lettenmaier, Dennis P. 1990A First Interim Report on Analysis of The Groundwater Monitoring Program for McAllister Springs, 8 pages. Lettenmaier, Dennis P. 1990B Second Report on Analysis of The Groundwater Monitoring Program for McAllister Springs, 6 pages.

McALLISTER SPRINGS
GEOLOGICALLY SENSITIVE AREA

RESOURCE PROTECTION REPORT

DRAFT

JUNE 1990

PREPARED BY:

THURSTON COUNTY DEPARTMENT OF PUBLIC HEALTH AND SOCIAL SERVICES

and

THURSTON COUNTY OFFICE OF WATER QUALITY AND RESOURCE MANAGEMENT

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EXECUTIVE SUMMARY

I. INTRODUCTION

In 1988 the Thurston County Board of Health adopted a Resolution (H-5-88) which established the McAllister Springs Geologically Sensitive Area (GSA). This action was taken in response to concerns that the rapid growth and development occurring within the area could affect the water quality of McAllister Springs and the associated aquifer system.

The GSA established standards for the review and approval of Building Site Applications and Preliminary Building Site Applications. These standards resulted in a moratorium on certain land use activities, and resulted in more stringent requirements for others.

The GSA resolution is due to sunset on August 15, 1990, prior to which the Board of Health must determine if it should be retained, modified or eliminated.

II. AREA CHARACTERISTICS

McAllister Springs is the water supply to some 47,000 people, and the ground water system that feeds it provides domestic water for thousands more. The system has the capacity to serve twice as many people as are currently served.

The area within the McAllister GSA has developed in a mix of land uses. The primary land uses are agriculture and residential development, with lesser areas of forestry, commercial and industrial sites. A large portion of the area, over 45 percent, lies vacant. It appears that residential use will dominate the area in the future.

The capture zone (the area which contributes to McAllister Spring's ground water flow) encompasses a large portion of the area south and east of Lacey, where rapid population growth has been taking place. Land use activities associated with this growth are of concern as they can impact water quality through the direct application or injection of materials to the ground water.

III. FINDINGS

Since the GSA was established, a substantial amount of research has occurred to further evaluate the ground water system that feeds McAllister Springs and the associated water systems. The following is a summary of the findings of this research:

VULNERABILITY

Review by consultants and county staff have confirmed the entire GSA is vulnerable to pollution from land use activities and other sources. The major findings, which are based on the geologic and hydrologic conditions are:

- The entire area is susceptible to contamination
- Both the shallow and deep aquifer levels are susceptible to pollution (The Vashon advance and Salmon Springs formations).
- Existing geologic formations (aquitards or fill) do not stop pollutants from migrating throughout the aquifer system.
- Shallow wells are more susceptible than deep ones, but wells of all depths can be polluted.
- A lag time of several years exists between when water and pollutants enter the ground water system and when they are discharged at McAllister Springs.

The following examples illustrate the areas vulnerability:

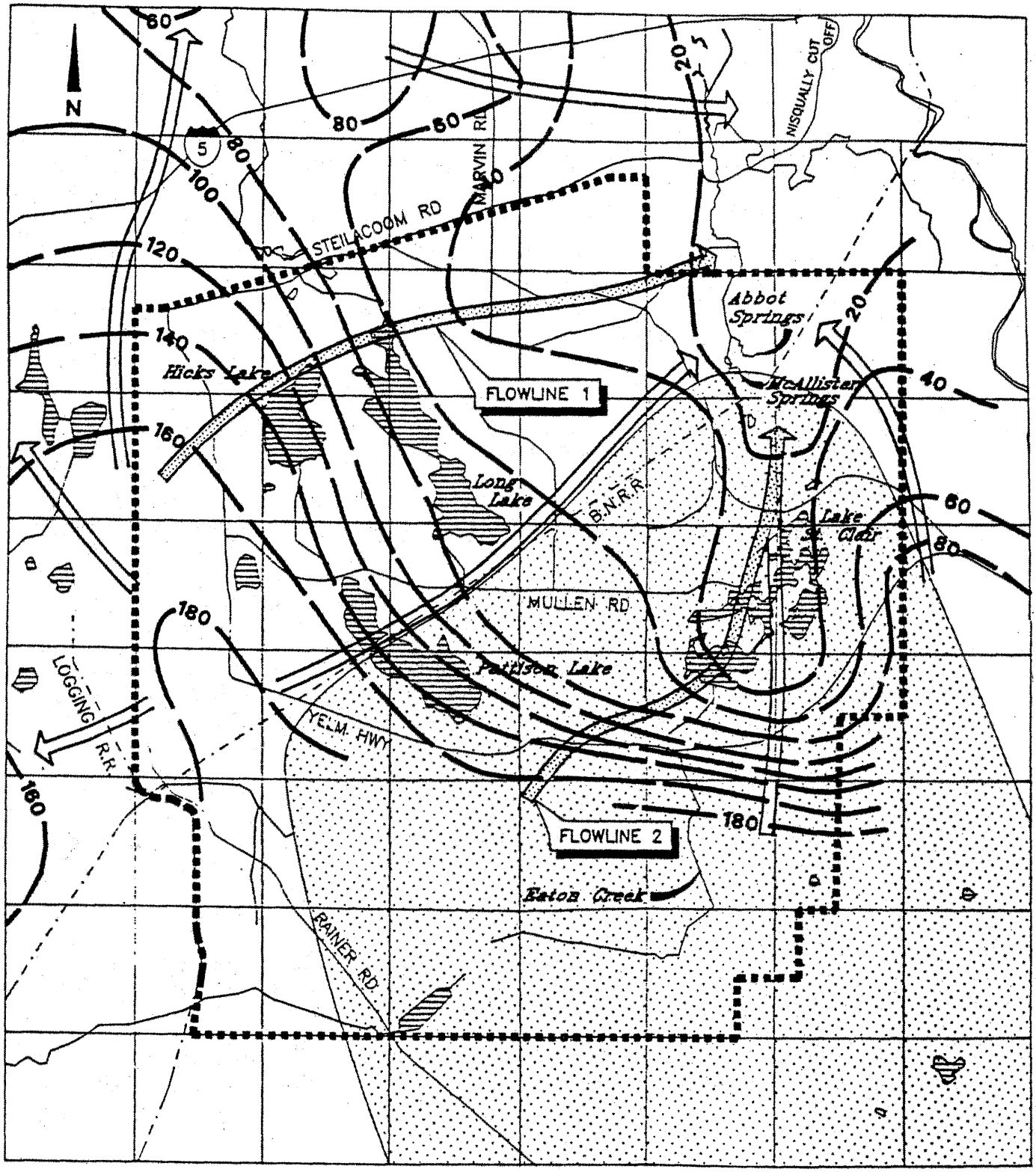
- Statistical evaluations confirm that the nitrate levels at McAllister Springs are going up.
- Pesticides associated with agricultural areas have been found in wells along the south side of Pattison Lake.
- The nitrate levels in wells within the McAllister area have been found to be significantly higher than other areas sampled within the Ground Water Management Area.

BOUNDARIES

Work done on behalf of Thurston County by hydrogeological consultants indicates that the recharge area or capture zone for McAllister Springs is smaller than the original GSA boundary (FIGURE ES-1).

- The capture zone is generally south of the springs.
- The capture zone is within Thurston County.
- Areas outside of the capture zone discharges at locations other than McAllister Springs.
- Eaton Creek and Lake St. Clair contribute as much as 20-40 percent of McAllister's flow.

FIGURE ES - 1



LEGEND:

- Equipotential (Feet)
- Horizontal Flow Component
- Approximate Capture Zone for McAllister Springs

0 6000 12000

SCALE IN FEET

FIGURE ES - 1

PIEZOMETRIC ELEVATIONS IN -50 TO 50 FT. ZONE

THURSTON COUNTY/McALLISTER GSA

PROJECT NO 903-1072.005 DWG NO 34090 DATE 6/5/90 DRAWN DJH APPROVED DB

Golder Associates

POLLUTION SOURCES

Research on the McAllister area indicates that its ground water system is at risk from pollutants associated within existing land use activities and transportation.

- Septic systems contribute the majority of nitrate within the GSA, followed by agriculture.
- Nitrogen loads from septic systems are sufficient to cause water quality violations within the GSA.
- The spill of hazardous materials pose a large risk for the area ground water system, with shallow wells near the spill area being at greatest risk.
- Hazardous material contamination associated with chronic storm water loading poses a risk to many areas within the GSA.
- Densities of more than one unit per acre can result in development which will result in the violation of water quality standards for area wells.
- Leaching pesticides are still being used within the GSA, and the Voluntary Best Management Practices (BMP's) for pesticides and fertilizers are not being fully utilized.
- The use of hazardous materials, pesticides and fertilizers by individuals and households poses a large, though non quantifiable, risk to ground water.

IV. RECOMMENDATIONS:

The following are the summarized recommendations to the Board of Health:

A. BOUNDARIES:

It is recommended that the McAllister GSA Boundary be changed to reflect the capture zone as defined by the work of Golder Associates, the hydrogeologic consultants to the County.

NOTE: Throughout the remainder of the Recommendations section of this report, the term **capture zone** will reflect the boundary within which the following actions are proposed.

B. AGRICULTURAL PRACTICES:

SPECIAL AREA REGULATIONS

It is recommended that the Board of Health (the Board) support and promote the development of a Special Area Regulations proposal by the Ground Water Advisory Committee (GWAC). If the proposed actions by the GWAC are not sufficient to protect the McAllister resource, additional measures should be considered by the Board of Health.

OTHER AGRICULTURAL MEASURES

* An annual review of the BMP'S for the Use of Pesticides and Fertilizers should be conducted by the Cooperative Extension Office of Thurston County.

* New land uses which include landscaping or major uses of fertilizers and pesticides to should develop Best Management Practices (BMP's) prior to project approval.

* The County should increase coordination with area schools and parks for BMP education and information purposes.

C. SEWAGE DISPOSAL

The following recommendations will be made to the Board regarding the permitting, use and design of on-site sewage disposal systems within the McAllister capture zone .

Septic System Standards:

* Pressure distribution will be required for all new septic systems, and for the repair of existing systems.

* A maximum excavation or trench depth of 30 inches should be required for the drainfield.

* At least 36 inches of separation shall be maintained between the trench bottom and any perching layer or zone, or any impervious layer.

Operational Permit Requirements:

An Operational Permit shall be required for all new septic systems and those that are repaired. This permit may be revoked when any of the following conditions exist:

* Public sewer becomes available.

* The on-site system fails to meet the maintenance and operational requirements set forth in the operational permit.

Density and Land Use Considerations:

The following density and land use recommendations should apply to new development within the capture zone :

* Density within the one year travel time zone of McAllister Springs should be limited to one unit per five acres, with no provisions for increase, regardless of changes in sewer status or UGMA boundaries.

* The maximum allowable density for new subdivisions using on-site sewage disposal systems within the capture zone will be one unit per five acres. Clustering and the use of community septic systems will be required within the Urban Growth Management Area (UGMA).

* As areas are connected to sewers, the underlying zoning densities will apply providing that the storm water facilities are designed to mitigate water quality impacts.

* For nonresidential uses, BSA's may be approved for the equivalent of the designed sewage flow of a single family residence.

* BSA's may be approved for vested lots which either received final approval prior to August 15, 1988, or were included in a fully completed application for preliminary subdivision, short subdivision, or large lot subdivision submitted to the Thurston County Planning Department prior to August 15, 1988.

Extension of Sewer Service:

* Homes and other facilities utilizing on-site sewage disposal systems will be required to connect to sewers when they become available.

* Sewer service should be accelerated to areas where ground water is believed to be at risk as a result of on-site sewage disposal systems.

Other Items:

* Thurston County should work to eliminate the discharge of sewage and waste water on the Burlington Northern railway tracks by Burlington Northern and Amtrak.

* Thurston County should request that the State quickly develop guidelines for septic systems that incorporate nitrogen removal methods.

D. STORM WATER AND HAZARDOUS MATERIALS:

The following recommendations are made regarding the control of storm water facilities and the use storage and disposal of hazardous materials and waste.

* Restrict truck traffic within the capture zone area by limiting truck traffic to certain, designated truck routes.

* The designated truck routes within the capture zone should be given high priority for road improvement and maintenance work.

* High risk intersections along the designated truck routes should be identified and storm water systems with containment capabilities designed and installed at these intersections.

* Burlington Northern Railroad should be advised as to the vulnerable nature of the ground water in the capture zone area and be requested to enhance their track surveillance and maintenance in this area.

* The County should coordinate emergency management strategies and procedures with Burlington Northern in the event a spill or accident occurs on their railroad tracks within the capture zone .

* The storm water Drainage Design Manual should be adopted and applied to all new proposed development in the capture zone.

* The zoning ordinance should be amended to prohibit land uses which use, handle, or store hazardous materials as part of their operations.

* No future areas should be zoned for commercial or industrial purposes within the capture zone .

* Special use permits and/or home based industry applications which involve the use, handling, or storage of hazardous materials should not be allowed.

* Existing land uses which become nonconforming as a result of zoning ordinance revisions regarding the use, handling or storage or hazardous materials should not be allowed to expand or intensify.

* The County should not utilize any chemical methods for the purposes of maintaining County properties such as roadsides or parks within the capture zone . Other entities such as the Department of Transportation, Fort Lewis, Burlington Northern, and Bonneville Power Administration should be requested to eliminate chemical usage in the area.

* The Department of Ecology should deny all permit applications for aquatic pesticide use in Lake St. Clair unless the application is reviewed by both Ecology and the County and there is concurrence that the pesticide use will be consistent with the ground water protection efforts for this area.

OTHER LAND USES:

Prohibit mining/mineral extraction permits within the capture zone.

E. MONITORING/DATA COLLECTION:

The following items should be included in the implementation phase and funding package for the North Thurston County Ground Water Management Area.

* All wells used for water level monitoring in the capture zone should be surveyed for elevation, and water levels should be measured in all the wells. This should be done in order to update the potentiometric surface maps of this area.

* Ground water quality monitoring should continue on the fifteen wells within the GSA previously monitored by the health department. Monitoring should occur twice a year to track changes in the area's water quality.

* Multilevel monitoring wells should be installed in the areas of high nitrogen concentrations and along the flow line from the Pattison Lake area towards McAllister Springs. These wells should be monitored to determine the vertical distribution of nitrogen in the various hydrogeologic units.

* A permanent, continuous stream-gaging station should be installed on Eaton Creek where it enters Lake St. Clair to assess the nitrogen loading to the lake.

CHAPTER 1: BACKGROUND INFORMATION AND AREA CONDITIONS

I. INTRODUCTION

McAllister Springs and its aquifer system, as delineated in 1988, lie in northern Thurston County, south and east of the City of Lacey (see FIGURE 1). Recent concern has centered around this area due to the tremendous resource represented by the springs and its associated aquifer system.

From 1980 to 1989, census figures show that Thurston county was one of the fastest growing counties in the State of Washington. The part of the county which had shown the highest growth rate was the area that was south of I-5, west of the Nisqually River, east of Lacey and north of Yelm Highway. The vast majority of this growth is in the form of residences utilizing on-site sewage disposal systems. This area comprises a large percent of the McAllister Springs recharge area. This growth trend, when combined with the value and magnitude of the resource, and concerns over its vulnerability, led the Thurston County Board of Health (the Board) to adopt a resolution which established the McAllister Springs Geologically Sensitive Area (GSA).

The Board's action (H-5-88), defined a geographic area as the GSA (FIGURE 2). It also established special standards for the Environmental Health Division of the Public Health and Social Services Department (Environmental Health) to use in the acceptance, review and approval of building site approvals and preliminary building site approvals. The use of these standards resulted in a moratorium on certain land use activities using on-site sewage disposal systems within the McAllister GSA.

Resolution H-5-88 was established for a two year period, ending August 15, 1990, prior to which it will be reviewed by the Board. At that time the Board will determine if it should be retained, modified, or eliminated in order to best serve public health. This paper will serve to provide background information to the Board and to assist them in the decision process.

II. AREA CHARACTERISTICS

MAGNITUDE OF THE RESOURCE

McAllister Springs currently is the domestic water source for some 47,000 people. Thousands of other residents are served by wells that are drilled into the aquifers that feed the springs. The McAllister ground water system provides water for most of the residents of Olympia, as well as many people in Lacey and eastern

F. EDUCATION

The recommended public education plan includes the following elements:

Target Group: **Homeowners**

* Issues: gardening practices, septic systems maintenance and household hazardous waste.

* Major Theme: save money and take actions to protect water quality

* Activities:

  Train master gardeners to assist in outreach efforts

  Hold workshops on gardening practices and household hazardous waste disposal

  Distribute materials on homeowner BMP's

  Conduct a briefing tour of the area for residents and property owners

Target Geographical Area: **Lake St. Clair**

The initial priority area will be Lake St. Clair because of its location in the area of the one year travel time of pollutants to the springs. The program will later extend to other portions of the capture zone.

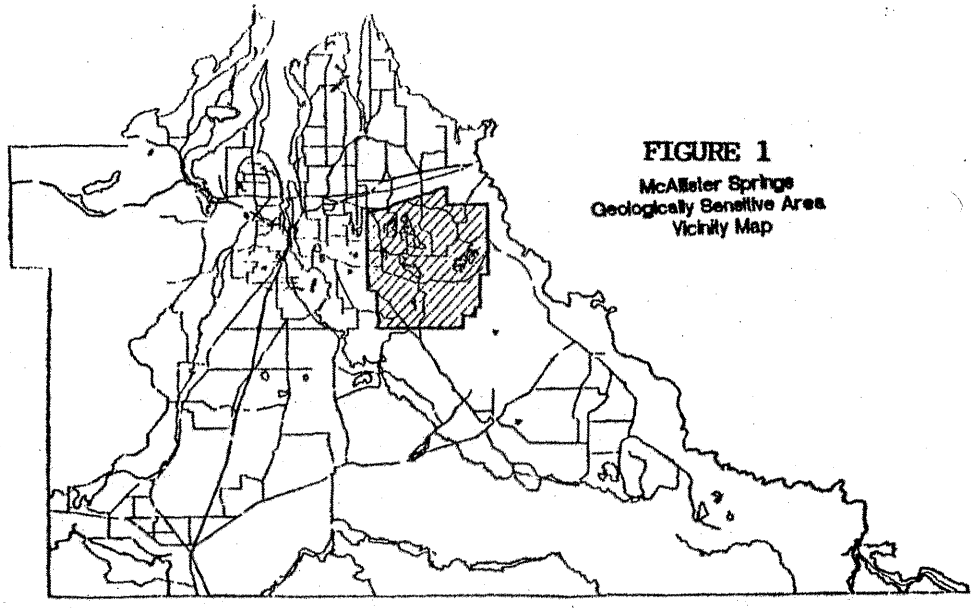
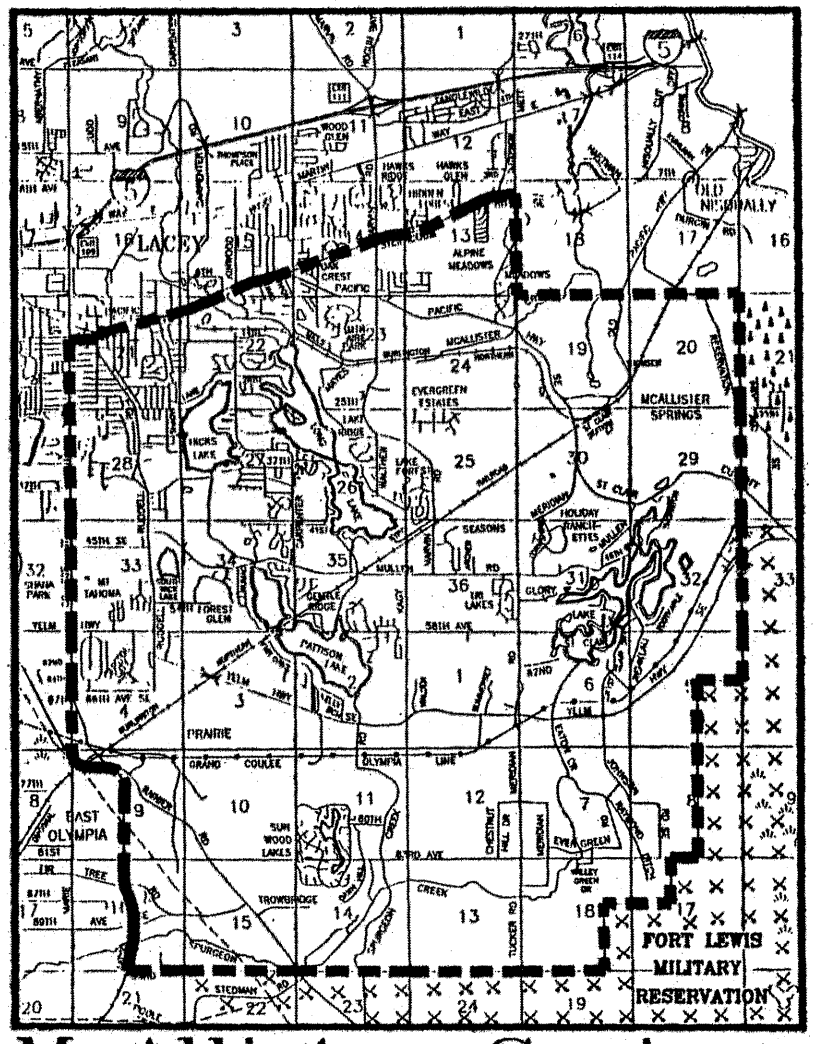


FIGURE 1
McAllister Springs
Geologically Sensitive Area
Vicinity Map

FIGURE 2



McAllister Springs
Geologically Sensitive Area

Boundary

MAP CREATED BY:
AUGUST 15, 1998 THURSTON GEOGRAPHICAL INFORMATION FACILITY

Thurston County, and it will be the major source of water to provide for their future needs. It is estimated that the springs can provide water to twice as many people as are currently being served (Thurston County Health 1988).

McAllister Springs itself produces an average of 16.5 million gallons per day (11,500 gallons per minute), which is almost ten times the capacity of the largest producing wells in the area. Other water systems, ranging in size from one to hundreds of service connections, are developed within the McAllister Aquifer system.

LAND USE

The McAllister Springs GSA has developed in a variety of land uses, most of which are associated with a rural or residential environment. As depicted on TABLE 1 and FIGURES 3-8, the majority of the recharge area is vacant, with agriculture and residential development being the next largest uses. The north portion of the area is where most of the residential development has occurred, while agriculture dominates to the south. The substantial amounts of vacant land are rather equally interspersed through the recharge area. Smaller amounts of property are used for other purposes, such as industrial, commercial, and forestry purposes.

TABLE 1

LAND USE ACREAGE*
WITHIN THE McALLISTER SPRINGS GSA
-1987-

CATEGORY	ACREAGE
VACANT	9,335
AGRICULTURE	4,254
RESIDENTIAL	3,267
FORESTRY	1,425
COMMERCIAL	97
INDUSTRIAL	51
UNDEFINED	2,409
LAKES	1,109
TOTAL ACREAGE	19,538

* SOURCE: THURSTON GEOGRAPHICAL INFORMATION FACILITY

FIGURE 3

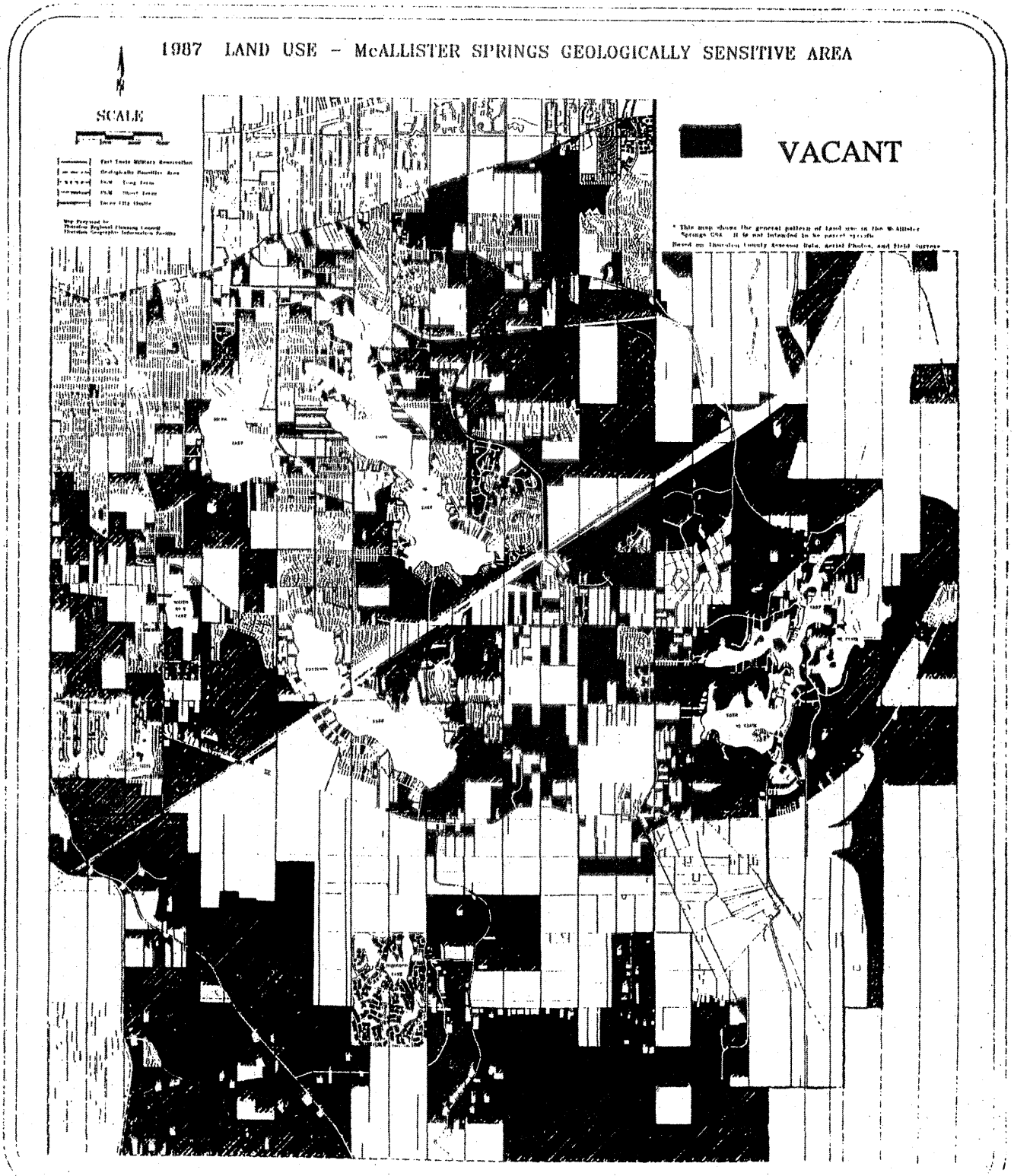

1987 LAND USE - McALLISTER SPRINGS GEOLOGICALLY SENSITIVE AREA
SCALE
VACANT

FIGURE 4

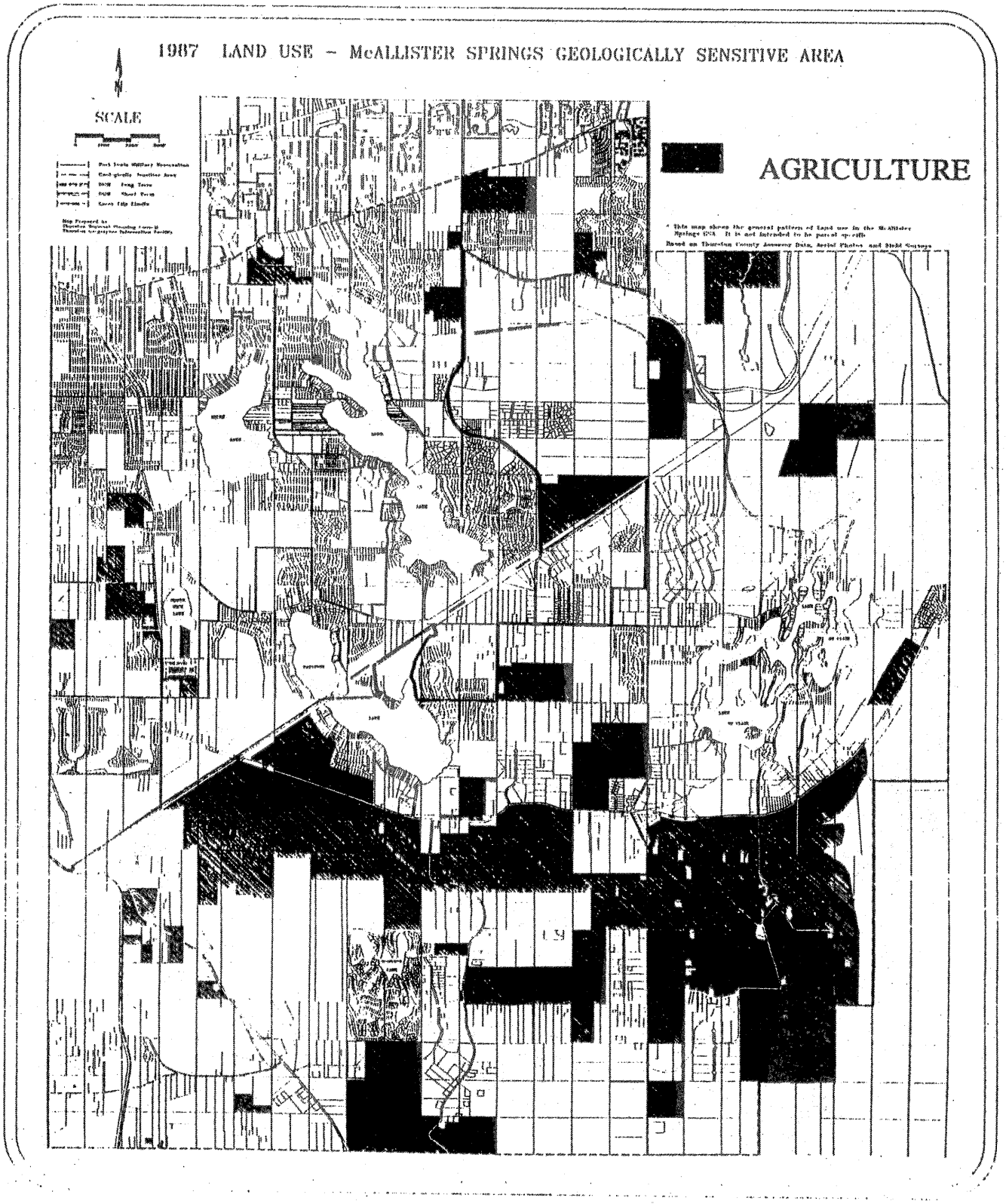

1987 LAND USE - McALLISTER SPRINGS GEOLOGICALLY SENSITIVE AREA
SCALE
AGRICULTURE

FIGURE 5

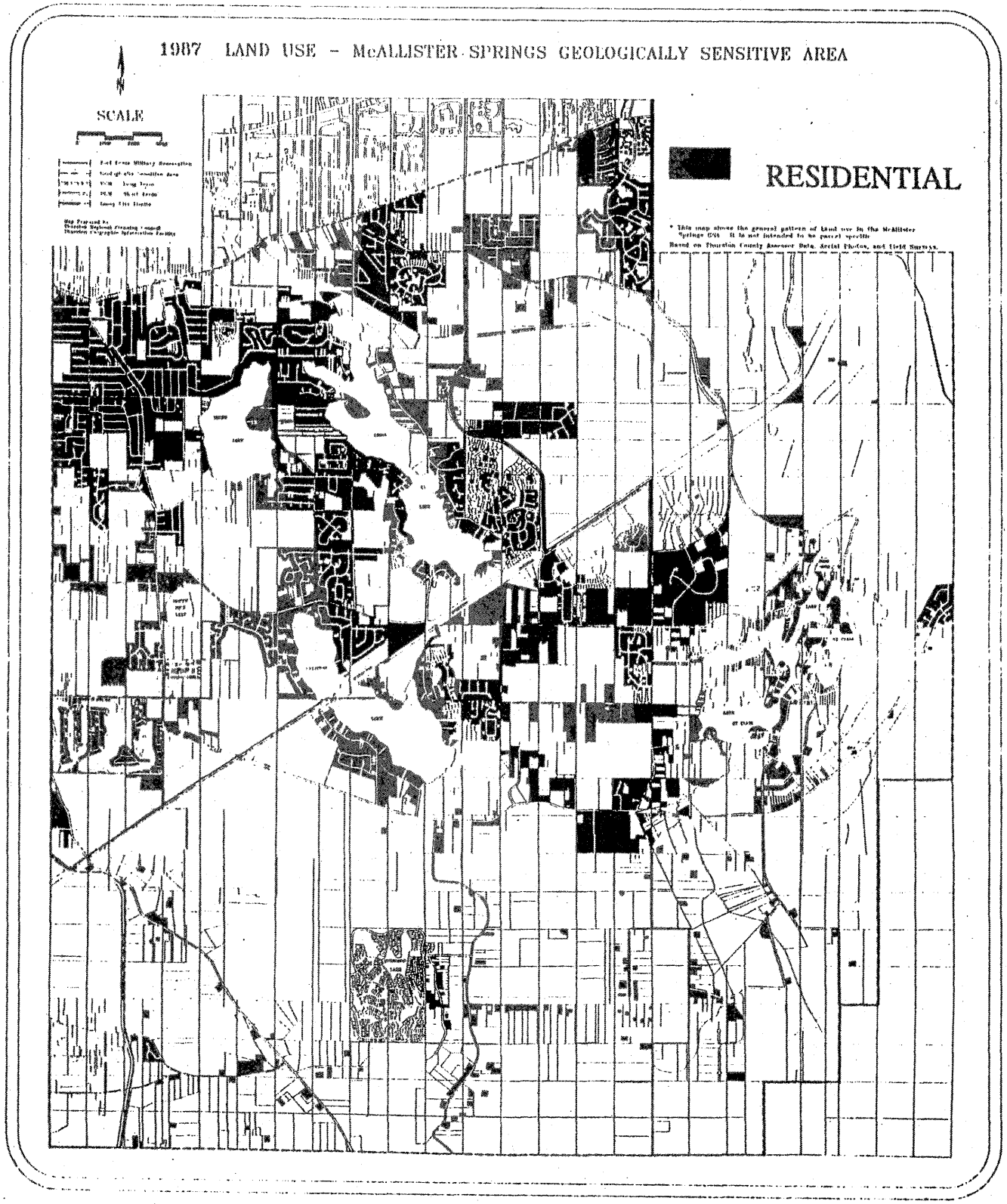

1987 LAND USE - McALLISTER SPRINGS GEOLOGICALLY SENSITIVE AREA
SCALE
RESIDENTIAL

FIGURE 6

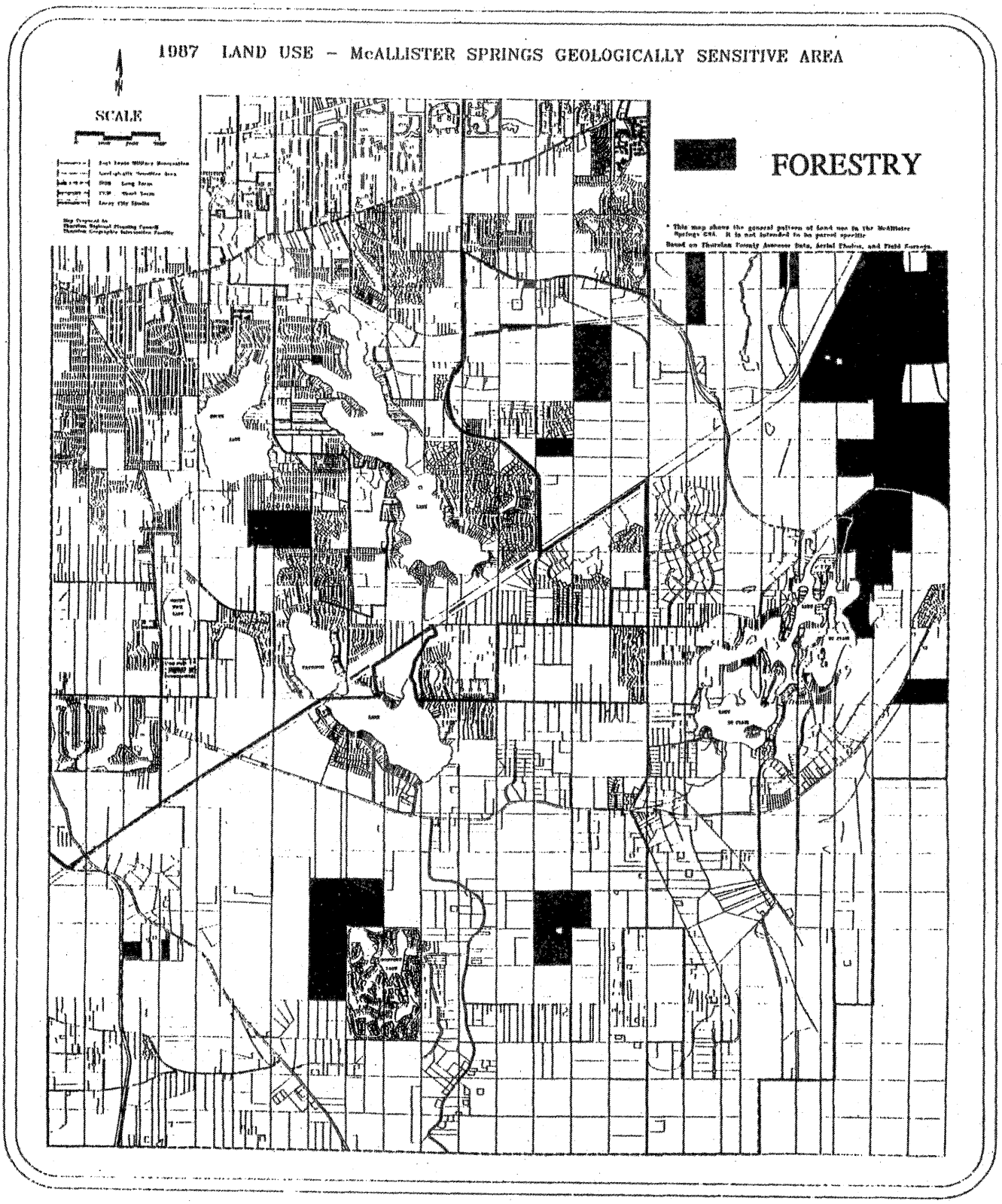

1987 LAND USE - McALLISTER SPRINGS GEOLOGICALLY SENSITIVE AREA
SCALE
FORESTRY

FIGURE 7

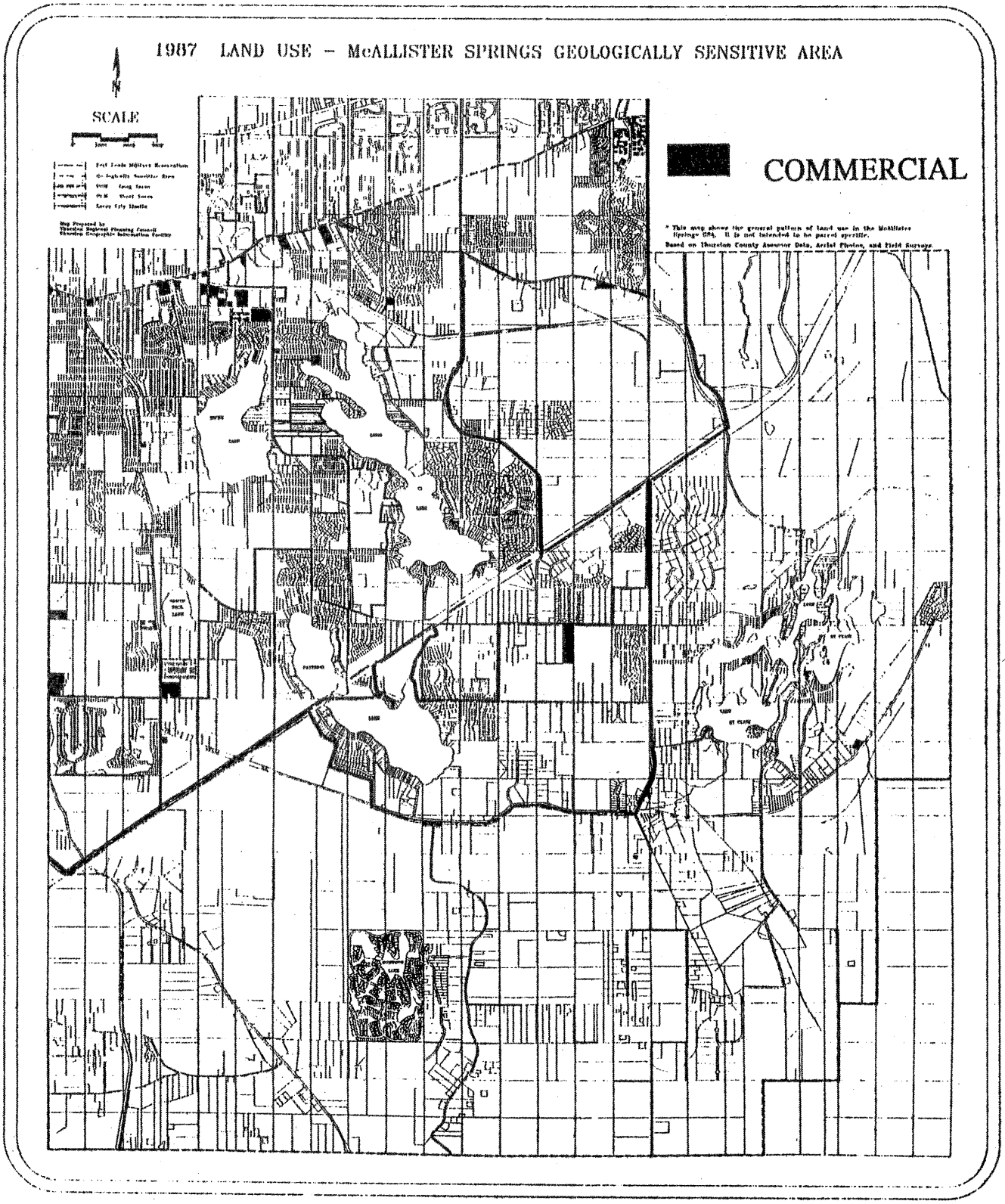
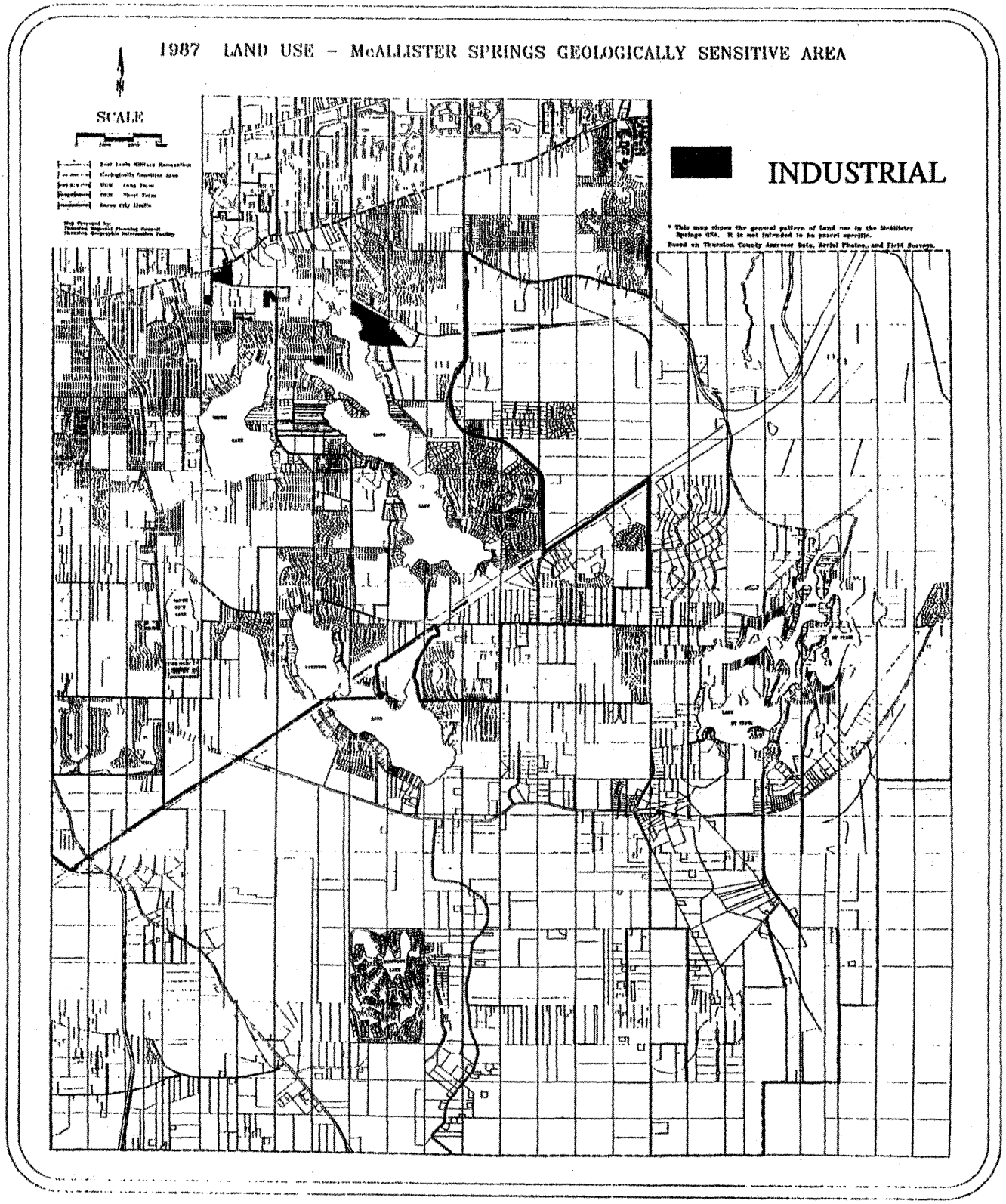

1987 LAND USE - McALLISTER SPRINGS GEOLOGICALLY SENSITIVE AREA
SCALE
COMMERCIAL

FIGURE 8


1987 LAND USE - McALLISTER SPRINGS GEOLOGICALLY SENSITIVE AREA
SCALE
INDUSTRIAL

The vast majority of the properties in the McAllister region are zoned for residential purposes, ranging from 1 unit per five acres to in excess of four units per acre in and near the City of Lacey (FIGURE 9). There are small areas where commercial and industrial uses are allowed. There are no areas that are designated specifically for use by agriculture, although agriculture is permitted in residential zones.

Given the underlying zoning, the existing land use, and the growth projections for this area (see below), it appears that most of the McAllister area will ultimately become residential.

GROWTH AND POPULATION

It is estimated that almost 26,000 people will occupy the McAllister GSA by the end of 1990, and that most of these residents will occupy homes utilizing on-site sewage disposal systems. Over time, it is anticipated that the population will grow at 2.1 percent per year, and that most of the parcels will be connected to municipal sewers rather than individual on-site sewage disposal systems (TABLE 2). The transition to sewer use will occur between the years 2000 and 2010, based on projections for sewer extensions within Thurston County.

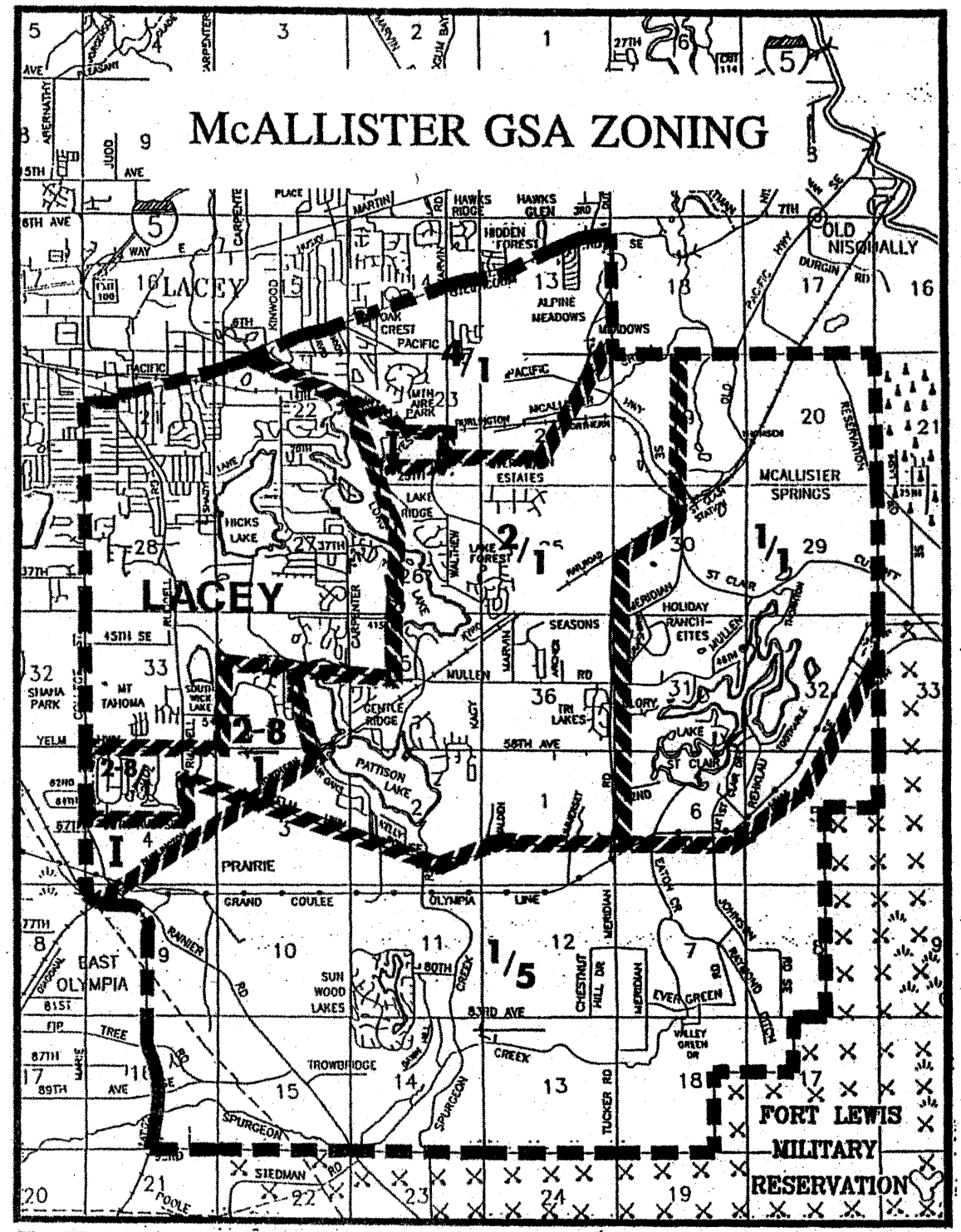
TABLE 2

McALLISTER SPRINGS GSA POPULATION PROJECTIONS*

YEAR POPULATION	SEWERED POPULATION	UNSEWERED POPULATION	TOTAL
1988**	10,386	14,376	24,762
1990**	11,342	14,620	25,962
1995	13,815	15,064	28,879
2000	16,640	15,356	31,996
2005	32,369	3,309	35,678
2010	35,387	4,271	39,658

* Source is Thurston Regional Planning Council
** Assumes continuation of McAllister GSA Resolution

FIGURE 9



McAllister Springs

Geologically Sensitive Area

Boundary

MAP CREATED BY:
AUGUST 15, 1988 THURSTON GEOGRAPHICAL INFORMATION FACILITY
ZONING LINES ADDED JUNE 1990

NOTE: ZONING LINES ARE APPROXIMATE

TOPOGRAPHY

The topography within the McAllister area is characterized by being relatively flat to gently rolling terrain. Within the western parts of the GSA, near Hicks, Long and Pattison Lakes, the land generally slopes to the west or north, towards Woodland Creek. The northern portions of the region slope to the north, again towards Woodland Creek. The Evergreen and Eaton Creek Valley areas, which are south of Lake St. Clair, slope towards that lake. Surface runoff, when it occurs, flows in the direction indicated by the slope.

Several lakes are within the GSA, the largest of which are Long, Pattison and St. Clair. Long and Pattison Lakes are part of a string of four lakes that form the headwaters of Woodland Creek. These lakes are isolated from Lake St. Clair, which is fed by Eaton Creek, but has no defined outlet.

CLIMATE

The McAllister region experiences the West Coast marine climate characteristic of the region. Summers are relatively dry and cool while winters are mild, wet and cloudy. The diurnal temperature variation is approximately 15 degrees in the winter and 25-30 degrees in the summer.

Annual precipitation averages about 55 inches. During the wet season, rainfall is usually of light to moderate intensity and continuous, rather than heavy and in brief intervals.

The winds are generally from the southwest and have a mean hourly speed of 6.5 mph. The average length of the 32 degree growing season is approximately 160 days. Some snowfall, averaging between 10-15 inches per year in the watershed, usually occurs between November and April (Aaland, 1989).

CHAPTER 2: RECHARGE AREA CHARACTERISTICS

I. GEOLOGY

The geology of Thurston County is dominated by features that are a result of glacial movement. The Thurston County area is where the last glacial advance, the Vashon, terminated or stopped (Wallace, 1961). As the glaciers advanced or receded (melted) they put down layers of material which now make up the strata of the McAllister Springs ground water system. Many well logs within the area show the stratification or layering of materials.

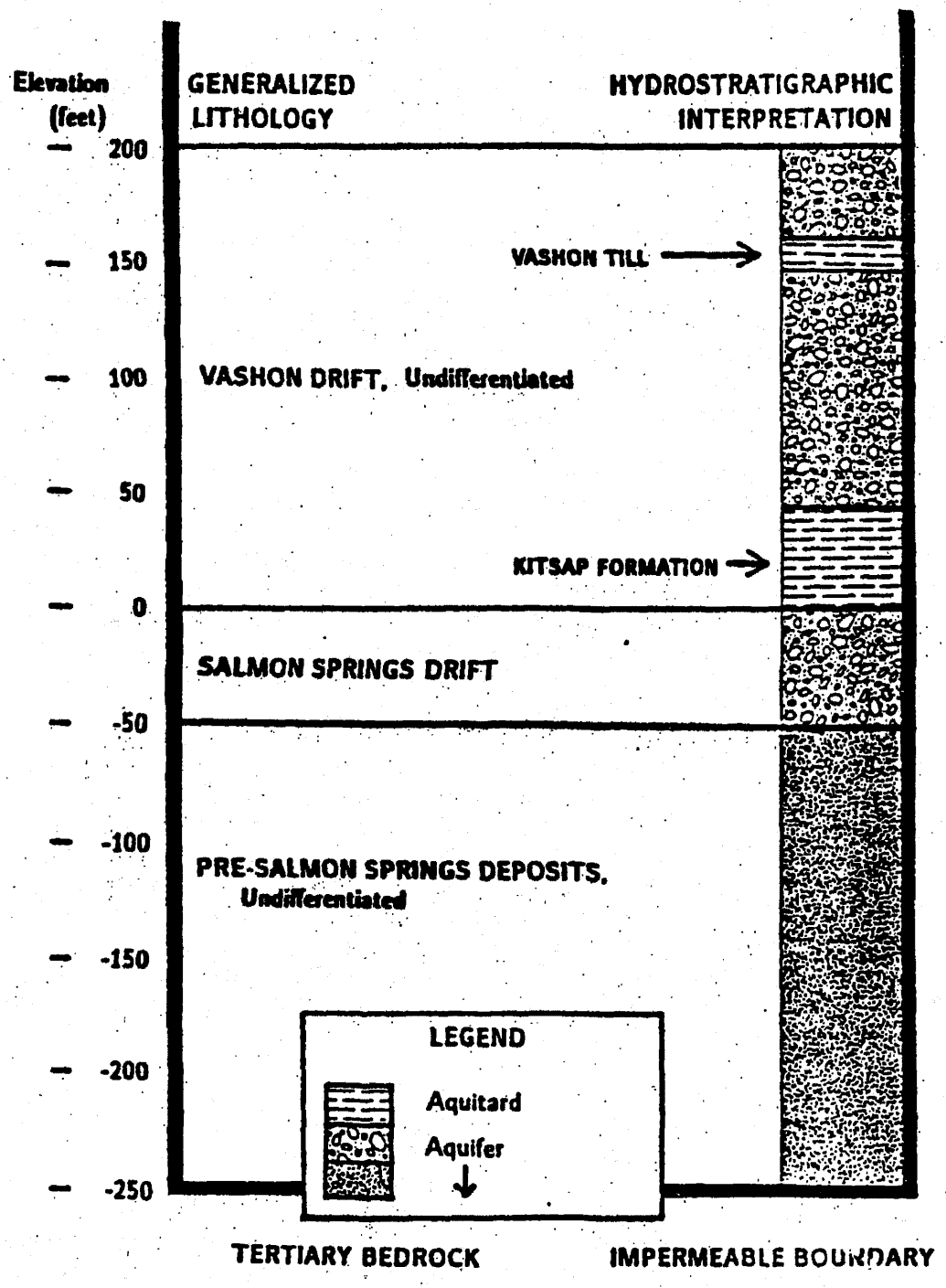
Several soil types are associated with glacial recession and melting. Melt waters and flooding associated with the glacial recession produced huge water flows that went through the Thurston County area. The prairies of Thurston County are believed to have been deposited through these activities. The surface soil types associated with moving water deposition are mapped as the Everett and Spanaway soil series, which are predominantly gravel. The other major soil types in the area are sands, such as the Indianola and Nisqually series. Most of these soil types are considered by the Soil Conservation Service (SCS)to be excessively drained, which means they have very high percolation rates and they have low potential to treat and retain pollutants (Soil Interpretation Records SCS, 1980-1982).

The deeper soils within the McAllister area are also sands and gravel which were deposited by moving water. These deposits, which were derived from glacial rivers and streams, are coarse and unconsolidated. They allow the rapid infiltration and transmission of waters. Water transmission rates vary substantially between layers, depending upon localized materials and the ground water gradient (U.S.G.S. 1988). Ground water flows through these strata and makes up the aquifer system. The total depth of these soils is in excess of 200 feet.

Within the area there is also a substantial amount of glacial till (5 - 10 percent). Glacial till is an unsorted mixture of gravel, sand, silt and clay, with the silt dominating. It was moved and placed by the movement of glacial ice. Some of this material exists as subsurface layers which slows, but does not stop, the flow of ground water (Golder 1990). The subsurface till layers are not continuous throughout the entire McAllister area.

It is believed that there are at least six different soil layers within the McAllister Springs area. The upper five layers are the ones where most wells are developed (or drilled into), with most wells being finished in the Vashon advance and Salmon Springs formations. The major area where these aquifers surface are McAllister Springs, Abbott Springs, Lake St. Clair and the bluffs north of McAllister Springs. FIGURE 10 depicts these geologic

FIGURE 10



Source: Noble and Wallace, 1966

units as they would occur in areas where all layers are present (there are many areas where one or more units are missing).

II. AREA SUSCEPTIBILITY

Of primary concern for the McAllister area is addressing its susceptibility to pollution from various sources and land use activities. Once it is understood that an area is susceptible to ground water pollution, it can then be determined if it is vulnerable to contamination as a result of land use or other activities. In this discussion, vulnerability refers to the potential for a susceptible aquifer to be contaminated due to land use activities.

Susceptibility is largely a function of a region's geology and hydrology. The soils that overlie and confine or protect an aquifer system have a great influence on whether it can be polluted. A shallow aquifer that is overlain by coarse gravel and sands is more susceptible to pollution than a deeper one that is overlain or confined by several layers of impermeable material, such as clay (Sacha et.al. 1987).

The McAllister ground water system is considered to be quite susceptible to pollution (Golder 1990, Brown & Caldwell, et.al. 1990, Golder et. al., 1987). This is due to its glacially dominated geology, which has resulted in several layers of coarse sands and gravel being deposited throughout the region. The Vashon advance and the Salmon Springs formations are the most permeable, while the Vashon till and Kitsap formations are less conducive to ground water flow. All layers are comprised mostly of sands and gravel, but they differ based on their porosity.

There is consensus that the different aquifer levels are connected, and that water from the upper levels will make its way to those that are deeper (Noble 1966, Entranco 1987, Golder 1990). Consequently, a pollutant introduced into the surface aquifer can migrate through the upper five levels. The ground water mixing is a result of holes or windows within various aquifer layers, and the presence of a strong vertical (downward) flow gradient within the aquifer system. These allow the ground water to flow down from one aquifer level to the one below it, either through the windows, or the intervening layer (Golder 1990).

The upper ground water bearing strata is often very shallow, as demonstrated by well depths that often are less than 50 feet. In many instances, the beginning of the water bearing material is higher, indicating that there is less than 50 feet of coarse soil left to protect the ground water system from surface activities. Depending on their location within the McAllister recharge area, these shallow wells can be developed in any of the upper five geologic units that make up the McAllister System.

The coarse soils in the McAllister area make ground water susceptible to pollution in other ways. These types of soils are generally poor at binding, trapping and filtering contaminants, so that pollutants in contact with the ground can eventually migrate into the ground water system (Sacha et.al. 1987, Brown and Caldwell, et. al. 1990, and Golder 1990), where they are readily transported.

The mechanisms available to reduce the potential impacts of pollution are microbial degradation and dilution. Microbial activities are largely limited to the upper soil horizons, and they are ineffective in reducing the impacts of many pollutants. Once the stable compounds reach the deeper soil horizons, dilution remains as the last means of minimizing the pollutants' impact.

The potential for pollutants to reach the ground water system is enhanced by the abundant rainfall that the area receives. Many pollutants can be washed from the soils into the water bearing materials.

III. EXAMPLES OF AREA VULNERABILITY

The area's vulnerability has been demonstrated in many ways, such as the occasions when pesticides have been detected in wells along the south sides of Pattison Lake and Lake St. Clair. In these instances, ethylene dibromide (EDB), 1, 2 dichloropropane (1, 2 DCP) and 1, 2 dibromo - 3 -chloropropane (DBCP), all of which are soil fumigants, were found in area wells, often at concentrations in excess of existing or proposed maximum contaminant levels (MCL's). It is believed that the pesticides are the result of applications made to agricultural fields in the surrounding area.

Another example of area vulnerability is the elevated levels of nitrate in ground water sampled from wells within the McAllister area. A statistical evaluation of the United States Geological Survey (USGS) nitrate data found that the wells inside the GSA had significantly higher nitrate levels than the other wells sampled in the north Thurston County area, or in the Bush Prairie area south of Tumwater (Lettenmaier 1990b). This indicates that land use activities, many of which apply nitrogen to the ground, are having an impact on ground water quality (FIGURE 11).

Area vulnerability can again be demonstrated by observing the nitrate data from McAllister Springs for the past several years. A strong trend of increasing nitrate levels is present, as can be seen on FIGURE 12 (Lettenmaier 1990a, Golder 1990). This is believed to be linked to land use activities within the McAllister area, which have resulted in an increase in nitrogen applications to the land (Golder 1990).

FIGURE 11

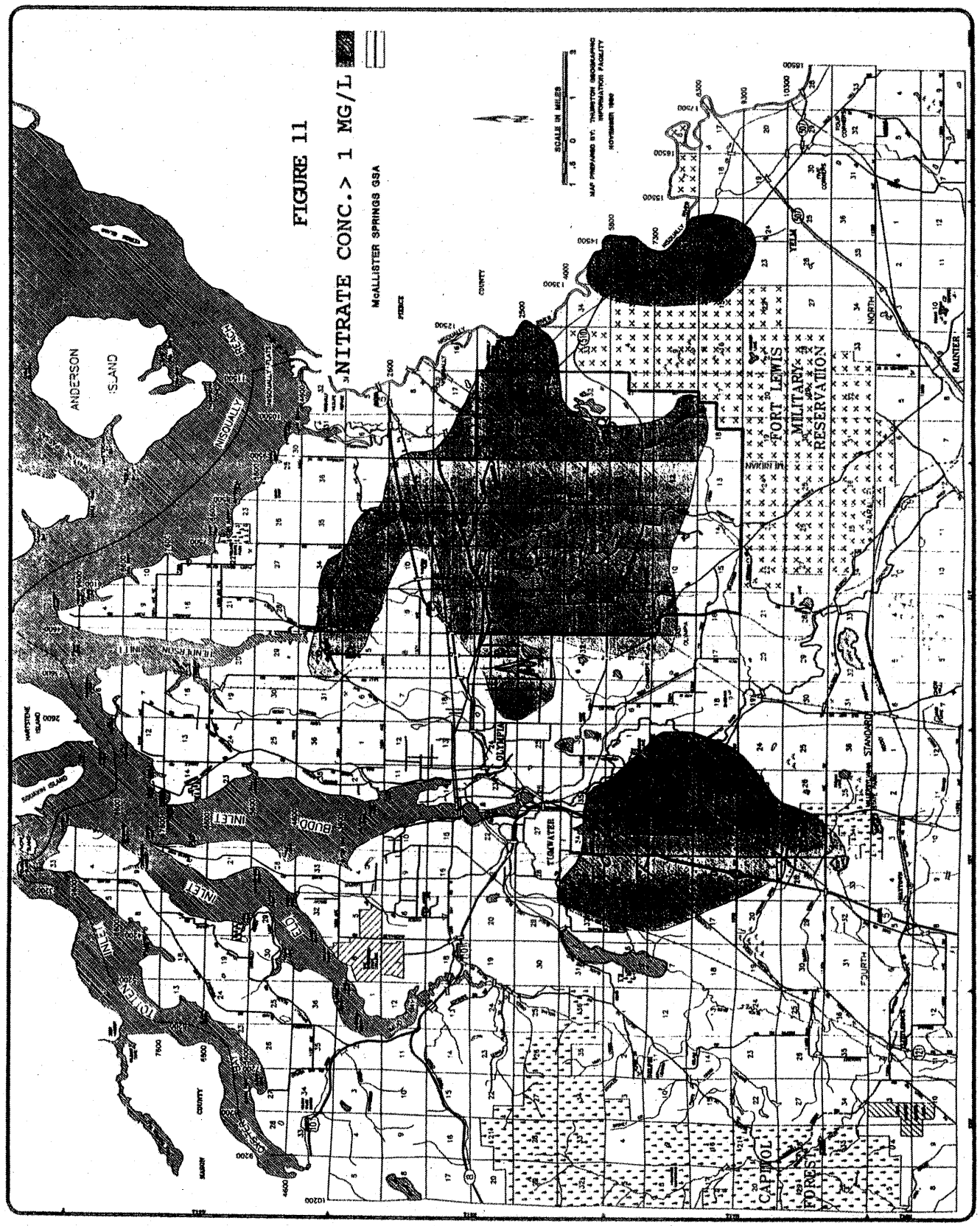


FIGURE 11
NITRATE CONC.> 1 MG/L
McALLISTER SPRINGS GSA
ANDERSON ISLAND
FORT LEWIS MILITARY RESERVATION
CAPITOL FOREST

FIGURE 12

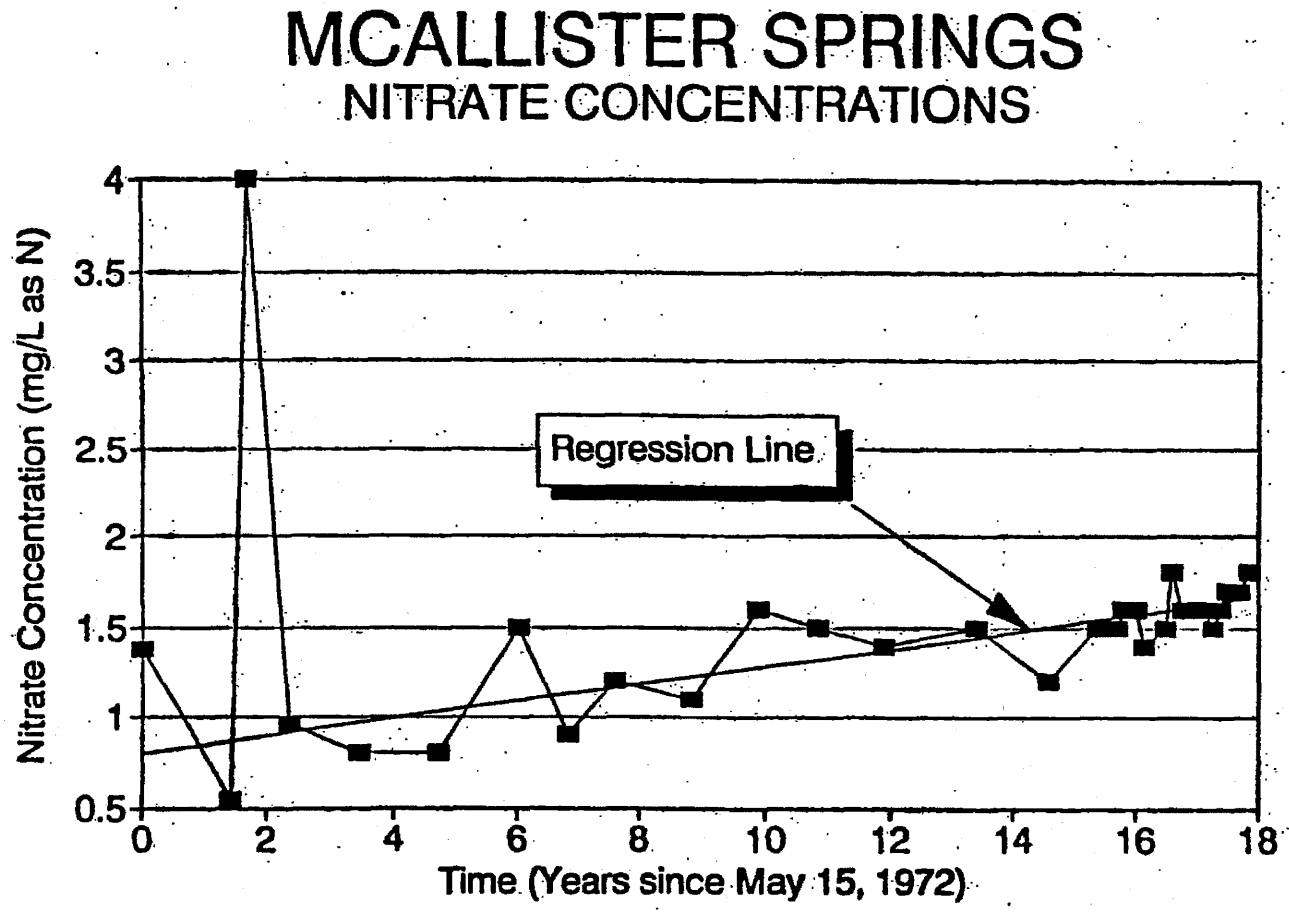


FIGURE 12
NITRATE CONCENTRATION IN MCALLISTER SPRINGS
THURSTON CO/MCALLISTER/WA

PROJECT NO. 903-1072.500 DWG. NO. 22391 DATE 6/11/00 DRAWN CW

Golder Associates

The importance of nitrate as a water quality monitoring tool, and the significance of increasing nitrate trends is based on many factors. Elevated nitrate levels can cause a blood disorder in infants called methemoglobinemia (blue baby syndrome), and some studies have suggested a link between elevated nitrate levels and certain forms of cancer (DOH 1989). Because of these concerns, a maximum contaminant level (MCL) for nitrate of 10 mg/liter has been established for drinking water (WAC 248-54).

Nitrate monitoring can also be used as an indicator method. Once within the ground water system, nitrate is highly mobile, and generally conserved (it is not bound, filtered or utilized). Also, nitrate is a product of many common land use activities, such as sewage disposal and fertilization of crop lands. Consequently, when nitrate levels increase, it may indicate that other pollutants that were not being monitored, may have entered the ground water system.

Ground water within the McAllister area is naturally low in nitrate levels, as shown by USGS data for the region, which indicate that nitrate levels would be below 0.2 mg/liter. Increases in nitrate levels therefore suggest impacts as a result of land use activities.

IV. CAPTURE ZONE BOUNDARIES

The McAllister Springs and aquifer system receives its water from infiltration of rain water and runoff that occurs within the capture zone (Noble 1966, Golder 1990). It is not supplied by water from mountains, rivers or streams outside of this area. Simply stated, rain falls within the capture zone, percolates through the soil, and enters the ground water system. This conclusion is supported by calculations comparing area rainfall to discharges and withdrawal, which show the two to be equivalent after the losses associated with evapotransporation, runoff (which leaves the region), and exportation are taken into account (Golder 1990, Brown and Caldwell 1990).

The ground water system for the McAllister area consists of six or more geological units of differing density and porosity (Noble 1966). Research indicates that these layers or levels are interconnected and that most of the water introduced to the surficial (uppermost) aquifer will ultimately reach the level of McAllister Springs, where it will be discharged (Entranco 1987, TCHD 1988, and Golder 1990). Some water is discharged to the Pattison and Long Lake systems while other will exit through springs and seeps along the bluffs bordering the Nisqually River. It is not believed that Long and Pattison Lakes contribute much to the McAllister ground water system (Golder 1990).

To identify the aquifer recharge area for McAllister Springs three ground water contour maps were prepared by Golder Associates. The maps were developed using well logs obtained from the Washington State Department of Ecology (Ecology), the Thurston County Environmental Health Division, the USGS, and information available from ground water studies done within the McAllister Springs area.

Ground water contour maps were made for each of three layers or depth zones, which represent the depths at which most wells were finished (Golder 1990). Ground water elevations were calculated by subtracting the depth to the static water elevation from the ground surface elevations, which yields the water level elevation above mean sea level. Water levels of the same elevation were then connected by lines to give lines of equal potential, or contours. The directions of ground water flow were then determined by recognizing that ground waters flow perpendicular to the contour lines, from high to low elevations. The specific methods used to develop contour information are listed in the 1990 Golder report.

Hydrologic boundaries of the capture zone were defined by using the contour information. The capture zone boundaries occur at contour "ridges" or "divides", or where it can be shown that ground water from particular source area discharges somewhere other than McAllister Springs. The ground water flow paths were refined with a particle tracking model utilized by Golder Associates. Divides occur between lines of equal contours, where the ground water elevation falls from both lines.

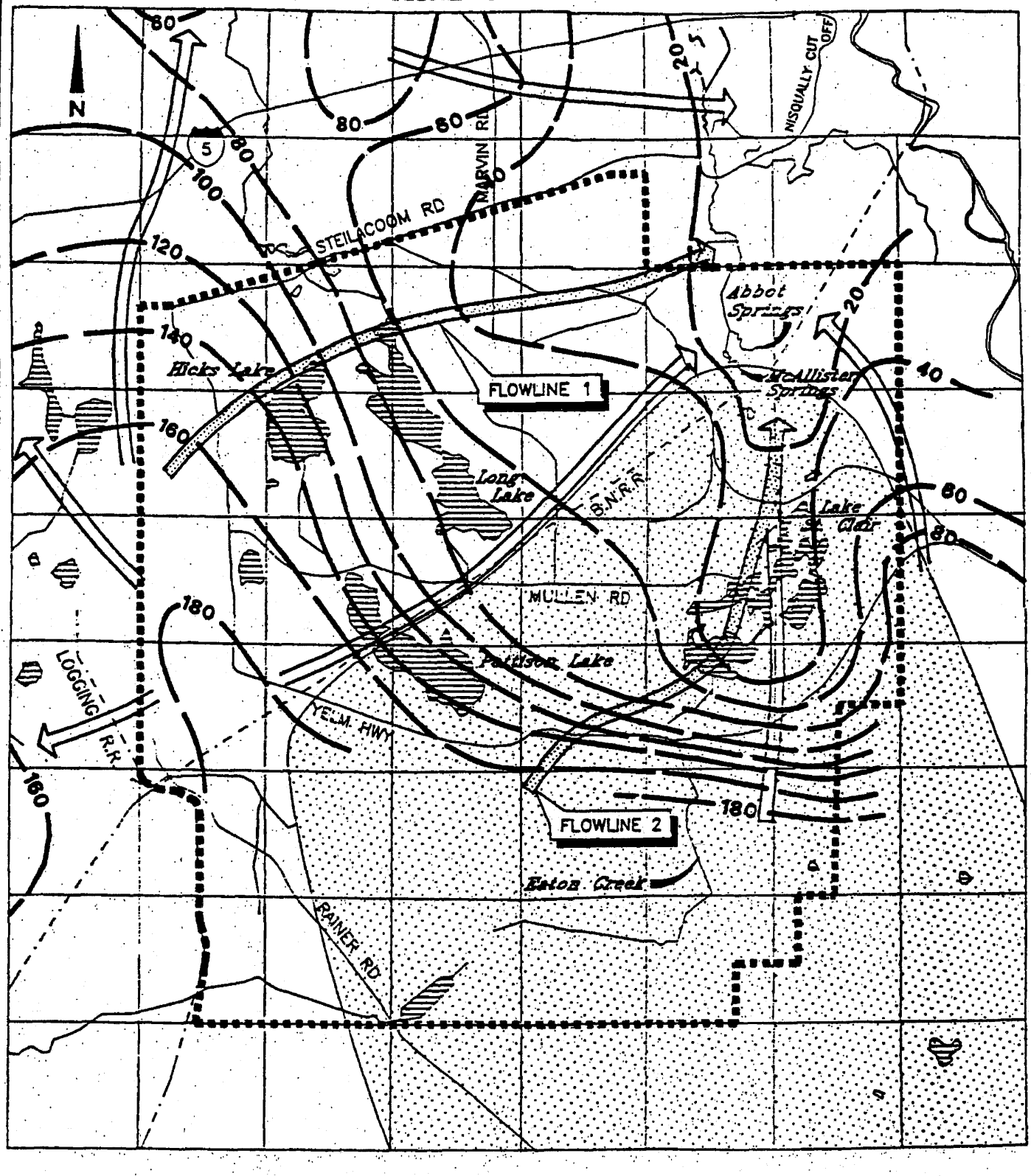
The capture zone for McAllister Springs is shown on FIGURE 13. It encompasses in excess of 27 square miles. The capture zone is believed to extend on to the Fort Lewis military reservation, however, its exact limits are not known due to a lack of available ground water information within that area.

V. GROUND WATER FLOW AND TRAVEL TIME

The work by Golder Associates states that there are two components to ground water flow within the McAllister system; a vertical (downward) component, and then a horizontal one. It is believed that once water is introduced to the surface soils, it generally travels down until it reaches the Salmon Springs formation, and then travels horizontally until it is discharged or withdrawn.

With this information, and the knowledge gained through establishing the capture zone boundaries, travel times for ground water flow within the capture zone area were determined. Travel times were calculated in a two step process, in recognition of the two ground water flow components. Both sets of calculations were aided by computer modeling.

FIGURE 13



LEGEND:

Equipotential (Feet)

Horizontal Flow Component

Approximate Capture Zone for McAllister Springs

0 6000 12000

SCALE IN FEET

FIGURE 13

PIEZOMETRIC ELEVATIONS IN -50 TO 50 FT. ZONE

THURSTON COUNTY/McALLISTER GSA

PROJECT NO 903-1072.005 DWG NO 34090 DATE 6/5/90 DRAWN DJH APPROVED CB

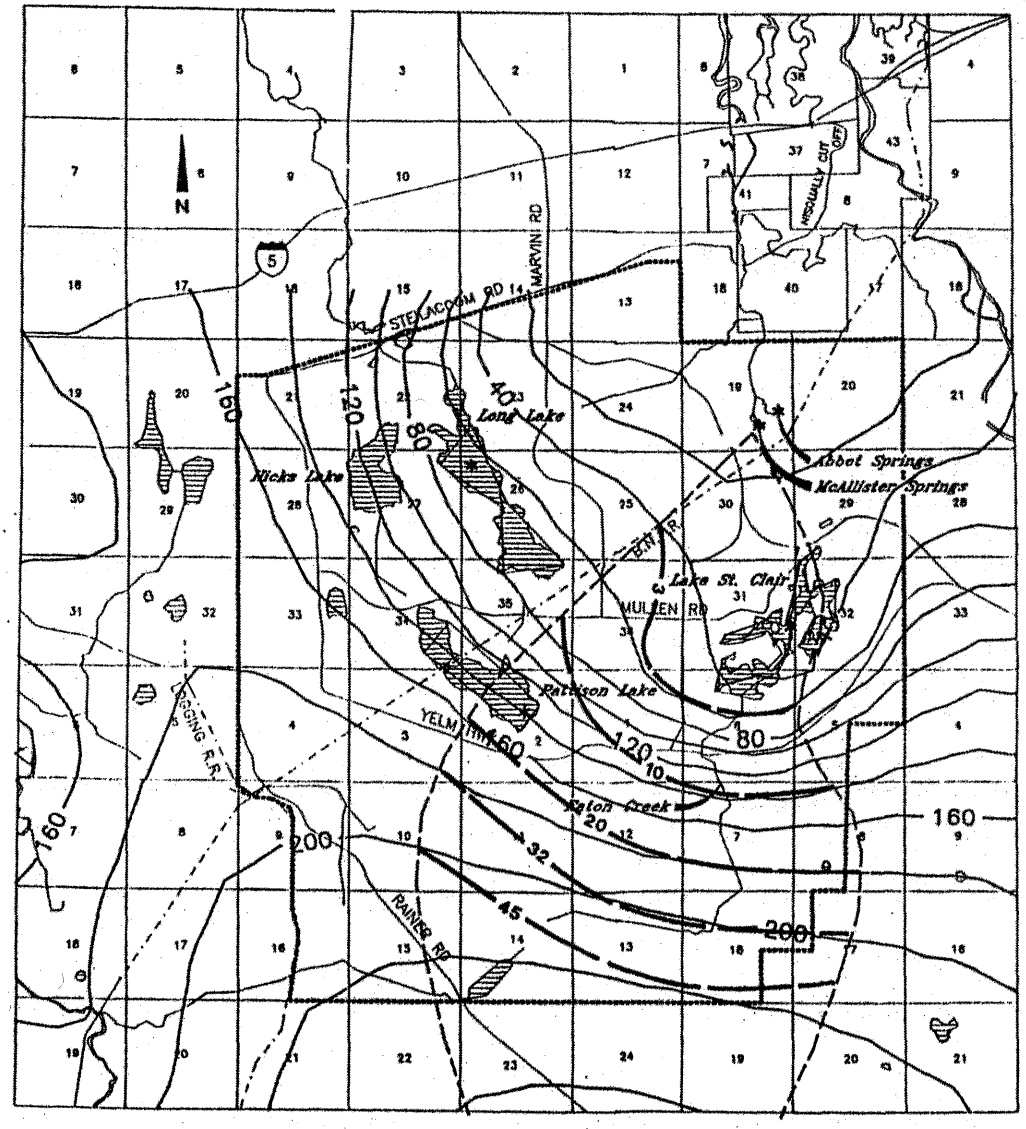
Golder Associates

The capture zone is the recharge area for McAllister Springs. Only rainfall and runoff within this area contribute to the flow of the springs.

Using these methods it was found that a substantial lag time exists between the introduction of water at the ground's surface, and its ultimate arrival at McAllister Springs. It is estimated that the vertical travel time, from the ground surface to the Salmon Springs formation takes anywhere from two to ten years (Golder 1990). Once within the Salmon Springs formation, travel times to discharge atMcAllister can be in excess of 50 years. A map showing travel times to McAllister Springs from the ground surface within the region is shown on FIGURE 14.

With these calculations, it can be seen that much of the water discharged today at McAllister Springs first entered the system many years ago. Accordingly, pollutant loads associated with these waters are the result of past land use practices, and they do not reflect the intensification of land use activities that have taken place over the past few years.

Another element of this work calculated the relative contributions of sources to McAllister Springs. Through these efforts it was determined that Lake St. Clair and Eaton Creek provide as much as 20 - 40 percent of McAllister's flow (Golder 1990).



LEGEND:

- McAllister Springs Geologically Sensitive Area Boundary
- 200 — Equipotential (ft)
- 3 — Travel Time from Water Table to Spring (years)
- Model boundaries

0 6000 12000
SCALE IN FEET

FIGURE 14
SLAEM MODEL
THURSTON COUNTY/McALLISTER GSA

PROJECT NO 9031072.005 DWG NO 34096 DATE 6/11/90 DRAWN DH APPROVED ____

Golder Associates

CHAPTER 3: POLLUTANT SOURCES WITHIN THE McALLISTER GSA

I. SEPTIC SYSTEM IMPACTS

On-site sewage disposal systems are of concern within the McAllister Springs area. On-site systems utilize the soil as the disposal medium for waste water. The waste water contains substantial amounts of bacteria, viruses, and chemical constituents, many of which threaten public health. Given the poor level of confinement of the aquifer and the coarse soils that overlie it, there is substantial concern that septic system effluent will detrimentally impact ground water within the McAllister Springs area.

SEPTIC SYSTEM PREVALENCE

Most homes within the McAllister Springs area are served by on-site sewage disposal systems. Of the 25,962 people estimated to be within the McAllister area in 1990, some 14,620 will utilize some sort of septic system (TRPC, 1990). The only areas served by a sewer utility are those in or adjacent to Lacey; along the McAllister GSA's west boundary.

Most septic systems within the McAllister area are forms of a "standard" type of sewage disposal system. Few alternative or experimental systems are present. Standard septic systems consist of the sewage collection system, a septic tank, and some sort of distribution system which is usually a gravel filled trench or bed. In some cases, the effluent is pumped to the drainfield site from an in line pump chamber.

EFFLUENT CONSTITUENTS

The effluent from on-site systems generally contains many things which can detrimentally impact ground water. In addition, it has the potential to carry other pollutants which pose significant risks to public health, such as toxic or hazardous chemicals which are improperly disposed of in the septic system.

Effluent normally contains relatively high levels of bacteria, viruses, and chemicals such as nitrogen and phosphorus. These are all products associated with the breakdown of sewage by natural organisms. Of these, bacteria, viruses and nitrogen are generally considered to be of the most significance to public health (EPA 1980, Duncan 1988).

Bacterial and viral removal is dependent on an aerobic environment and unsaturated soil conditions. Almost all bacteria and viruses are filtered or absorbed after the effluent travels

through two to four feet of unsaturated soil providing it is not excessively coarse (Cogger 1988a, Reneau 1989). Soils sufficient for removal of bacteria and virus exist throughout most of the McAllister Springs recharge area; however, this may not be true for coarse soils, such as the Spanaway series.

Phosphorus is not considered to be a significant public health threat, although it can lead to the eutrophication of surface waters (eutrophication is the excessive growth of aquatic organisms which result in oxygen depletion in the water). Phosphorus is usually bound quite well to soil particles, however, that is not the case for many of the soils in the McAllister area. There was concern that phosphorous from septic systems was contributing to lake eutrophication, however, documentation of these concepts has been difficult (Entranco, 1987).

Nitrogen, in the form of nitrates, is of great public health concern. Elevated nitrate levels in ground water can cause a blood disorder in infants called methemoglobinemia, and some studies have suggested a possible link between nitrate and cancer (Washington State Department of Health 1989). State and federal drinking water standards have established a maximum contaminant level (MCL) of 10 mg/l for nitrates in drinking water (WAC 248-54).

Septic systems are of concern because they produce substantial amounts of nitrogen rich waste water. Each person is responsible for the average production of 170 liters of waste water per day, which correlates to 10.5 grams of nitrogen per person per day which reaches the drainfield (Bauman 1985). A majority of the nitrogen that reaches the drainfield is released to the environment (Porter 1980, and others). With the porous soil types in the McAllister area, it is estimated that 75-100 percent of the nitrogen present in effluent ultimately will reach ground water (Cogger, 1989).

Once within the subsoil, nitrates are very stable and highly mobile. They are not readily filtered, absorbed or degraded by elements within the soil and they are difficult to remove (Cogger 1988). Their ultimate fate is usually ground or surface waters.

TOXIC AND HAZARDOUS MATERIALS

Toxic and hazardous materials and wastes can also be found in septic systems. Studies have documented the presence of such compounds in residential, commercial and industrial waste water (DeWalle et.al. 1985, Hughes et.al. 1985).

A study of a community residential septic system in Pierce County found a variety of toxic chemicals that reached the septic tank,

including five priority pollutants (DeWalle, 1985). It was found that little breakdown or separation of these chemicals occurred within the septic tank, and that the majority of them were released into the drainfield. Once in the drainfield, some biodegradation might have occurred, but many types would be expected to be persistent and migrate within the soil and ground water (DeWalle 1985, Cogger 1988a). Within the ground water system, little additional breakdown is likely to occur, and one study found the degradation products to be equally if not more toxic than their parent compounds (Parsons, 1984).

The potential for soil and ground water contamination from commercial and industrial septic systems is similar to that of residential systems. Both types of systems operate in a similar manner and toxic waste can be disposed of in either one. A major difference with businesses is that they deal with larger quantities of hazardous materials that are often of greater concentrations. While no formal survey of Thurston County businesses has been conducted to determine the number that use their septic systems for toxic material disposal, it is likely that a substantial number do. A survey of small businesses using septic systems in the Los Angeles area found hazardous materials in more than fifty percent of their septic systems (Los Angeles Sanitarian Department, 1986). Another example is the Weyerhaeuser box plant in the McAllister area which was found to have cyanide in the drainfield from improper disposal of cleaning products (Washington State Department of Ecology 1989).

The presence of toxic materials in septic systems can be due to a variety of reasons, ranging from the use of cleaning products which contain toxic materials,, to the improper disposal of products and wastes in the septic system. Even septic tank cleaners and degreasers can affect ground water, as they often carry acids, bases or solvents. One study (Noss, 1987) found that solvent cleaners released methylene chloride into the ground water, and that most chlorinated compounds had low removal rates within the septic system. He further found that none of the septic tank cleaners were effective in maintenance of the septic tank sludge/grease levels.

There are many reasons why the release of toxic chemicals into ground water is of concern. First, many of the hazardous chemicals which have been found within septic systems, or that are commonly used in businesses, are much more toxic than compounds such as nitrates. For instance, trichloroethylene, which has been found in septic systems, has a proposed MCL of 5 ug/l. This represents a concentration that is 2000 times less than is allowed for nitrates in ground water. A second concern about several toxic chemicals is that they are quite stable, as well as mobile once they are in the ground water system. The relative toxicity of several common organic chemicals, along with their stability and mobility, represent a significant ground

water threat if a quantity of these compounds is released or spilled. Such a release or spill could pollute many millions of gallons of water so as to make a ground water source unsuitable for use for years without extensive and expensive treatment (Mackey, 1985).

REDUCING THE IMPACTS OF INDIVIDUAL SEPTIC SYSTEMS

It is apparent that cumulatively, septic systems can and have had a significant impact on ground water. In some instances a single system can have a large effect on water quality if it is used as for the disposal of toxic or hazardous materials.

Much research has gone into the evaluation and development of on-site systems to minimize their effects on ground waters. Unfortunately, while progress has been made, there is no universally accepted method which can significantly reduce levels of all ground water pollutants. Some of the more promising are still in the experimental phase, and it will probably be years before they are approved for use in the state of Washington by the Technical Review Committee of the Department of Health (DOH).

There are some concepts that can be employed to maximize the effectiveness of the more standard trench type system. First, installing the drainfield in the upper soil horizon places it in somewhat less permeable soils, resulting in less short circuiting of the effluent through macro pores or soil channels (Reneau, 1987). This can maximize the chance for soil organisms to metabolize nitrogen and phosphorous, while providing the best opportunity for the uptake of waste water nutrients by plants (Reneau 1989, Cogger 1988a). Unfortunately, plants take up relatively small amounts of nutrients, only about 10-15 percent of the nitrogen, and this would not occur during the colder wet season experienced in the Pacific Northwest (Gold 1989, Cogger 1988a).

The use of pressure distribution provides several other advantages for effluent treatment, the primary one being that it distributes the effluent evenly throughout the entire drainfield area. Equalized distribution in turn avoids overloading a portion of the drainfield which may result in saturated flow and clogging. It creates a biomat over the entire drainfield, which maximizes microorganisms' opportunities to metabolize nutrients such as nitrogen, while providing more potential binding sites for chemicals such as phosphorus (Reneau, 1989). Pressure distribution enhances the soil's ability to filter and absorb bacteria and viruses. It is also believed that poor distribution maximizes the potential for chemical migration (Reneau, 1989). Other advantages are that it may allow the placement of the drainfield in an area with better soil conditions which would not

be possible with gravity flow, and it allows the placement of the drainfield high within the soil profile.

Other septic system research has been done, and it has been aimed primarily at nitrogen removal. Tests of various types of sand filters, which are used to treat effluent before it reaches the drainfield, indicate that as much as 50 percent of effluent nitrogen can be removed (Ritter, 1985), and that final nitrate levels less than 30 mg/l can be expected (Washington DSHS, 1989). Disadvantages to these types of systems are cost, the possible need for a second pump if pressurized distribution is desired, and the additional maintenance required to insure the system's performance.

Another type of system which may achieve greater levels of nitrogen removal is called the RUCK System. This system incorporates the use of a sand filter and a rock tank between the septic tank and the drainfield (Gold, 1989). After the septic tank effluent leaves the septic tank, it passes through the sand filter, and enters the rock tank. There a carbon source is added, which is either gray water, methanol or ethanol, and denitrification of the effluent occurs.

With gray water as a carbon source, as much as 50 percent of the nitrogen can be removed from waste water (Gold, 1989a). When methanol or ethanol is added to the rock tank as a carbon source, nitrogen removal rates as high as 80 percent may be possible (Gold, 1989b). Reductions in other waste water parameters were not reported.

At this time, RUCK systems are not permitted by DOH for use in the State of Washington, as they are still largely experimental. In addition, their special operations and maintenance needs, and their added cost for installation cannot be ignored. RUCK systems may hold some promises for the future where nitrogen removal is a primary goal.

COMBINED SEPTIC SYSTEM IMPACTS

It is difficult to assess the effects of septic systems for all of the pollutants they do produce. However, calculations on the amount of nitrogen that they contribute have been done. In their analysis, Golder Associates (1990) found that the nitrogen load to the ground water system from septic systems is greater than the load from other sources (Figure 15). There is little information that can be used to calculate the amounts of hazardous wastes that are contributed by septic systems.

McAllister Geologically Sensitive Area
Nitrogen Inputs

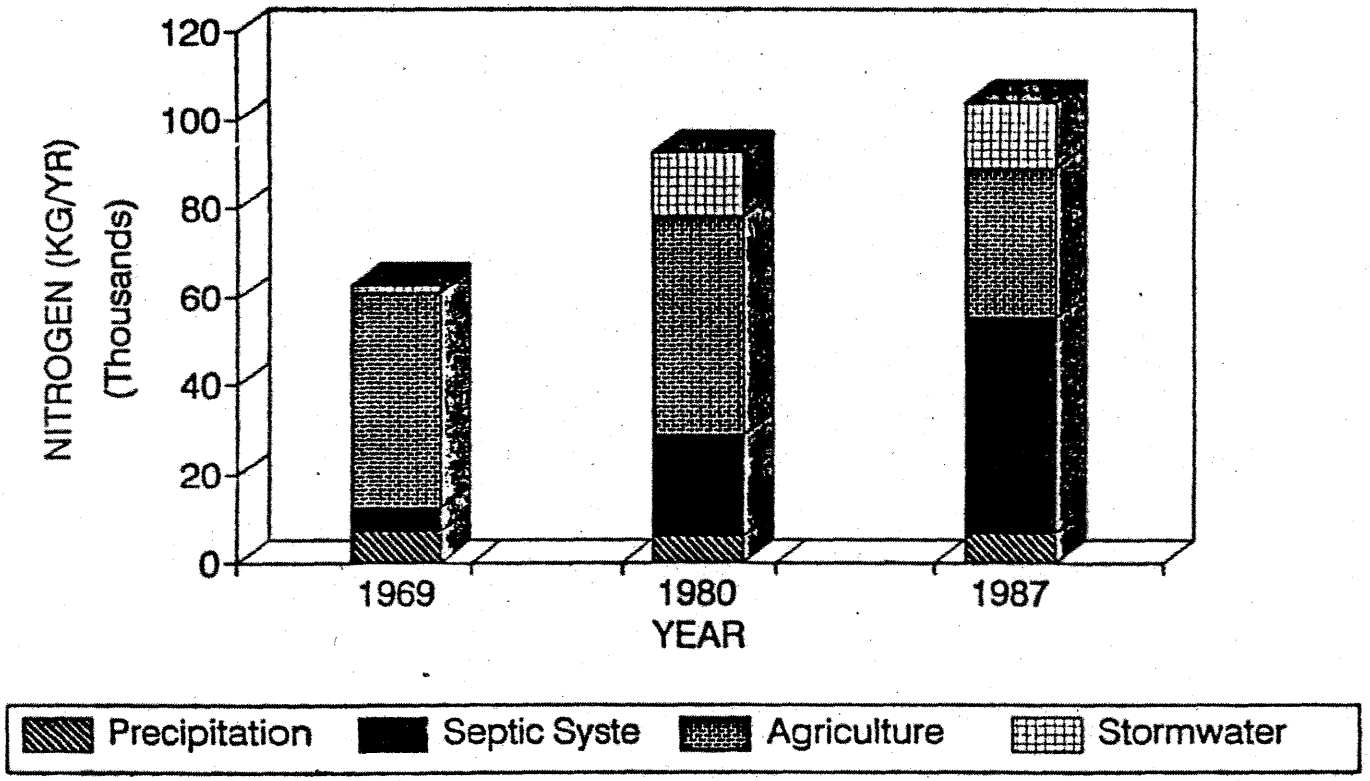


FIGURE 15

FIGURE 15

NITROGEN INPUTS
THURSTON CO/MCALLISTER/WA

PROJECT NO. 903-1072.500 DWG. NO. 22392 DATE 6/11/90 DRAWN CW

Golder Associates

In their evaluation which evaluated nitrate contributions from septic systems, Brown and Caldwell found several areas within the GSA that are thought to be vulnerable. The septic system risks are maximized when septic system densities are increased and the under flow ground water volume and velocity are low. It is believed that wells within area 305 on FIGURE 16 may exceed the drinking water standard for nitrate as the area is currently developed. Wells in areas 101, 102, 207, 208, and 304-306 and 400 may be vulnerable to contamination at projected growth rates if sanitary sewers are not utilized (Brown and Caldwell 1990).

II. STORM WATER AND RUNOFF

Within the McAllister GSA there are over 140 storm water systems, and over 84 percent of the runoff is recharged to the ground water system (Brown & Caldwell, 1990). Studies have shown that runoff or storm water can contain substantial amounts of pollutants, and there is concern about the impacts that millions of gallons per year of storm water will have on the ground water system. This concern is heightened given the vulnerable nature of the ground water system.

To evaluate these concerns, Thurston County contracted with Brown and Caldwell Consulting Engineers. The results of their evaluations, and other information is presented below.

A review of articles and reports has shown that the primary storm water risks are associated with three pollutant types, based on their solubility and density. These general types of pollutants are:

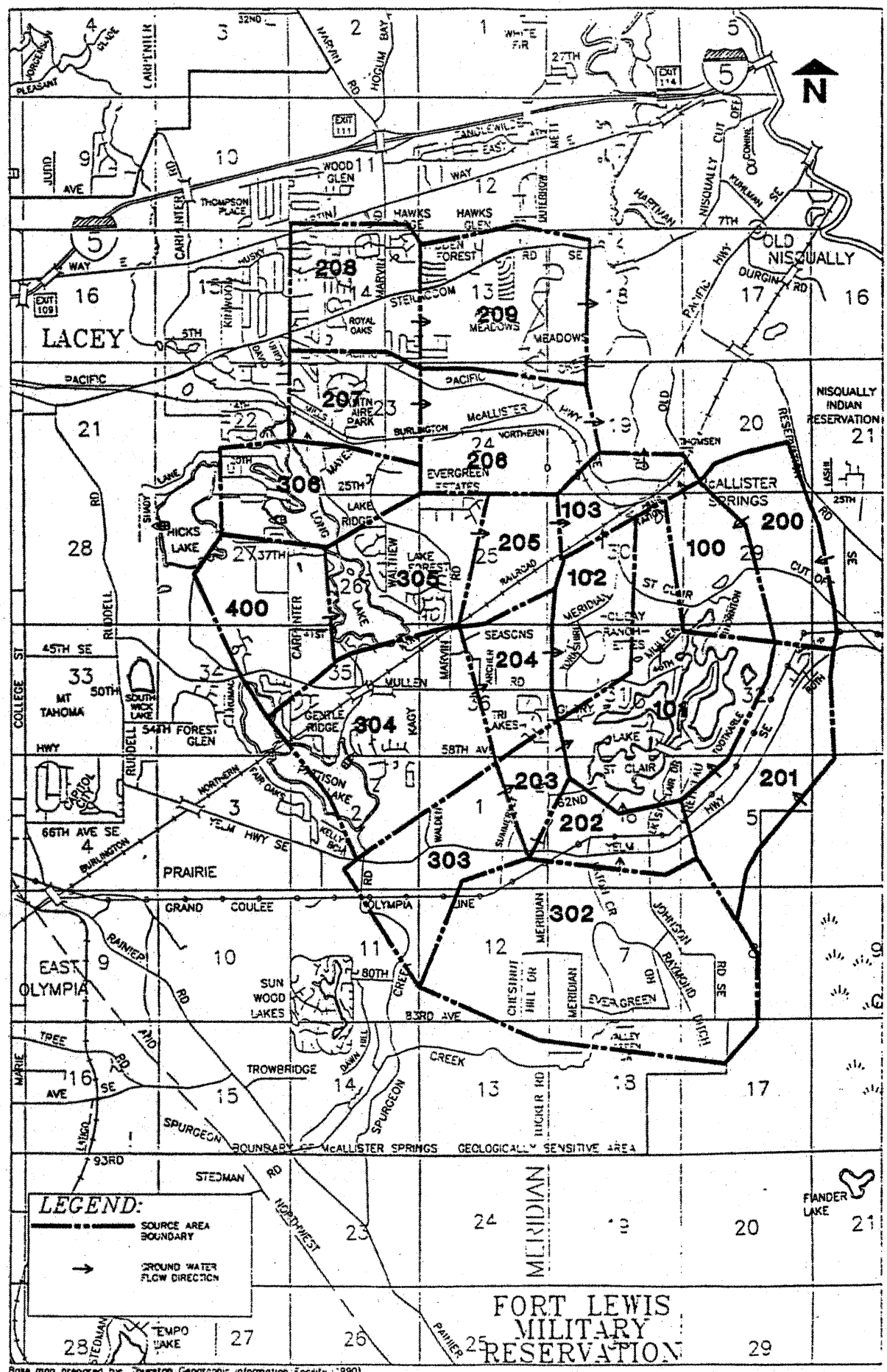
- Hazardous Material Type 1 (HM-1): soluble, water coincident material, that generally moves with the aquifer flow (such as nitrate);

- Hazardous Material Type 2 (HM-2): light, slightly soluble petroleum products, capable of forming dissolved and floating plumes; and

- Hazardous Material Type 3 (HM-3): dense, slightly soluble to insoluble solvent materials that form dissolved as well as sinking product plumes.

Brown and Caldwell's work found that risks from hazardous materials to the ground water are likely to result from: spills of materials associated with their transport, spills on private property associated with business or industry, and chronic loads associated with storm water facilities and septic systems.

FIGURE 16



From Brown and Caldwell (1990)

In addition to categorizing risk types, the assessment model used by Brown and Caldwell was able to predict areas and situations where risk was increased. A discussion of these findings is included below as well.

HM-1 (NITRATE) RISK

While nitrate is not the only water soluble storm water constituent, it is of health significance, and it is the pollutant on which the risk assessment model was based. The following comments are based largely on nitrate risk.

A review of available references, including the Woodland and Woodard Creek Study in Thurston County, have shown that nitrate levels in storm water are usually below 1.0 mg/liter, which is one tenth the drinking water standard for nitrates. This finding was confirmed by the work of Golder Associate (Golder 1990). Consequently the nitrate risk associated with storm water appears to be minimal.

Because septic systems are distributed over the entire area, all wells in the area could be affected, with shallow wells having the greatest risk.

HM-2 and HM-3 RISK

CHRONIC RISK

When all risks associated with storm water and runoff were evaluated, the risks associated with HM-2's and HM-3's were found to be the greatest. In particular, the risk due to spills of HM-2's (petroleum products) during their transport was found to be high. Day to day pollutant loads from storm water facilities were also found to be high, with HM-2's being the major concern. As with septic systems, increased risk was linked to increased development density (independent of sewer status) and ground water underflow volume and velocity. Shallow wells down gradient from development are believed to be more vulnerable.

Areas 101, 102, 207, 208, 304, 305 and 400 (FIGURE 16) are currently at risk, based on the risk assessment model and area 306 is added to this list by 2010 if correction measures are not employed. Again, because the storm water systems are located throughout each section, the associated pollution problems would affect the entire area.

RISK DUE TO SPILLS AND ACCIDENTS

Spills and accidents involving hazardous materials are the greatest threat to the regions ground water, based on Brown and Caldwell's Risk Assessment Model. Petroleum products (HM-2's) are the materials associated with most spills and largest risks.

Accidental spills of materials, in conjunction with traffic accidents, are the largest potential cause of ground water standard violations. Four times as many water quality standard violations are predicted as a result of transportation spills when compared to spills due to land use or business activities. The majority of the water quality violations are expected to result from the spill of fuels by 5000 gallon tankers.

By the year 2010, it is believed that the occurrence of spills and accidents will increase, especially if transportation systems and storage and handling facilities for hazardous materials are not improved. The number of times water quality standards would be exceeded due to spills and accidents are expected to increase by some 220 percent, from 28 to 66 events per year, while the population in the area nearly doubles.

The risk due to railroad spills was evaluated and considered to be slight, given the very low rail accident rates. Such a spill involving hazardous materials would be devastating, however, due to the volumes of materials hauled in rail cars (20,000 gallons.)

The risks associated with spills and accidents can be attributed to a variety of factors. These include traffic volumes, numbers of containers in the area that can spill, accident risk associated with the roadways, and plumes of pollutants influencing down gradient wells.

Based on this analysis, areas 204, 206, 207 and 304 have the highest rate of drinking water violations due to use related spills, while areas 203, 206, and 207 have the highest transportation risks (FIGURE 16).

In the future, population and traffic increases tend to compound existing problems, making bad situations become worse in the more vulnerable zones. Areas 203, 206, 208 have the greatest potential for problems due to land use activities by year 2010, while area 208 can be added to the list of areas with transportation related concerns. Areas 303, 306 and 400 are also exposed to moderate spill and accident risks.

It must be noted that the nature of hazardous material spills makes their impacts different than the chronic types listed earlier. The spills represent one time, or at least less frequent events. Their influence on water quality is in part due to the amount and type of material spilled and its proximity to

wells. Accordingly, some water quality standard violations may be short term in nature, influencing only one or two wells while larger spills (5000 gallons) may influence many wells for years.

REDUCING STORM WATER IMPACTS

The work by Brown and Caldwell indicates that many of the problems associated with the impacts of hazardous materials can be greatly reduced. The methods used are somewhat dependent whether chronic storm water or spills are being addressed, although some control measures are helpful for both.

The principles for risk control and basic management strategies are listed below:

* Reduce the opportunity for spills of hazardous materials by employing containment devices where spills are most likely to occur. Control measures would include spill containment systems at high risk intersections and roadways, as well as sites where hazardous materials are used, produced or stored.

* Reduce the chances for spills within areas, and try to limit the areas where they can occur. Safety measures would include controlling where truck traffic is allowed, placing limitations on businesses and uses that utilize hazardous materials, and limiting density, which affects traffic volume.

* Reduce the amount of hazardous materials within storm water and runoff. This can be done through the proper design and location of storm water facilities, and by limiting development densities, which influences raw storm water quality. The design of these kinds of facilities should include biofiltration and detention.

* Provide for prompt cleanup and containment when spills occur.

The specific control methods recommended by staff for implementation are listed in the RECOMMENDATIONS section of this report.

III. AGRICULTURAL PRACTICES

Much attention has recently been focused on agricultural practices, specifically pesticide and fertilizer use, and how those might affect ground water quality. This is largely due to recent surveys which found pesticides in wells within the GSA, and elevated nitrate levels in ground water adjacent to crop production areas (Entranco 1987).

As part of the 1988 GSA resolution, voluntary Best Management Practices (BMP's) were developed for the use of pesticides and fertilizers. These were developed in response to concerns of the area's vulnerability to ground water pollution as a result of poor pest control and fertilization practices. BMP's are methods designed to eliminate or reduce the impacts of pesticide and fertilizer use on ground water.

The use of fertilizers within the GSA has been recently evaluated by Golder Associates. This was done in an attempt to determine the amounts of associated pollutants that can enter the ground water system. Washington State University's Cooperative Extension office for Thurston County (Cooperative Extension) has visited the major users of pesticides and fertilizers within the GSA in an attempt to evaluate the effectiveness of the BMP's. In addition a telephone survey of City of Lacey staff was conducted. Seven of the ten users of these products are associated with agriculture, the others are the North Thurston School District, the Capital City Golf Course and Lacey.

NITROGEN CONTRIBUTION

Substantial amounts of nitrogen, used as fertilizer, are applied to the land within the McAllister area. In their assessment of 1987 nitrogen loading in GSA, Golder found that contributions from agriculture were second only to those from septic systems (FIGURE 15). This represents about one third of the calculable nitrogen contributions to the McAllister ground water system (Golder 1990).

The BMP evaluations show that the rate of nitrogen application varies substantially, depending on the target crop or vegetation, and the applicator. Rates from 6.1 to over 125 kilograms per acre have been recorded within the GSA, with the average rate being 35 kilograms per acre (Tapio 1990). This figure is consistent with Golder's loading rate of 0 to 32 kilograms of nitrogen per acre.

The amount of nitrogen that is released to the ground water regime varies depending on a number of factors. These include; rate of application, soil type and organic content, applications methods, the amount and duration of irrigation and rain fall that

follows the fertilizer application, soil moisture content and others. In soils similar to those found in the GSA, as much as 60 percent of the nitrogen was found to leach from the soil into the ground water system (Nelson 1988), while Golder's McAllister report indicates average nitrogen losses of 50 percent.

PESTICIDE CONTRIBUTIONS

Pesticides include the broad group of materials that are used to control weeds, grasses, insects, and other "pests" that are considered undesirable by the property managers. Within the McAllister GSA, a wide variety of materials were found to be in use by the major pesticide users. Of the 28 different pesticides (based on active ingredients) that were used within the GSA, seven were listed on the Environmental Protection Agency's (EPA) list of pesticides that have shown a tendency to leach or migrate within soils (TABLE 3). Two others were listed as being mobile within sandy soils (Extoxnet). A third product, Mancozeb or Dithane M-45, has a degradation product (ETU) which is on EPA's leacher list.

Many other pesticides in use were considered to have carcinogenic, mutagenic or tetragenic properties (Extoxnet), and three of these were considered to be leachers by the EPA.

Specific use data is available for only the large pesticide and fertilizer users. Little reliable information exists for residential of household users of these materials.

While it is almost impossible to predict the amount of pesticides that will enter the ground water system in the area, pesticide contamination can and has happened within the GSA. The potential for pesticide to enter the aquifer still remains, as mobile, persistent materials are being applied by a variety of property owners.

BEST MANAGEMENT PRACTICES

The recent evaluation of area BMP's was the first attempt to do so since they were finalized in early 1989. Because of this and the fact that previous records on fertilizer and pesticide use were not available, it is difficult to determine if the voluntary BMP approach has made measurable changes in the types and amounts of materials applied, and the methods and safeguards that were employed.

TABLE 3
PESTICIDES USED WITHIN THE
McALLISTER GSA
1989-1990[1]

Acephate
Benlate
Bravo *
Captan
Chloropicrin
Chipco 26019
Chloropyrifos
Devrinol **
Diazinon *
Dithane M-45 (Mancozeb) ***
Diuron *
Dursban
Enide *
Endosulfan
Fore
Glyphosate
Linuron
Methyl Bromide **
Oxyflourofen
PCNB
PMAS
Ronilan
Simazine*
Subdue
Surflan
Telone *
Triclopyr **
2,4 - D *

[1] Source: Best Management Practices Report for McAllister Springs

* On EPA's Leacher List
** Moderate - High potential to migrate in soils, but these pesticides are not on EPA leacher list
*** Has degradation product (ETU) which is on EPA's Leacher list, although this product is not listed

When the BMP evaluations are reviewed, pesticide and fertilizer practices appear to be of greater significance than those for manure handling and disposal. This is because there is only one large livestock operation (a dairy), that was evaluated within the area, and the BMP report indicates that it was well managed.

A comparison of pesticide and fertilizer use evaluations reveals that all BMP's were not consistently utilized (TABLE 4). While certain BMP's are not appropriate for use by all of the group evaluated, there are other BMP's that are applicable to many settings that were not used by anyone.

The most widely used BMP's were proper facilities for the storage of materials, and soil testing to determine soil fertility and fertilizer needs. All eight of the operators use some sort of integrated pest management strategy, although specific practices were not recorded.

On the other hand, leachable pesticides, as indicted by EPA's leacher list (See Appendices), were used on five of the eight surveyed properties. Few seemed to keep adequate fertilizer use records, or information regarding the weather conditions and timing strategies to minimize pesticide and fertilizer leaching potential. The survey did not indicate that any operator used nitrification inhibitors, although the golf course did use a slow release nitrogen formulation.

These results indicate that many of the BMP's are not being utilized, or that the evaluation methods are incomplete or inconsistent.

IV. RESIDENTIAL AND HOUSEHOLD POLLUTANTS

There is a large potential for individuals and households to contribute to ground water pollution. This is because most of the types of materials that can readily contaminate ground water are very accessible to individuals.

Residential impacts can be significant. Two different studies indicate that even at moderate densities (1-4 units per acre), nitrogen loads from lawn fertilization can be equivalent to half of that from septic systems (Hughes 1985, Nelson 1988). Such loadings in the McAllister area would make lawn fertilization the third highest source, slightly behind agricultural practices. Excessive rainfall and watering can make these contributions even greater (Morris 1988).

TABLE 4
PESTICIDE AND FERTILIZER
BEST MANAGEMENT PRACTICES USED
WITHIN THE McALLISTER SPRINGS GSA*
1989-1990

	DESCRIPTION OF BMP	SITES USING/ TOTAL SITES**	PERCENT SITES USING BMP
PESTICIDE BMP'S	PESTICIDES MIXED AWAY FROM WELLS	4/8	50
	STORED IN PROPER FACILITIES	7/8	87.5
	PROPER METHODS USED FOR USE OR DISPOSAL OF WASTE/EXCESS	UNKNOWN	UNKNOWN
	ADEQUATE RECORDS KEPT	5/8	62.5
	BANDS PESTICIDE APPLICATIONS	UNKNOWN	UNKNOWN
	USE INTEGRATED PEST MANAGEMENT METHODS	8/8	100
	LEACHING PESTICIDES NOT USED	3/8	32.5
	USES LICENSED APPLICATOR	6/8	77
FERTILIZER BMP'S	SOIL TESTS USED TO DETERMINE FERTILIZER NEEDS	7/9	77
	APPLICATIONS TIMED TO MINIMIZE LEACHING	3/9	33
	FERTILIZER APPLICATIONS SPLIT	2/9	22
	TESTS WELLS FOR NITRATES	4/9	44
	ADEQUATE RECORDS KEPT	3/9	33
	BANDS FERTILIZER APPLICATIONS	3/9	33

SOURCE: Best Management Practices Report for McAllister Springs

* Results are not available for BMP's not listed

** Represents the reported number of sites were reported as using the BMP compared to the total number of sites

While little information is available on household pesticide use within the GSA, such materials are obviously being used. Given the vulnerability of the area, the availability of pesticides, and the fact that no licensing or training is required for over the counter products, the potential for these products contributing to ground water degradation certainly exists.

The use and disposal of hazardous materials, either by individuals or businesses, represents another threat to ground water. As with pesticides, many of these materials are both mobile and stable within the ground water system. It is estimated that anywhere from 920 to 1856 tons of hazardous wastes are produced each year by households and small quantity generators (Thurston County, 1990). While some 70 percent of these wastes are disposed of at landfill sites, the fate of the remaining 30 percent is unknown. Certainly some of these wastes reach septic systems, storm drains and other areas where they can be enter the ground water system.

CHAPTER 4: DISCUSSION AND RECOMMENDATIONS

I. DISCUSSION OF FINDINGS

Since the McAllister Geologically Sensitive Area was established in 1988, a substantial body of information has been gathered. This new information increases our understanding of the area and the many factors which can put the ground water system at risk.

We now have confirmation that the geologic and hydrologic characteristics within the GSA make the entire region vulnerable to pollution, and that pollutants can come from numerous sources. Septic systems, agricultural practices, storm water facilities and household activities all influence ground water quality. These activities can influence both nearby wells and the larger aquifer system that makes up McAllister Springs. Both shallow and deep wells can be affected.

Evidence has been gathered that show the regions aquifer system has already been impacted. The rising nitrate trend at McAllister Springs, the presence of pesticides in several wells, and elevated nitrate levels within the McAllister GSA all confirm that the McAllister area is vulnerable.

It is known that there is a substantial lag time between when water and pollutants enter the ground water system, and when they are discharged or withdrawn at McAllister Springs. Impacts of today's land use activities will not be seen for years at McAllister, and it is not known how high contaminant levels will climb, even if no more pollutant sources are allowed.

It is now apparent that ground water pollution risk can be reduced by controlling sources and events which affect the water quality. Consequently density and land use limitations become important as they control the number of septic systems, storm water facilities, vehicles and spills which are in an area, and in turn the ability of these pollution sources to impact water quality.

The control of hazardous materials and wastes is also very important. This is not only due to the high toxicity of these materials, but because they are stable and mobile once within the ground water system. What's perhaps more significant is that these materials are not readily removed by septic systems or conventional storm water facilities, and they can be introduced to the aquifer system if they are spilled, improperly disposed of, or if in some other way they enter septic or storm systems. The control of storage, transport and use of these materials within the area is crucial.

The proper use of pesticides and fertilizers, whether by large agricultural producers, golf courses, or individuals is an important issue as well. The area is already experiencing the impacts of certain pesticides. The information available shows several leachable pesticides are still in use, and that all applicable Best Management Practices are not always followed. The potential for impact by individual or homeowner use of pesticides and fertilizers is also great, and cannot be ignored.

These findings make it clear that steps must be taken if the water quality for McAllister Springs and the other water supplies is to be preserved. Without substantial action, there is a very real chance that water quality will be substantially impaired, resulting in the loss of water resources or increased costs due to the need for water treatment.

II. GOALS OF THE RECOMMENDATIONS:

Section III presents a series of recommendations designed to protect the ground water system that feeds McAllister Springs and the many wells and water supplies developed within its capture zone.

The goal of these recommendations is to maintain water quality at levels which will not exceed existing or proposed water quality standards, or put the public at undue risk due to impaired water quality. It is the intent of these public health actions to preserve water quality not only at McAllister Springs, but throughout the area that makes up its capture zone.

It is recognized that pollutant levels within the area's boundary will most likely continue to increase in the near future. This increase will be a reflection of pollutants already within the McAllister ground water system, and the years that it takes for pollutants to travel through it. By acting now, it is the intent that pollution levels not exceed public health standards, and that eventually the pollutant levels will recede with a corresponding improvement in water quality.

These recommendations are based on the best information that is currently available. As new information and monitoring results become available, the actions may need to be modified. In this regard, the County will continue to seek information on which to gauge the effectiveness of any implemented recommendation, and modify those recommendations as warranted.

III. McALLISTER GSA RECOMMENDATIONS

The following are staff recommendations for the McAllister Geologically Sensitive Area (GSA):

A. BOUNDARIES:

It is recommended that the McAllister GSA Boundary be changed to reflect the capture zone as defined by the work of Golder Associates, the hydrogeologic consultants to the County. This shift is consistent with the intent of the original GSA, which based the GSA boundary on what was thought to be the recharge area for McAllister Springs. Because it is recognized that the entire area is vulnerable to pollution, Thurston County will develop methods to protect ground water resources outside of the McAllister capture zone, based on recommendations from the Thurston County Ground Water Advisory Committee (GWAC). A more complete discussion of the Recommendations for the areas outside of the capture zone are included in the Appendices.

NOTE: Throughout the remainder of the Recommendations section of this report, the term **capture zone** will reflect the boundary within which the following actions are proposed. The capture zone is shown on FIGURE 12.

B. AGRICULTURAL PRACTICES:

SPECIAL AREA REGULATIONS

Greater control is recommended over the types of pesticides that can be used within the GSA, especially those that have the potential to leach into ground water. Special Area Regulations (SAR's), which can be adopted by the Washington State Department of Agriculture, are the best method to serve this purpose.

At this time, the GWAC is developing a strategy for the management of pesticides within areas where the ground water is vulnerable to pollution. It is understood that the GWAC recommendations will include a request for the Department of Agriculture to adopt SAR's which will restrict the use of leaching pesticides. This approach may be based on localized criteria to determine if a pesticide leaches within the soil types found within the GSA.

It is recommended that the Board of Health (the Board) support and promote the development of a Special Are Regulations proposal by the GWAC. If the proposed actions by the GWAC are not sufficient to protect the McAllister resource, additional measures should be considered by the Board of Health at that time.

OTHER AGRICULTURAL MEASURES

In addition to SAR's, the following measures are recommended regarding agricultural practices within the GSA:

* Until the SAR's are complete, The Board of Health should direct that an annual review of the BMP'S for the Use of Pesticides and Fertilizers be conducted by the Cooperative Extension Office of Thurston County. Cooperative Extension shall report back to the Board regarding their findings. A specific and thorough evaluation procedure should be developed by Cooperative Extension with the assistance of the Environmental Health Division. The evaluation methods and procedures should be submitted to the Board for review and approval prior to January 1991.

* The Board should require any new land uses which include landscaping or major uses of fertilizers and pesticides to develop Best Management Practices (BMP's) prior to the approval of the project. Failure to follow the BMP's would result in revocation of the land use permit.

* The County should increase coordination with area schools and parks in order to provide education and information on the use of BMP's for pesticides and fertilizers.

C. SEWAGE DISPOSAL

The following recommendations will be made to the Board regarding the permitting, use and design of on-site sewage disposal systems within the McAllister GSA. The on-site sewage disposal permitting and design requirements can be addressed through changes in the GSA requirements as allowed in Article IV (the sewage code). Density and land use issues will need to be accomplished by modifying the zoning ordinance, which will require action by the Thurston County Planning Commission and the Board of County Commissioners.

Septic System Standards:

The following standards shall govern the issuance of any Building Site Application (BSA) within the GSA:

* Pressure distribution will be required for all new septic systems, and for the repair of existing systems. The design of these systems must be in accord with Washington Department of Health (formerly DSHS) Technical Review Committee guidelines.

* A maximum excavation or trench depth of 30 inches for the drain field.

* A minimum separation of 36 inches shall be maintained between the trench bottom and any perching layer or zone, or any impervious layer.

Operational Permit Requirements:

An Operational Permit shall be required for all new septic systems and those that are repaired. These requirements are consistent with approved revisions to Article IV, which will be implemented September 1, 1990. This permit may be revoked when any of the following conditions exist:

* Public sewer becomes available.

* The on-site system fails to meet the maintenance and operational requirements set forth in the operational permit.

Density and Land Use Considerations:

The following density and land use recommendations should apply to new development within the GSA:

* Density within the one year travel time zone of McAllister Springs should be limited to one unit per five acres, with no provisions for increase, regardless of changes in sewer status or UGMA boundaries.

* The maximum allowable density for new subdivisions using on-site sewage disposal systems within the capture zone will be one unit per five acres. Within the UGMA boundary, lots must be clustered, and a community on-site sewage disposal system with an operational permit will be required. Outside of the UGMA boundary, the maximum density will be one unit per five acres.

* As areas are connected to sewers, the underlying zoning densities will apply providing that the storm water facilities are designed to mitigate water quality impacts by incorporating water treatment methods.

* For nonresidential uses, BSA's may be approved for the equivalent of a designed sewage flow of 450 gallons per five acres per day. Waste water quality must be the equivalent of typical residential waste water.

* BSA's may be approved for vested lots which either received final approval prior to August 15, 1988, or were included in a fully completed application for preliminary subdivision, short subdivision, or large lot subdivision submitted to the Thurston County Planning Department prior to August 15, 1988.

Extension of Sewer Service:

* Homes and other facilities utilizing on-site sewage disposal systems will be required to connect to sewers when they become available.

* Sewer service should be accelerated to areas where ground water is believed to be at risk as a result of on-site sewage disposal systems. These areas include the developments to the southeast of Long Lake: namely the Lake Forrest, Seasons and Eagle Crest subdivisions.

Other Items:

* Thurston County should work to eliminate the discharge of sewage and waste water on the Burlington Northern railway tracks by Burlington Northern and Amtrak.

* Thurston County should request that the Technical Review Committee of the Washington State Department of Health develop guidelines for septic systems that incorporate nitrogen removal methods as quickly as possible.

D. STORM WATER AND HAZARDOUS MATERIALS:

The Brown & Caldwell risk analysis of storm water impacts to ground water in the McAllister GSA has identified hazardous material spills as the greatest threat to ground water quality. Accidental spills from traffic accidents involving hazardous material transporters was identified as the primary threat. Given this assessment of risk the following recommendations are made:

* Restrict truck traffic within the capture zone area by limiting truck traffic to certain, designated truck routes. This restriction can be accomplished through an amendment of Thurston County Code 12.44.051. All but the major arterials (eg. Hwy 510, Yelm Hwy) should be designated as restricted to all truck traffic (local deliveries exempted) and the roads posted with signs identifying the restriction.

* The designated truck routes within the capture zone should be given high priority for road improvement and maintenance work. Minimizing accidents on these routes will be a major step in preventing ground water contamination in this area.

* High risk intersections along the designated truck routes should be identified and storm water systems with containment capabilities designed and installed at these intersections. This work should be included in the final McAllister/Eaton Creek storm water Capital Improvement Plan (CIP).

* Burlington Northern Railroad should be advised as to the vulnerable nature of the ground water in the capture zone area and be requested to enhance their track surveillance and maintenance in this area.

* The County should coordinate emergency management strategies and procedures with Burlington Northern in the event a spill or accident occurs on their railroad tracks within the GSA.

* The storm water Drainage Design Manual should be adopted and applied to all new proposed development in the GSA. The manual incorporates water quality treatment into all system designs prior to its discharge to ground or surface waters. Treatment will typically involve biofiltration or detention of the 2 year, 24 hour storm event to allow for removal of suspended contaminates.

* The zoning ordinance should be amended to prohibit certain land uses under the Neighborhood Convenience District within the GSA. Prohibited uses should include those which use, handle, or store hazardous materials as part of their operations. Examples of these uses included: gas stations, dry cleaners, furniture strippers, etc.

* Currently there are very limited areas zoned for commercial use within the GSA, and these sites have already been developed. No future areas should be zoned for commercial or industrial purposes within the GSA.

* Special use permits and/or home based industry applications which involve the use, handling, or storage of hazardous materials should not be allowed. These applications will need to be identified in the case-by-case review process of such applications and should be denied.

* Existing land uses which become nonconforming as a result of zoning ordinance revisions regarding the use, handling or storage or hazardous materials should not be allowed to expand or intensify.

* The County should not utilize any chemical methods for the purposes of maintaining County properties such as roadsides or parks within the GSA. Other entities such as the Department of Transportation, Fort Lewis, Burlington Northern, and Bonneville Power Administration should be advised of the vulnerability of the ground water system and be requested to eliminate chemical usage in the area.

* The Department of Ecology should be requested by the Board to deny all permit applications for aquatic pesticide use in Lake St. Clair unless the application is reviewed by both Ecology and the County and there is concurrence that the pesticide use will be consistent with the ground water protection efforts for this area.

OTHER LAND USES:

Prohibit mining/mineral extraction permits within the GSA.

E. MONITORING/DATA COLLECTION:

The following items should be included in the implementation phase and funding package for the North Thurston County Ground Water Management Area.

* All wells used for water level monitoring in the capture zone should be surveyed to within 0.1 feet elevation. Subsequent to the surveying, water levels should be measured in all the wells within a one week period. This should be done quarterly for one year in order to update the potentiometric surface maps of this area.

* Ground water quality monitoring should continue on the fifteen wells within the GSA previously monitored by the health department. Monitoring should occur twice a year to track changes in the area's water quality.

* Multilevel monitoring wells should be installed in the areas of high nitrogen concentrations near Pattison Lake, Pacific Ave./Marvin Rd, and along the flow line from the Pattison Lake area towards McAllister Springs. Hydraulic parameters (hydraulic conductivity, storativity) of these wells should be determined. These wells should be monitored twice a year to determine the vertical distribution of nitrogen in the various hydrogeologic units.

*Install a permanent, continuous stream-gaging station on Eaton Creek where it enters Lake St. Clair. Water quality at this station should be measured on a quarterly basis and during high flows to assess the nitrogen loading to the lake.

F. EDUCATION

Education on individual Best Management Practices is critical to the long term protection of water quality within the McAllister GSA. The recommended public education plan would be carried out by County water resources educator in the Office of Water Quality and Cooperative Extension. It includes the following elements:

Target Group: **Homeowners**

* Issues: gardening practices, septic systems maintenance and household hazardous waste.

* Major Theme: save money and take actions to protect water quality

* Activities:

  Train master gardeners to assist in outreach efforts

  Hold workshops on gardening practices and household hazardous waste disposal

  Distribute materials on homeowner BMP's

  Conduct a briefing tour of the area for residents and property owners

Target Geographical Area: **Lake St. Clair**

The initial priority area will be Lake St. Clair because of its location in the area of the one year travel time of pollutants to the springs. The program will later extend to other portions of the GSA.

TABLE 5
SOURCE OF RECOMMENDATIONS FOR McALLISTER CAPTURE ZONE
-SEWAGE DISPOSAL-

RECOMMENDATION	NEW PROPOSAL	PART OF 1988 GSA PROVISIONS	PART OF EXISTING COUNTY PROGRAMS/ PROPOSALS
REQUIRE PRESSURE DISTRIBUTION, 30 INCHES MAX. TRENCH DEPTH AND 36 INCH SEPARATION FOR NEW SEPTIC SYSTEMS AND REPAIRS		XXXX	
REQUIRE REVOCABLE OPERATIONAL PERMITS FOR NEW CONSTRUCTION AND REPAIRS		XXXX	XXXX
MAXIMUM DENSITY IN ONE YEAR McALLISTER TRAVEL ZONE IS ONE UNIT PER FIVE ACRES	XXXX		XXXX[1]
ONE UNIT PER FIVE ACRE MAX. DENSITY FOR NEW PLATS THAT USE SEPTIC SYSTEMS	XXXX		XXXX[1]
AREAS REVERT TO UNDERLYING ZONING WITH SEWERS AND ENHANCED STORM WATER TREATMENT	XXXX		XXXX[2]
NONRESIDENTIAL SEWAGE FLOWS LIMITED TO 450 G/5 ACRES/DAY FOR NEW SITES	XXXX		
SEPTIC SYSTEM PERMITS CAN BE APPROVED FOR VESTED LOTS		XXXX	XXXX
EXISTING HOMES ON SEPTIC SYSTEMS MUST SWITCH TO SEWER WHEN IT BECOMES AVAILABLE	XXXX		
ACCELERATE SEWER SERVICE TO HIGH RISK AREAS	XXXX		XXXX[3]
TRY TO ELIMINATE SEWAGE DISCHARGES ON RAIL LINES	XXXX		
REQUEST STATE TO DEVELOP GUIDELINES FOR LOW NITRATE SEPTIC SYSTEMS	XXXX		
BOARD OF HEALTH DIRECTS DEVELOPMENT OF INTERIM MEASURES TO PROTECT GROUND WATER OUTSIDE OF CAPTURE ZONE, PENDING GROUND WATER MANAGEMENT PLAN			

[1] BEING PLANNED FOR ALL AREAS OUTSIDE OF UGMA BOUNDARY
[2] ENHANCED STORM WATER TREATMENT INCLUDED IN INTERIM STANDARDS PROPOSAL BY PUBLIC WORKS DEPARTMENT
[3] IN CONFORMANCE WITH SEWER GENERAL PLAN. THIS STUDY IDENTIFIES CAPTURE ZONE AS AREA OF HIGHER RISK

TABLE 6
SOURCE OF RECOMMENDATIONS FOR McALLISTER CAPTURE ZONE
- BOUNDARY AND AGRICULTURE -

RECOMMENDATION	NEW PROPOSAL	PART OF 1988 GSA PROVISIONS	PART OF EXISTING COUNTY PROGRAMS/ PROPOSALS
CHANGE BOUNDARY	XXXX		
SUPPORT THE GROUND WATER ADVISORY COMMITTEES DEVELOPMENT OF SPECIAL AREA REGULATIONS FOR AGRICULTURE	XXXX		
BMP EVALUATIONS		XXXX	
BMP'S REQUIRED FOR NEW LAND USE PERMITS	XXXX		
BMP OUTREACH FOR SCHOOLS AND PARKS IN CAPTURE ZONE		XXXX	

TABLE 7
SOURCE FOR RECOMMENDATIONS IN McALLISTER CAPTURE ZONE
- MONITORING, DATA COLLECTION AND EDUCATION -

RECOMMENDATION	NEW PROPOSAL	PART OF 1988 GSA PROVISIONS	PART OF EXISTING COUNTY PROGRAMS/P PROPOSALS
SURVEY MONITORING WELLS USED FOR CAPTURE ZONE DETERMINATION	XXXX		
CONTINUE TO MONITOR GSA WELLS	XXXX		
INSTALL MULTILEVEL MONITORING WELLS AT DESIGNATED AREAS	XXXX		
INSTALL STREAM GAGING STATIONS AT EATON CREEK MOUTH	XXXX		
DEVELOP EDUCATION PROGRAM FOR HOMEOWNERS ON PESTICIDE AND FERTILIZER USE	XXXX		XXXX

TABLE 8
BASIS FOR McALLISTER CAPTURE ZONE RECOMMENDATIONS
- STORM WATER AND HAZARDOUS MATERIALS -

RECOMMENDATION	NEW PROPOSAL	PART OF 1988 GSA PROVISIONS	PART OF EXISTING COUNTY PROGRAMS
RESTRICT TRUCK TRAFFIC IN CAPTURE ZONE	XXXX		
DESIGNATE TRUCK ROUTES	XXXX		
PROVIDE SPILL CONTAINMENT AT HIGH RISK INTERSECTIONS	XXXX		
COORDINATE SPILL RESPONSE WITH BURLINGTON NORTHERN	XXXX		
WORK TO HAVE BURLINGTON NORTHERN ENHANCE TRACK MAINTENANCE AND SURVEILLANCE	XXXX		
ADOPT STORM DRAINAGE MANUAL AND APPLY TO McALLISTER			XXXX
AMEND ZONING TO PROHIBIT NEW USERS OF HAZARDOUS MATERIALS IN NEIGHBORHOOD CONVENIENCE ZONES	XXXX		
NO NEW COMMERCIAL OR INDUSTRIAL ZONES	XXXX		
DENY SPECIAL USE AND HOME BASED INDUSTRY PERMITS THAT USE HAZARDOUS MATERIALS	XXXX		
NO EXPANSION FOR NON CONFORMING USES THAT USE HAZARDOUS MATERIALS	XXXX		
COUNTY SHOULD NOT USE CHEMICAL CONTROL METHODS IN AQUIFER SENSITIVE AREAS			XXXX
ECOLOGY SHOULD DENY AQUATIC PESTICIDE PERMIT APPLICATIONS FOR LAKE ST. CLAIR	XXXX		
PROHIBIT MINING AND MINERAL EXTRACTION	XXXX		

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APPENDICES

RECOMMENDATIONS FOR GROUND WATER PROTECTION OUTSIDE THE McALLISTER SPRINGS CAPTURE ZONE

The work to date on the review of the McAllister Springs Geological Sensitive Area and the Northern Thurston County Ground Water Management Area has identified other areas outside of the specific McAllister Springs recharge area as also being geologically sensitive and vulnerable to ground water contamination from land use activities. The area originally contained in the McAllister GSA but now determined to be outside the capture zone of the Springs is still found to be susceptible to ground water contamination for the same reasons as the area comprising the recharge area of the Springs. The geological formation of this area provides no greater protection than the area recharging the Springs. Similarly, the work of the USGS and others has also identified other areas of Thurston County as vulnerable to ground water contamination.

While recognizing the principle purpose to the GSA declaration to be the protection of McAllister Springs specifically, there is still a need for clear County direction in protecting ground water resources elsewhere. At the same time, the Northern Thurston County Ground Water Management Area Plan is approaching completion. This Plan should provide the necessary management framework for the long term protection of ground water. However, for the interim period pending completion of the Plan, Thurston County should assure that ground water protection is addressed outside of the Geologically Sensitive Area. The following discussion lists a proposed actions proposed for implementation by the County in order to protect ground water resources outside of the McAllister GSA:

Land Use Activity Review

The existing County policies, plans and procedures should be used on a case by case basis to review proposed land uses in a manner that is most protective of ground water. The current Sewerage General Plan, County Comprehensive Plan, Environmental Review and Sanitary Code all provide means of protecting ground water.

Board of Health Direction

The Thurston County Board of Health should direct staff to interpret the existing County plans, policies and procedures in a manner that provides protection to ground water. Areas throughout the county identified and mapped with information to date as aquifer sensitive should be afforded maximum protection to the extent allowable under the existing policies, plans and procedure.

Ground Water Area Management Plan Development

The Board of Health, acknowledging the role of the Ground Water Advisory Committee in developing a plan for protecting ground water, should forward to the committee its concerns that areas of ground water vulnerability need a long term management strategy. The Board of Health should review the Ground Water Area Plan when completed to assure that long term protection strategies are sufficient. In the event the Plan does not adequately address specific protection needs, the Board should consider employing Geologically Sensitive Area standards in those areas of the county not adequately addressed.

APPENDIX

U.S. ENVIRONMENTAL PROTECTION AGENCY
Leachable Agricultural Chemicals

April 14, 1988

The EPA has determined that these substances have a heightened potential for reaching ground water. This list is periodically updated by the Environmental Protection Agency. The Thurston County Cooperative Extension agent should be contacted for information prior to the use of these substances.

Generic name	Usage	Trade name
Acifluorfen	herb.	Blazer
Alachlor	herb.	Lasso
Aldicarb *	pest.	Temik
Aldicarb sulfone		
Aldicarb sulfoxide		
Ametryn	herb.	Evik
Atrazine	herb.	Atranex
Baygon	insect.	Propoxur
Bromacil	herb.	Hyvar-X
Butylate	herb.	Sutan
Carbaryl	pest.	Sevin
Carbofuran *	pest.	Furadan
Carboxin	fun.	Vitavax
Chloramben	pest.	Amiben
Chlordane-alpha *	insect.	Gold Crest
Chlordane-gamma *		
Chlorothalonil	fun.	Bravo
Cyanazine *	herb.	Bladex
2,4-Dichlorophenoxyacetic acid	herb.	2,4-D
Dalapon	herb.	Dowpon-M
1,2-Dibromo-3-chloropropane **	pest.	DBCP
Diazinon	insect.	Basudin
Dicamba	herb.	Banvel
1,2-dichlopropane	fun.	1,2-DCP
cis-1,3-dichloropropene *	fun.	Telone
trans-1,3-dichloropropene *		
Dieldrin	insect.	HEOD
Dinoseb	herb.	Dinitro
Diphenamid	herb.	Enide
Disulfoton *	insect.	Di-Syston
Diuron	herb.	Duran
Endrin *	pest.	
Ethylene dibromide	pest.	EDB
Ethylene thiourea	pest.	ETU
Fenamiphos *	nema.	Nemacur
Fluormeturon	herb.	C 2059
Heptachlor *	insect.	

Heptachlor epoxide		
Hexachlorobenzene		
Hexazinone	herb.	Velpar
Methomyl *	insect.	Nudrin
Methoxychlor	herb.	Marlate
Metolachlor	herb.	Dual
Metribuzin	herb.	Lexon
Metribuzin DA		
Metribuzin DADK		
Metribuzin DK		
Nitrates		
Nitrites		
Oxamyl *	insect.	Vydate
Pichloram *	herb.	Tordon
Pronamide *	herb.	Kerb
Pronamide metabolite, RH24, 580		
Propachlor	herb.	Ramrod
Propazine	herb.	Primatol
Propham	herb.	Chemhoe
Simazine	herb.	Princep
2,4,5-Trichlorophenoxyacetic acid	herb.	Fortex
2,4,5-Trichlorophenoxypropionic acid	herb.	Silvex
Tebuthiuron	herb.	Spike
Terbacil	herb.	Sinbar
Terbufos *	insect.	Counter
Trifluralin	herb.	Treflan

* EPA listed Restricted Use Product
(current as of May 3, 1988)

** No longer marketed for use in the United States.

REPORT TO THE THURSTON COUNTY BOARD OF HEALTH

on

Best Management Practices for the use of pesticides and fertilizers in the McAllister Springs GSA

Thurston County Environmental Health
February, 1989

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EXECUTIVE SUMMARY

Because of the need to protect the vulnerable McAllister Springs aquifer system, the Thurston County Board of Health established two year interim protective measures for the area by signing Resolution H-5-88, on September 28, 1988. The resolution designated a Geologically Sensitive Area (GSA) over the aquifer system and its recharge area, restricted new development using on-site sewage permits and increased standards for on-site systems. The resolution also directed the Department of Public Health and Social Services (DHSS) to develop Best Management Practices for the use of pesticides, herbicides, fertilizers and manures within the GSA.

Staff of the Thurston County DHSS coordinated the development of the BMP's for the Geologically Sensitive Area. The Thurston County Agricultural Advisory Committee, Cooperative Extension, Soil Conservation Service and agriculturalists within the GSA provided technical assistance and graduate students from The Evergreen State College provided research assistance.

Key findings include the following:

- Pesticides can, and have been known to contaminate ground water even when label directions have been followed.
- Under EPA's proposed National Pesticide Strategy, local agencies would be given the ability to help tailor pesticide use to local ground water protection needs.
- The EPA maintains a list of agricultural chemicals which have a greater potential for leaching to ground water. Proposed revisions to the state pesticide law will provide increased regulation of many of these chemicals.

- o There are no regulations governing fertilizer application rates or record keeping although the application of unmanipulated manures above agronomic rates is a violation of the state solid waste law.
- o State pesticide laws are currently undergoing revision to provide improved ground water protection.
- o Urban pesticide use (residential, parks, golf courses, right-of-ways, etc.) may far exceed commercial agricultural use. Residential pesticide use poses particular problems in that there are few regulatory controls or record keeping requirements.
- o Five major commercial agricultural operations have been identified within the GSA.

The recommended Best Management Practices contained in this report address pesticide and herbicide use, pasture and animal waste management, and fertilizer use. Implementation of a BMP program within the GSA should be tailored to the differing needs of three major user groups; commercial agriculture, residential users, and miscellaneous urban entities.

An implementation program based on the following actions is recommended:

- o Development of informational materials.
- o Coordination of outreach and technical assistance.
- o Annual visits to major commercial operations for BMP implementation review by the Cooperative Extension agent.
- o Record keeping of commercial operations and major miscellaneous urban use by the Cooperative Extension agent.
- o Annual evaluation of records to determine effectiveness of voluntary compliance.

BACKGROUND

The local soils, geology and ground water conditions of the McAllister Springs recharge area render it highly vulnerable to ground water contamination. (Water Supply Paper 2325 USGS) Current information indicates that there is an immediate need to protect McAllister Springs from the impacts of rapidly increasing human activity. On August 15, 1988 the Thurston County Board of Health established interim protective measures for McAllister Springs which put immediate restrictions on land development and created increased regulatory requirements for the construction of on-site sewage disposal systems. On September 28, 1988 the Board of Health voted to extend the interim actions for two years and signed Resolution H-5-88 designating a Geologically Sensitive Area (GSA) over the aquifer system and its recharge area. The Resolution directed County Staff to only allow new on-site septic systems with increased standards and to issue permits for new on-site septic systems only to existing lots. The actions are considered an interim protective measure while further study and research leads to appropriate long term ground water protection measures for McAllister Springs.

As part of the resolution, the Board of Health directed the Department of Public Health and Social Services, with the assistance of the Thurston County Agricultural Advisory Committee and other appropriate technical resources, to

develop Best Management Practices (BMP's) for the application of manures, inorganic fertilizers, pesticides and herbicides in the McAllister Springs GSA. The resolution calls for voluntary compliance with these BMP's through education and other appropriate means. If the Board determines that such voluntary compliance is not adequately protecting the ground water, it intends to take appropriate additional measures to the extent allowed by law. (Background Information, 1988 Thurston Co. Environmental Health)

DEVELOPMENT OF BEST MANAGEMENT PRACTICES

The Department of Public Health and Social Services (DHSS) has functioned as the lead agency during the development of best management practices for pesticides and fertilizers. The DHSS has coordinated research, served as a resource for the various research activities, and has developed methods of disseminating and implementing the best management practices. The Resource Protection staff of the Health Department researched pesticide use by homeowners, available user guides, and reviewed and compiled the findings of the researchers and the recommendations made by the agricultural Advisory Committee and Cooperative Extension.

The Thurston County Health Department, with the help of the Thurston County Agricultural Advisory Committee and the agriculturalists in the GSA, have compiled best management practices for the use of pesticides and fertilizers in the Geologically Sensitive Area. The Agricultural Advisory Committee reviewed the research for applicability to local conditions.

The Evergreen State College, Washington State University Cooperative Extension, Soil Conservation Service and the Washington State Department of Agriculture have provided research assistance. Graduate students from The Evergreen State College researched agricultural practices across the country, specific practices in the GSA, researched public involvement methods, produced case studies on ground water management and researched pesticide use and enforcement.

FINDINGS

1. Pesticides are currently regulated by the U.S. Environmental Protection Agency under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (Public Law 80-104). FIFRA gives states authority to additionally register or restrict the use of pesticides.

   It is unclear how much authority exists to directly regulate pesticides on the local level, and legal opinions vary on this matter. However, the Department of Agriculture can adopt regulations that are locally oriented. (FIFRA as amended, US EPA 1986) Locally, the Thurston County Board Of Health has adopted a policy discouraging the use of aquatic pesticides, and restricts the use of herbicides by county operations in environmentally sensitive areas.

2. The Environmental Protection Agency will develop a long-term approach for managing pesticide contamination in ground water through the Proposed National Pesticide Strategy. (Proposed Strategy, US EPA 1987) The EPA is interested in having state or local agencies tailor the conditions of pesticide use to specific local ground water needs through local land use planning, ground water classification and specific hydrogeologic and crop use. Where appropriate, the EPA would consider modifying the Federal registration to accommodate the state or local ground water management program. The strategy will be finalized and available to the states by late 1989.

3. User practices are generally controlled by pesticide label directions, since pesticide labeling bears force of law under FIFRA. Users are generally exempted from liability when the pesticide is used according to the label directions. Unfortunately, it is possible for pesticides to enter ground water even when label directions are followed. (EPA CERI-87-2B)

4. The U.S. Environmental Protection Agency maintains and periodically updates a list of chemicals that have been shown to have a heightened potential for entering ground water. This list is contained in the Appendix of this report. Extra precautions should be used when applying these chemicals, and where possible in the GSA, the use of substitute practices should be considered. The Thurston County Cooperative Extension agent should be contacted for the latest updates and advice before applying these substances.

5. Ground water warnings on labels currently tend to be written in very general terms. Therefore, increased ground water information (depth to ground water, flow directions, soil types, well locations, etc.) should be provided to pesticide users, to aid in the determination of high risk areas and for the proper understanding and use of pesticide label directions. (M. Jaffe and DiNovo 1987)

6. The control of pesticide usage (registrations, usage restrictions, etc.) is governed at the state level by the Washington Department of Agriculture under the authority

of the Washington Pesticide Control Act (Ch.15.58 RCW) and the Washington Pesticide Application Act (Ch 17.21 RCW). The Washington Department of Agriculture responsibility for pesticide control includes pesticide registration and quality control sampling; testing and licensing of individuals who apply, sell or consult about pesticides; and enforcement of regulations. (E. Nelson and Lee 1987)

7. Pesticides are addressed in the state hazardous waste regulations as follows: "The application of fertilizers or pesticides for the purposes of producing crops, farm animals, or any other farm product, Christmas trees, nursery plants, or growing trees, is exempt from the provisions of RCW 70.105B.040 (3) (d) (Hazardous Waste Management Regulations) so long as the application is without negligence and is in accordance with all federal and state laws. This provision is not valid if the release of the pesticide threatens human health or the environment."

8. Fertilizers are regulated by the Department of Agriculture, Washington Commercial Fertilizer act, Chapter 15.54 RCW. This regulation, however, does not control application rates and does not require record keeping.

9. The Soil Conservation Service, in conjunction with Cooperative Extension, is developing BMP's for pesticides and fertilizers to be implemented through its farm plan

program. The Soil Conservation Service will have this manual in place and in use in early 1989. Staff review of these BMP's indicates that though they are somewhat less specific, they generally are consistent with the practices being recommended in this document.

10. As part of the Non-point Source Management Plan, the Department of Ecology will be identifying best management practices to protect ground water from agricultural impacts and will develop an implementation plan that will address this issue. The Department of Ecology will draw from the work done by Cooperative Extension, the Soil Conservation Service and other resources in developing BMP's for agriculture. This development process is expected to take 18 months to complete. Since the BMPs recommended by county staff in the present document were developed with the assistance of the same source agencies, it is expected that they will be compatible with Ecology's future recommendations. (D. Stratton 1988)

11. State pesticide laws are currently undergoing revision to provide improved ground water protection. Improved record keeping requirements proposed through WAC 16-228 will be implemented in 1989. This WAC will require that certain pesticides from the EPA Priority Leacher List of April 14, 1988 be declared state restricted use pesticides to be distributed only by licensed pesticide dealers to certified applicators or their duly authorized representatives. Pesticides labeled and intended for home and garden uses are exempt from the requirements of

this rule. Currently, private applicators, such as growers and forestland owners, are exempt from record keeping requirements. Proposed WAC 16-228 would require that all applicators keep records of applications of state restricted use pesticides for a period of five years from the date of application, rather than three years as currently required. The new requirements would include important information previously excluded, such as:

1. Number of acres.
2. Crop or site.
3. Number of pounds or gallons of formulation applied per acre.
4. Pounds per gallon or percent active ingredient.

12. Urban pesticide use (including residential, playfield, parks, golf courses, etc.) may exceed agricultural use. A recent EPA report on pesticide use in Puget Sound counties found that comprehensive pesticide use information is not available, but estimated the proportionate pesticide use for the following user categories within Thurston County:

    68% by Urban
    25% by Agriculture
     5% by Right-of-ways
     2% by Forestry

    It is apparent that effective ground water protection will require significant concentration on BMPs for non-agricultural use of pesticides. (Tetra Tech Inc. 1988, see reference section for entire reference)

13. Five major commercial agricultural operations have been

identified within the Geologically Sensitive Area. The total acreage under crop production is 719 acres which includes:

Carrots	310 acres
Turf	45 acres
Daffodil bulbs	30 acres
Strawberries and raspberries	70 acres
Nursery stock	14 acres
Green manure	50 acres
Christmas trees	200 acres

It was determined that a total of 1961 acres of land was in pasture, 1000 acres used by two dairy operations of 125 cows each and 120 acres used by the Capital City Golf Course. (G. Theyal and Towle 1988)

FACTORS AFFECTING PESTICIDE AND FERTILIZER MOVEMENT

The four major factors that determine whether a pesticide or fertilizer is likely to reach ground water are:

1. The properties of the chemical
   a. Solubility
      -the ability of the substance to travel with water

   b. Adsorption
      -the ability of the substance to cling to soil particles

   c. Volatility
      -the ability of the substance to travel in gaseous form

   d. Rate of degradation
      -the effective life of the chemical

2. The properties of the soil
   a. Soil texture and soil permeability
      -determines how quickly the substances will move through the soil

   b. Organic matter content
      -high organic content can bind many chemicals to retard their movement

3. Conditions of the site.
   a. Depth to ground water
      -higher ground water is more vulnerable

   b. Geologic conditions
      -confining layers and protective layer can retard movement of contaminants.

   c. Climate
      -rainfall can drive chemicals through the soil

4. The agricultural management practices.
   a. Application methods
      -accurate mixing and controlled application

   b. Application rates and timing
      -use during periods of crop uptake and use lower rates and more frequent application.

(Cornell Cooperative Extension 1988)

(E. Nelson and Lee 1987 USDA)

BEST MANAGEMENT PRACTICES FOR THE USE OF PESTICIDES AND FERTILIZERS IN THE McALLISTER SPRINGS GSA

These Best Management Practices are designed to limit or reduce the contamination of ground water from pesticides and fertilizers. In all cases agriculturalists should consult with and work in conjunction with the USDA Soil Conservation Service, Washington Department of Agriculture, Cooperative Extension, the Agricultural Advisory Committees and other local and state agencies.

Pasture management

The goal of good pasture management is to improve pasture productivity by increasing the quality and quantity of forage production. Good pasture management reduces runoff and the leaching of fertilizers and pesticides and other potential pollutants from the land. Best Management Practices for pasture management are implemented through The Conservation District and the 208 plan.

1. Drag pastures frequently to spread manure and promote uniform grazing.
2. Clip vegetation during the growing season to control weeds and remove old growth.
3. Develop a pasture rotation system to limit overgrazing and soil compaction.

Animal Waste Management

Manures contain high concentrations of bacteria and nutrients. Proper animal waste management is essential to prevent serious water quality problems. Best Management Practices for animal waste management are implemented through The Conservation District and the 208 plan.

1. Divert runoff away from surface water and from ground water recharge areas.
2. Avoid accumulation of manure in standing water.
3. Recycle water used for barn wash down.
4. Divert roof runoff away from manure storage areas by using gutters and downspouts. Use ditches and dikes to prevent runoff from entering feedlot areas from uphill.

5. Cover stored manure to prevent rainfall runoff.

6. Collect manure regularly for proper storage.

7. Locate manure holding areas away from ditches and ponded or flowing water. Holding areas and lagoons must have impermeable liners to prevent percolation to ground water.

8. Apply manure at a rate that does not exceed the crops' capacity as determined by soil testing. Keep accurate records to establish a nutrient budget.

9. Do not spread manure on saturated soils.

10. Maintain buffer areas near surface water.

Pesticide and Herbicide Management

Proper management and use of pesticides and herbicides is essential for personal and public safety and for the protection of surface and ground water. Contact and utilize the local Cooperative Extension Office and other experts for advice pertaining to pesticide use.

1. Read and understand label recommendations and instructions. Know the classifications of soils in your field, the depth to ground water, the location of surrounding wells, and other factors that determine high risk areas. Know which active ingredients have been determined by EPA to have a greater potential for entering ground water (see Appendix).

2. Dispose of tank rinse water by applying to the field at rates not exceeding label recommendations.

3. Keep chemicals in a secure, locked storage area.

4. Follow Department of Ecology guidelines for the proper handling and disposal of empty pesticide containers.

5. Never dispose of chemicals or tank rinse water into storm drains, plumbing, septic tanks or surface water.

6. Use care when handling pesticides to avoid spills, personal contamination and possible danger to others. If possible use closed loading, transfer and mixing systems.

7. Do not apply pesticides to saturated soils.

8. Take precautionary measures to avoid applicator tank overflow and backflow.

9. Keep accurate records of pesticide use including date, climate, rates, crop and any test results.

10. Always consider alternatives to pesticide use.

11. Band applications of fertilizers and pesticides when appropriate.

12. All applicator equipment should be properly maintained, calibrated and used in accordance with its design.

13. Use cultivation and crop rotation practices that will ensure minimum use of pesticides.

14. A scientifically sound Integrated Pest Management plan is a recommended alternative to purely chemical pest control.

15. Practice a good neighbor policy when applying pesticides. Contact neighbors about your spray program to ensure the safety of livestock and human health.

16. Use separate containment tanks for applicator rinse water.

17. Apply pesticides under proper conditions. Follow label directions as to time of day and proper climatic conditions.

18. Use appropriate safety measures in chemigation. Over irrigation causes soil saturation and pooling which can concentrate pesticides and make them more readily available for infiltration. Ensure that back-siphoning devices are in place and operating properly to prevent back-siphoning into irrigation wells.

Fertilizer Management

Fertilizer management can minimize the threat of ground water contamination from agricultural activities.

1. Use soil tests to establish proper fertilization rates to encourage a proper nitrogen balance and to ensure maximum plant utilization.

2. Time applications to minimize leaching.

3. Split applications to minimize excess NO3.

4. Use nitrification inhibitors when possible.

5. Attempt the most accurate placement of fertilizers.

6. Test soil for residual nitrate at the beginning of the growing season and monitor use throughout the season.

7. Fertilize during periods of maximum crop uptake.

8. Test on-site wells annually for nitrate where fertilizers or manures are handled.

9. Keep accurate records of fertilizer use, including date, climate, rates, crop and test results.

10. Fertilizer nutrients can be carried into the ground water by rainfall and irrigation. Apply fertilizers during periods of appropriate rainfall and adjust irrigation rates accordingly.

RECOMMENDED IMPLEMENTATION PROCEDURES

For the purposes of implementation, pesticide use within the GSA can be grouped into three major user categories:

1. Residential and noncommercial (hobby) agriculture
2. Commercial agriculture
3. Miscellaneous urban use

Each category is distinguished by differences in use patterns, government regulation, economics, information needs and available methods for outreach and education. Tables 1 through 3 provide a comparison of some characteristics of each of these groups within the GSA. Information outreach techniques are provided for each group, including an analysis of existing materials and suggested additional materials.

Tables 1 through 3 indicate that the miscellaneous urban use category tends to resemble commercial agriculture in the areas of regulation and licensing, practices, and informational needs. For implementation purposes, it is suggested that these two user groups be treated similarly.

On the basis of this information, the following implementation program is recommended:

1. Coordinate the development of appropriate informational materials for the residential, agriculture and miscellaneous urban sectors. Several local agencies exist which could act a resources and which share similar information needs.

2. Coordinate the dissemination of Best Management Practices information. Outreach to the residential sector should be coordinated with the efforts of other county programs addressing fertilizer and pesticide usage by this sector. A master mailing list should be developed for the major agricultural producers in the GSA, right-of-way ownerships, licensed pesticide applicators, commercial landscapers and major entities of the miscellaneous urban category

3. The County Cooperative Extension agent should visit at least once a year each major agricultural producer and the major entities in the miscellaneous urban sector. Such visits would allow the exchange of information on best management practices and evaluation of their implementation. The extension agent could also obtain samples from on-site water wells where appropriate.

4. A checklist of best management practices should be developed for the use of the extension agent when visiting the major operators within the GSA. This checklist can also be used as a self-evaluation tool by operators. Check list information resulting from the agent's on-site visits should be retained at the county Cooperative Extension Office

for evaluation of the implementation of the BMP program within the GSA.

5. The Board of Health should evaluate the effectiveness of the voluntary BMP program at least annually. This could be accomplished by evaluating BMP checklists maintained by the extension agent, and obtaining pesticide use records required by the State Department of Agriculture.

6. Thurston County should cooperate with state and federal agencies as they develop programs and policies which could be used to assist the county's efforts to protect the McAllister Geologically Sensitive Area. These programs include, but are not limited to:

   State pesticide applicator licensing training performed by Cooperative Extension.
   Developement of best management practices by the Department of Ecology and Soil Conservation Service.
   Any future development of state pesticide plan by Dept. of Agriculture under the EPA National Pestide Stategy.
   Dept. of Ecology's aquifer classification program, which would allow local jurisdictions to request protective designations for aquifers of concern.

TABLE 1

Implementation Of
Best Management Practices For
RESIDENTIAL USE

Uses:	Gardens, landscape, lawns, driveway and border weed control, moss control, "hobby farms".
Special Needs:	No regulatory controls. Users generally possess less sophisticated equipment and training. Current WSU/Cooperative Extension recommendations may need to be adapted.
Existing Outreach:	Cooperative Extension call-in advice, clinics, Master Gardener program, newsletter. Conservation District assistance to small farms. Noxious weed control board.
Possible Outreach:	Garden and horticulture clubs Nurseries and garden supply outlets (retail) 4-H, FFA, Scouts Environmental organizations Farmers' Market Home shows Homeowners Associations Schools Direct mail
Outreach Materials:	Create utility bill inserts Create media releases Existing brochure on reading pesticide labels needs revision to make it more readable incorporating information on BMPs, ground water and disposal Existing WDOE information on substitutes for house-hold toxics. Modify to incorporate ground water and drinking water information Modify ground water speakers' materials to include residential BMP information

TABLE 2

Implementation Of
Best Management Practices For
COMMERCIAL AGRICULTURE

Use:	Row crops, dairies and livestock, Christmas trees, nurseries, turf growers.
Special Needs:	Ability to follow label directions requires knowledge of local ground water conditions, well locations, soil classifications. Chemigation and fertigation may require special measures to protect ground water.
Existing Outreach:	Training and licensing requirements for applicators of restricted pesticides. Cooperative Extension, conservation district. Professional associations (dairymen, horticulturists, forestry, etc.)
Possible Outreach:	Grange and Farmer's Market Agricultural Advisory Committee sponsorship of events. Mailing list of affected producers and licensed applicators. Have the Planning Department advise permit applicants planning agricultural activities: provide GSA information and refer applicant to Cooperative Extension.
Outreach Materials:	Existing brochure on ground water and pesticides. Need literature explaining GSA, local ground water concerns, BMP program, local ground water information. Provide action checklist; BMP information in poster format. Need to revise an existing BMP checklist.

TABLE 3

Implementation Of
Best Management Practices For
MISCELLANEOUS URBAN USE

Use:	Golf Courses, parks, landscaping, right-of-way maintenance, school grounds, cemeteries
Special Problems:	Chemical use is subject to management policies of commercial businesses, institutions, etc. Few controls exist for fertilizer use. Ability to follow label directions depends on knowledge of soil types and certain ground water information.
Existing Outreach:	Commercial applicator training and licensing for restricted pesticides.
Potential Outreach:	Notification of school districts, parks and recreation managers, golf courses, cemeteries, right-of-way entities. Create mailing list of local commercial landscapers. Offer training to crews, staff, and management, with assistance of Cooperative Extension.
Outreach Materials:	Existing brochure on label interpretation. Existing brochures on pesticide practices to prevent ground water contamination. Modify existing BMP checklist. Incorporate local ground water information. Provide ground water information, BMP action checklist, and BMP information in poster format.

APPENDIX

U.S. ENVIRONMENTAL PROTECTION AGENCY
Leachable Agricultural Chemicals

April 14, 1988

The EPA has determined that these substances have a heightened potential for reaching ground water. This list is periodically updated by the Environmental Protection Agency. The Thurston County Cooperative Extension agent should be contacted for information prior to the use of these substances.

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Aldicarb sulfoxide		
Ametryn	herb.	Evik
Atrazine	herb.	Atranex
Baygon	insect.	Propoxur
Bromacil	herb.	Hyvar-X
Butylate	herb.	Sutan
Carbaryl	pest.	Sevin
Carbofuran *	pest.	Furadan
Carboxin	fun.	Vitavax
Chloramben	pest.	Amiben
Chlordane-alpha *	insect.	Gold Crest
Chlordane-gamma *		
Chlorothalonil	fun.	Bravo
Cyanazine *	herb.	Bladex
2,4-Dichlorophenoxyacetic acid	herb.	2,4-D
Dalapon	herb.	Dowpon-M
1,2-Dibromo-3-chloropropane **	pest.	DBCP
Diazinon	insect.	Basudin
Dicamba	herb.	Banvel
1,2-dichlopropane	fun.	1,2-DCP
cis-1,3-dichloropropene *	fun.	Telone
trans-1,3-dichloropropene *		
Dieldrin	insect.	HEOD
Dinoseb	herb.	Dinitro
Diphenamid	herb.	Enide
Disulfoton *	insect.	Di-Syston
Diuron	herb.	Duran
Endrin *	pest.	
Ethylene dibromide	pest.	EDB
Ethylene thiourea	pest.	ETU
Fenamiphos *	nema.	Nemacur
Fluormeturon	herb.	C 2059
Heptachlor *	insect.	

Heptachlor epoxide		
Hexachlorobenzene		
Hexazinone	herb.	Velpar
Methomyl *	insect.	Nudrin
Methoxychlor	herb.	Marlate
Metolachlor	herb.	Dual
Metribuzin	herb.	Lexon
Metribuzin DA		
Metribuzin DADK		
Metribuzin DK		
Nitrates		
Nitrites		
Oxamyl *	insect.	Vydate
Pichloram *	herb.	Tordon
Pronamide *	herb.	Kerb
Pronamide metabolite, RH24, 580		
Propachlor	herb.	Ramrod
Propazine	herb.	Primatol
Propham	herb.	Chemhoe
Simazine	herb.	Princep
2,4,5-Trichlorophenoxyacetic acid	herb.	Fortex
2,4,5-Trichlorophenoxypropionic acid	herb.	Silvex
Tebuthiuron	herb.	Spike
Terbacil	herb.	Sinbar
Terbufos *	insect.	Counter
Trifluralin	herb.	Treflan

* EPA listed Restricted Use Product
(current as of May 3, 1988)

** No longer marketed for use in the United States.

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McAllister Geologically Sensitive Area Information

(Resolution H-3-90)

What is the McAllister Geologically Sensitive Area (GSA)?

The McAllister GSA is an area where geologic conditions exist that make the ground water system vulnerable to pollution as the result of land use activities. On August 15, 1990, Thurston County Board of Health Resolution H-3-90 went into effect, and it established the McAllister GSA and measures designed to protect the areas ground water resources. Resolution H-3-90 replaces a previous Board of Health action (H-5-88).

Where is the McAllister GSA?

The McAllister GSA encompasses over 17 square miles, and is located south and east of the City of Lacey (see map). The boundary represents the limits of the capture zone or recharge area for the aquifer system that feeds McAllister Springs.

What are the key features of the GSA resolution?

The actions required by the GSA seek to reduce the potential for ground water pollution from many sources. These pollution sources include: septic systems, agricultural practices, storm water, hazardous materials and household activities. Specific measures have been developed for each pollution source, and most them are summarized below. A complete set of the actions and recommendations are contained within Resolution H-3-90, which can be obtained from the Resource Protection Section of the Thurston County Environmental Division (phone # 754-4111).

* **Sewage Disposal Standards:** Several standards have been established for new on-site sewage disposal systems and those that are being repaired. These standards include:

  - The use of pressure distribution will be required.
  - The maximum trench or excavation depth is 30 inches.
  - At least 36 inches of separation must be maintained between the trench bottom and any seasonally saturated or impermeable soils.
  - An Operation Permit (revokable) is required for all new or repaired septic systems.

- Any premise utilizing an on-site sewage disposal system will be required to connect to the sewer when it comes within 200 feet of the premise, as described in Article IV of the Thurston County Sanitary Code.

- The County Health Department will request that the Washington State Department of Health develop guidelines for on-site sewage disposal systems that reduce waste water nitrogen outputs.

- New septic systems which serve something other than a single family residence will be limited to wastewater flows of 450 gallons/five acres/day or less, and the waste water must be of residential quality.

* **Agriculture:**

- The voluntary use of the Best Management Practices for pesticides and fertilizers will continue to be encouraged. The major users of these materials will be evaluated each year.

- The County will advocate the development of Special Area Regulations by the Ground Water Advisory Committee, for adoption by the Washington Department of Agriculture. These regulations should pertain to the use and handling of leaching pesticides.

* **Storm Water:**

- The County Public Works Department will develop a design manual which includes appropriate storm water treatment methods for use in the design of storm water facilities within the GSA.

- Thurston County will not use chemical control methods (pesticides) on any County property within the GSA.

- Thurston County will request that the Washington State Department of Transportation, the Nisqually Tribe, Fort Lewis, Puget Power and the Bonneville Power Administration not use chemical control methods (pesticides) on their properties or right of ways within the GSA, or areas believed to be within the Capture Zone for McAllister Springs.

- The County will request that Burlington Northern and Amtrak prohibit the discharge of sewage and the use of chemical controls (pesticides) on the railroad tracks or right of ways within the GSA.

- The County will request that the Washington Department of Ecology deny any permits for aquatic pesticide applications on Lake St. Clair unless first approved by the Thurston County Health Department.

- The County will work with the City of Lacey and the State to develop designated truck routes through the GSA, with spill control facilities at high risk intersections. This will be done to address the high potential risks associated with hazardous materials spilled from trucks.

* **Education:** An education program directed at McAllister residents will be developed, with initial efforts aimed at residents in the Lake St. Clair area.

  - This program will focus on residential use of pesticides and fertilizers, and the operation and maintenance of on-site sewage disposal systems.

* **Land Use Controls:** The Thurston County Planning Commission has been asked to make recommendations on land use control measures aimed at water quality preservation. The Planning Commission recommendations will then be forwarded to the Board of Commissioners for approval and implementation. The recommendations submitted to the Planning Commission for their consideration include:

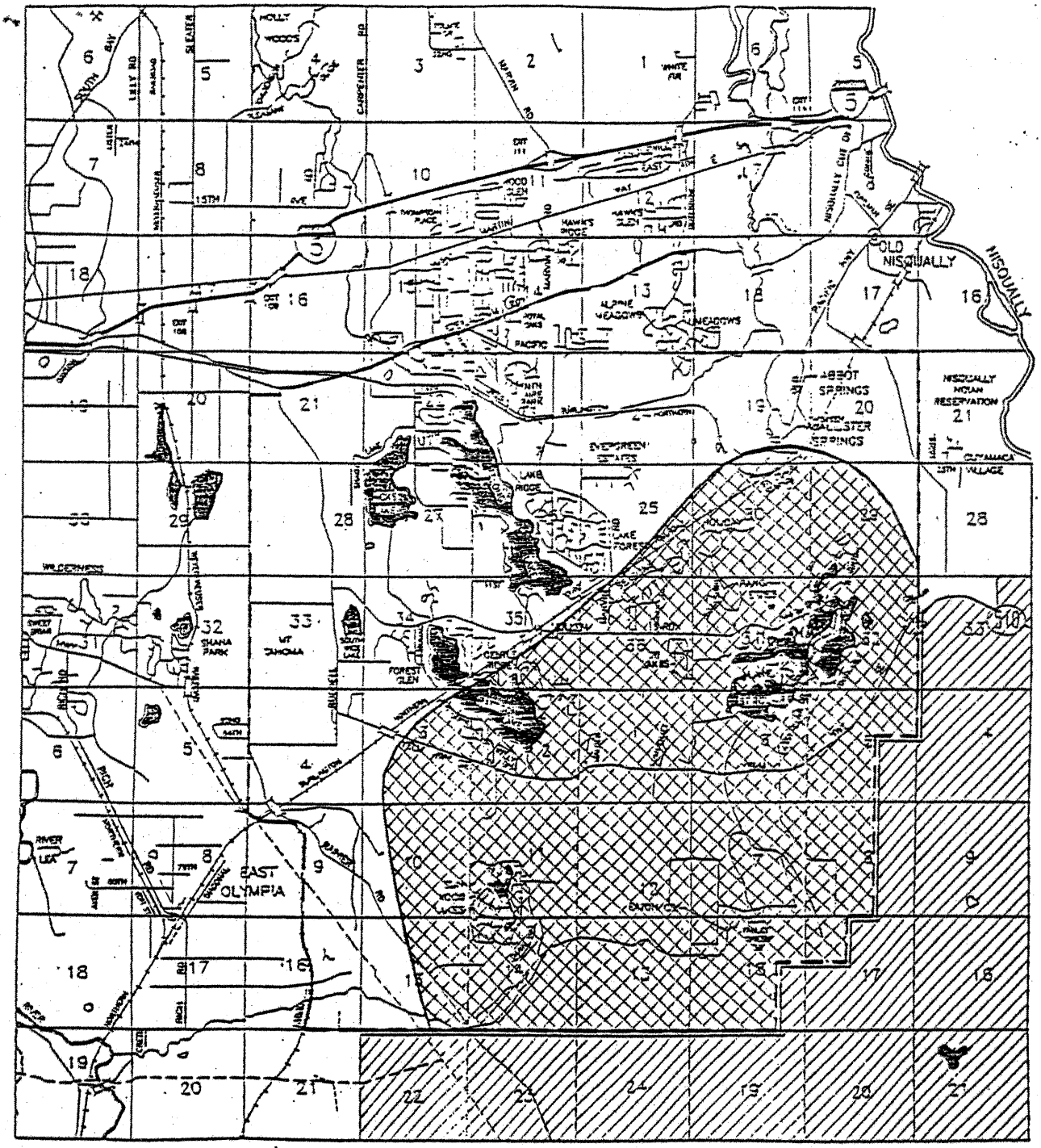
  - Limiting the density of new subdivisions to one unit per five acres, or less.

  - Denying permit approvals for land use proposals that use, produce or store hazardous materials or wastes.

  - Not approving permits for the intensification of land uses where hazardous materials or wastes are used, produced or stored.

  - Until the Planning Commission acts on the above recommendations, a six month moratorium has been put in place on the acceptance of plat, short plat, and large lot subdivision applications.

* **Sanitary Sewers:** Thurston County will work with the City of Lacey to accelerate sewer service to high risk areas with high septic system densities, such as the areas south and east of Long Lake.



LEGEND

Previous McAllister Springs GSA Boundary (H-5-88, Expired 8/15/90)

McAllister Geologically Sensitive Area Boundary (H-3-90, in effect 8/15/90)

Fort Lewis Military Reservation

0 6000 12000

SCALE IN FEET

MCALLISTER GEOLOGICALLY SENSITIVE AREA

MCALLGSA.DWG