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Wellhead protection
plan for the City
of Everson

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WELLHEAD PROTECTION PLAN FOR THE CITY OF EVERSON

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WELLHEAD PROTECTION PLAN
FOR THE
CITY OF EVERSON

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EXECUTIVE SUMMARY

One hundred percent of the City of Everson's drinking water comes from the ground. The wells are shallow (less than 40 feet deep) and located in gravel and sand. The aquifer or ground water reservoir is vulnerable to contamination, because the soils covering it are coarse-grained and loose, and contain no protective clay layer to keep out contaminants. Actual depth to the ground water in most of the area is less than 20 feet and, at the wellfield, about 12 feet.

Rainwater seeps through the ground to replenish the aquifer that feeds the wells. If rainwater carries any potential contaminants and the soils are not fine enough to filter out pollutants, the aquifer can become contaminated. This aquifer system is the sole source of drinking water for the City, and as such, if it becomes contaminated, the potential consequences are serious. Cleanup of the aquifer, if it were required and possible, would be very expensive and take years to accomplish. The City has already recently spent $1.3 million upgrading its water supply system.

The Everson wellhead protection project creates an active role for the citizens of Everson and the surrounding area in maintaining drinking water quality, and finding the least restrictive way to maximize ground water protection. To do this, Everson has delineated **wellhead protection areas** around the public water supply wells.

The City's well field is located approximately one-half mile south of the Nooksack River, near Strandell. The area around the City's wells is called a **wellhead**. The wellhead protection areas are land areas that surround the City's **wellfield**, through which contaminants could reach the City's wells. The **time of travel** is the estimated amount of time required for a contaminant to move from a specific point to a well.

As the first step in the development of the Everson Wellhead Protection Program, the Wellhead Protection Advisory Committee was formed. It was composed of local officials, policy makers, and representatives of county government, neighboring water systems, professional interests, local businesses, and the public at large. This group provided invaluable input to the process, and helped focus the results into a meaningful and realistic plan for the City of Everson.

The delineation of the Wellhead Protection Area was carried out as the next step in the process, based on an analysis of the hydrogeologic setting, and application of a numerical computer model to define the zone of contribution on 1, 5, and 10 year times of travel to the city wells. In this case, the 25 year time of travel zone was also estimated. This is based on projected pumpage of 800 gallons per minute from the city wells, which is the maximum projected use of the wells and the limit of the current water rights.

The Wellhead Protection Area is being treated as two zones for planning purposes, equal to the 1 year and the 10 year time of travel zones. This has been done primarily because:

- The size of the overall 10 year time of travel zone area is smaller and more manageable than originally anticipated.

- The 1 year time of travel zone is of special concern due to the potential bacteriological and chemical impacts of development in the area, and the very short potential response time within it.

- The aquifer setting is one of high vulnerability from an environmental perspective, with little potential benefit from segregation of management strategies based on the 5 and 10 year time of travel zones.

Following the identification of the Wellhead Protection Area, an inventory of the potential sources of contamination was carried out. This involved coordination with Western Washington University and students participating in file research and visits to properties in the area. This process identified the following major categories of potential sources of concern:

- Unprotected and Improperly Abandoned Wells
- Household Hazardous Products
- Storage Tanks
- Storm Water Management
- Gravel Mining
- Agricultural Sources
- Onsite Sewage Disposal Systems
- Commercial and Industrial Activities
- Hazardous Materials Transportation

Based on these findings, along with considerable input and discussion during the public involvement process, the next step was to develop the management options and final recommendations. In undertaking this step, the following very important points raised during the process were considered.

1. Recommendations must be fiscally responsible and necessary.

2. A distinction should be made wherever appropriate between controls designed to address potential existing sources and sources related to future development.

3. The limitations of currently available information on sources within the Wellhead Protection Area must be recognized, and factored into the planning process.

The end result is a series of recommendations which address those measures which should be implemented now, while also addressing future measures needed to take this plan to the next step of development. The final plan recommendations include:

1. The City should develop a formal resolution adopting the Everson Wellhead Protection Plan.

2. A Wellhead Protection Advisory Committee should remain active to facilitate local action and interjurisdictional cooperation.

3. Additional studies should be undertaken within 12 months of plan adoption to add to the inventory and further quantify the potential threat posed by specific sources (e.g., storage tanks, storm drainage, unprotected or improperly abandoned wells).

4. The City should review existing local ordinances and state regulations related to wellhead protection. Enforcement of existing local and state regulations should take priority over adoption of new regulations related to wellhead protection.

5. The City's Growth Management Act planning should be fully integrated with the wellhead protection plan. Amendments to existing ordinances and policies should be adopted to accomplish mutual goals.

6. Pollution prevention, accomplished through technical assistance and education, should be the highest priority. A public education and involvement plan that addresses all potential sources of contamination should be developed in coordination with the Everson Wellhead Protection Advisory Committee. This plan should be built on existing state and local programs.

7. The City should explore available financing options for wellhead protection. State matching grants may be available to fund additional phases of wellhead protection.

8. Source-specific recommendations should be implemented in accordance with this plan.

9. The City should revise and update the plan on an ongoing basis.

As this program was developed, it became clear that certain critical information necessary to develop a comprehensive long term program for the WHPA is not currently available. This information includes a complete understanding of the storm water management system and information on the occurrence and condition of underground storage tanks. As a result, this plan should be viewed as the initial Wellhead Protection Plan for the area and systematically updated to address these issues.

The consultant team further recommends that discussions with potential grant sources for the next phase of planning be initiated as soon as this plan is adopted.

A RESOLUTION

No. _____

FOR THE PURPOSE OF ADOPTING the Wellhead Protection Plan for the City of Everson, Washington.

WHEREAS, the residents of the City of Everson are dependent upon ground water to meet demands for domestic, commercial, and industrial needs; and

WHEREAS, the City of Everson lacks a readily available alternate water supply and is growing increasingly dependent upon this resource as the community experiences population growth; and

WHEREAS, the Washington Department of Health requires development of a wellhead protection program for all public water supplies to provide measures which protect wellheads from contamination; and

WHEREAS, the plan contains a delineation of wellhead protection areas, an analysis of ground water susceptibility, an inventory of land use activities, a series of wellhead protection strategies, and an Implementation Plan; and

WHEREAS, the Implementation Plan contains recommendations for the Council's adoption of the Wellhead Protection Plan for the City of Everson, Washington, as well as other necessary action to ensure its implementation.

NOW THEREFORE, BE IT RESOLVED, that the City of Everson Council hereby adopts the Wellhead Protection Plan for the City of Everson, Washington.

BE IT FURTHER RESOLVED, that the City of Everson Council authorizes the Mayor to appoint a Wellhead Protection Advisory Committee with the expressed function to review, recommend and assist the City in the implementation of the Wellhead Protection Action Plan.

ADOPTED this _____ day of _____, 1994.

_____

Attest: _____ Approved as to form: _____

SECTION 1.0
INTRODUCTION

The City of Everson relies primarily on wells located in the Strandell Wellfield, on the south side of town, for its normal water supply needs. Throughout Washington State, examples of ground water contamination of public water supplies resulting in lost sources of supply, and expensive modifications or cleanup of existing facilities can be seen. Everson is moving ahead progressively and proactively, to meet the challenges of growth, including taking every reasonable precaution to safeguard the existing City wells.

The primary objective of this planning effort is to prevent contamination of the ground water used by the City, and therefore provide safe drinking water into the future. In addition, recent requirements under both federal and state statutes require that Wellhead Protection Programs be put in place to address this need. In particular, Washington State requires:

- Delineation of the Wellhead Protection Area (WHPA)
- Inventory of all potential sources of ground water contamination within the area
- A management plan to reduce the likelihood that source contamination will occur
- Contingency plans for alternative sources in the event contamination does occur
- Opportunities for public participation in plan development

This Wellhead Protection Plan is intended to meet these requirements, and is organized into the following key sections: Wellhead Protection Area Delineation (Hydrogeology), Inventory of Potential Sources of Contamination, Management Options and the Wellhead Protection Plan. Public participation was provided throughout the process through the involvement of the Wellhead Protection Advisory Committee and public meetings providing a forum for input and involvement.

Funding for this effort has been provided by the City of Everson and through a grant from the Centennial Clean Water Fund administered by the Washington State Department of Ecology, with assistance from the Department of Health Drinking Water Division.

SECTION 2.0
WELLHEAD PROTECTION AREA DELINEATION

This portion of the report is divided into two major sections designed to describe hydrogeologic conditions in the vicinity of Everson, and to document the wellhead protection area delineation methodology.

2.1 HYDROGEOLOGIC SETTING

The City of Everson obtains its water supply from the Strandell wellfield located about 3/4 of a mile southwest of downtown Everson. The Everson wellhead protection area (WHPA) is underlain by sand and gravel of glacial origin. Ground water for the City of Everson's Strandell wellfield is contained in a shallow unconfined aquifer system developed in these sand and gravel deposits. The depth to ground water is about 10 feet at the Strandell wellfield which currently produces at rates up to approximately 400 gallons per minute (gpm).

2.1.1 Geology

The geology of western Whatcom County was mapped and described by Easterbrook (1976). The surficial geology in the vicinity of Everson is illustrated on Figure 2-1. The Strandell wellfield is located on the Sumas outwash plain, which covers many tens of square miles extending from the Canadian border to Bellingham Bay. The Sumas outwash plain has been dissected by the Nooksack River and its tributaries. The surficial geology in the vicinity of Everson is dominated by Pleistocene glacial and recent alluvial deposits. Bedrock is exposed about 2 miles southwest of the Strandell wellfield, and in the Sumas Mountains located about 3 miles east of Everson (Figure 2-1).

The bedrock consists primarily of Eocene age (about 50 million years before present (mybp)) Hundingdon formation sandstone and shale originally deposited in coastal plain environments. Paleozoic (225-400 mybp) Chilliwack series volcanics and sandstones occur in limited exposures in the Sumas Mountains.

The Fraser glaciation is the most recent Pleistocene glaciation of Whatcom County and has been divided into two periods of glacial advance (Vashon and Sumas) separated by a nonglacial event (Everson Interstade). These sediments are overlain by alluvial deposits of the Nooksack River. The geology of the region is illustrated on a diagrammatic geologic cross section (Figure 2-2). These units are briefly described in the following section from oldest to youngest.

Two Vashon Stade units were identified by Easterbrook (1976) including the Esperance sand member and Vashon till. The Esperance consists of crossbedded outwash sand and gravel deposited from melt-water streams during the advance of the Vashon ice sheet. Vashon till consists of a poorly sorted mixture of gravel and cobbles in a matrix of sand, silt, and clay. The till was deposited at the base of the ice sheet, which was about 6000 feet thick, resulting in a very compact unit, generally ranging from 10 to 30 feet thick.

Easterbrook (1976) identified three Everson Interstade units in the Everson area, including the Kulshan Drift, Deming Sand, and Bellingham Drift. The Kulshan Drift consists of an unsorted,

blue-gray mixture of silt, clay, sand, and pebbles derived from sediment melted out of floating berg ice and deposited on the sea floor. The Deming Sand overlies the Kulshan Drift and generally consists of stratified, brown, well sorted, medium to coarse sand deposited in stream environments. The Bellingham Drift, like the Kulshan Drift, was derived from debris melted out of floating ice and deposited on the sea floor, and consists of blue-gray, unsorted, pebbly, sandy silt and pebbly clay.

Three Sumas Stade units were identified by Easterbrook (1976) including till and ice contact deposits, outwash sand and gravel, and silt and clay sediments. Sumas outwash consists of sandy gravel between Everson and Laurel. The thickness of the Sumas outwash ranges from 50 to 60 feet near the southern margin of the WHPA to in excess of 150 feet in the vicinity of the Strandell wellfield.

Recent alluvial deposits consist of silt, sand, and gravel. These sediments were deposited in river channels and flood plain environments.

2.1.2 Hydrology

The Nooksack River is the most significant surface water feature in the vicinity of Everson. There are no well developed drainages on the outwash plain immediately south of the Strandell wellfield. Tributaries to the Nooksack River, developed on the Sumas outwash plain east of Everson, include Fourmile Creek and Tenmile Creek. Lake Fazon occupies a closed depression about 3 miles south of the Strandell wellfield.

2.1.3 Hydrogeology

Communities, businesses, farms, and individual homes obtain water from the regionally extensive Sumas/Nooksack aquifer system. This vast aquifer system encompasses most of the area mapped by Easterbrook (1976) as Sumas outwash and alluvial deposits extending from the Canadian border to Bellingham Bay.

Sumas Outwash Aquifer

The City of Everson's wells at the Strandell wellfield are completed in Sumas outwash deposits. This aquifer consists of permeable stratified sand and gravel deposits interbedded with thin beds and lenses of relatively low permeability silts and clays. The depth to the top of the water table at the Strandell wellfield is about 10 feet, but is in the range of 30 feet near the intersection of Mission Road and Pole Road located approximately 1-1/2 miles south of the wellfield. Seasonal water level fluctuations range from approximately 5 to 10 feet (Converse, 1993 and GeoEngineers, 1994).

Aquifer thickness is determined by the depth to water and the topography at the base of the Sumas outwash where it overlies the low permeability silts and clays of the Bellingham Drift. The thickness of the Sumas aquifer ranges from a few tens of feet near the southern boundary of the study area to at least 140 feet at the Strandell wellfield.

Ground Water Elevations and Flow

Ground water flow direction in the Everson WHPA is generally from upland areas in the south to the Nooksack River in the north, although seasonal and local water level fluctuations cause some variations in ground water flow directions. Ground water elevations range from about 92 feet near the Mission Road and Pole Road intersection to 74 feet at the Nooksack River bridge at Everson. The ground water elevation at the Strandell wellfield is approximately 78 feet. The average hydraulic gradient is about 10 feet per mile in the Everson WHPA (Converse, 1993).

Ground Water Recharge

Ground water recharge to aquifer systems can be from several sources. Three primary sources have been identified for the Sumas outwash aquifer.

- Direct recharge through infiltration of precipitation
- Recharge through inflow from the Nooksack River
- Lateral flow from the Bellingham Drift

The primary recharge source to the Sumas outwash aquifer is interpreted to be from infiltration of precipitation. The amount of precipitation recharge available to the aquifer is determined by the total precipitation minus any losses due to runoff, evaporation or plant uptake. Due to the permeable nature of the Sumas outwash and low topographic relief, the percentage of precipitation entering the ground water system is relatively high.

Precipitation is monitored at two stations located in Bellingham about 12 miles southwest of Everson. Mean annual precipitation at both locations averages about 35 inches per year based on National Oceanic and Atmospheric Administration (NOAA) records for years 1951-1980. The mean annual temperature for Bellingham is approximately 50 F. Ground water modeling studies indicate recharge to the Sumas outwash aquifer averages about 20 inches. This is described in greater detail in Section 2.2.2 and Appendix A.

Recharge through inflow from the Nooksack River is interpreted to be seasonal in nature. Computer modeling of the ground water system indicates that recharge to the aquifer from the Nooksack River occurs primarily during the wet winter months. The amount of recharge from the Nooksack River is small compared to recharge from precipitation.

Recharge due to lateral flow from the Bellingham Drift has not been quantified, but is considered insignificant for the Everson WHPA.

Aquifer Hydraulic Properties

The hydraulic properties of the Sumas outwash aquifer in the Everson WHPA were based on pump tests of wells at the Strandell wellfield (Converse, 1993) and are summarized in Table 2-2.

Several aquifer characteristics were determined from the pump tests at the Strandell wellfield. These included the coefficient of transmissivity (T), the specific yield (S_y), and horizontal hydraulic conductivity of the aquifer (K). The physical significance of these parameters is discussed in the following paragraphs.

Hydraulic conductivity is a measure of the capacity of a porous medium to transmit water. Values of hydraulic conductivity are related to the size and shape of pores, the effectiveness of pore continuity, and physical properties of the fluid. Hydraulic conductivities are low in fine-grained sediments, but are high in coarse-grained sand and gravel units. Flow paths in the aquifer are assumed to be horizontal and K represents the horizontal hydraulic conductivity of the aquifer. Hydraulic conductivity has units of length/time and is commonly expressed in feet per day (ft/d). The hydraulic conductivity of the Sumas outwash aquifer averaged approximately 130 ft/d. Hydraulic conductivities in aquifer systems commonly range from less than 10 ft/d to over 250 ft/d.

The coefficient of transmissivity indicates how easily water will move through the aquifer and is the product of the average horizontal hydraulic conductivity and the saturated thickness of the aquifer. Transmissivity represents the rate of flow under a unit hydraulic gradient through a cross section of unit width over the saturated aquifer thickness. Transmissivity is commonly expressed in terms of gallons per day per foot (gpd/ft), and was calculated to average approximately 118,000 gpd/ft for the Sumas outwash aquifer. Aquifer transmissivities range from less than 10,000 gpd/ft to more than 1,000,000 gpd/ft.

The specific yield represents the volume of water released or taken into storage per unit area for a unit change in head of an unconfined aquifer. Values of specific yield range from 0.01 to 0.30, reflecting the effective porosity of the aquifer. Specific yield is a dimensionless value and was determined to average 0.20 at the Strandell wellfield.

TABLE 2-1
AQUIFER HYDRAULIC PROPERTIES OF THE STRANDELL WELLFIELD

PARAMETER	AVERAGE VALUE
Hydraulic Conductivity	130 ft/d
Transmissivity	118,000 gpd/ft
Specific Yield	0.20

Source: Converse, 1993.

2.2 WELLHEAD PROTECTION AREA DELINEATION

The wellhead delineation process establishes a specific geographic area around a well or wellfield, and is an essential element of a wellhead protection plan (WHPP). The WHPA delineation process includes mapping the zone of contribution (ZOC) and time of travel (TOT) zones around the well. The ZOC includes the surface and subsurface areas contributing water to the well. The TOT zones identify the time required for a particle of water to reach a well and is typically expressed in years.

2.2.1 Washington State Wellhead Delineation Requirements

Under the 1986 amendments to the federal Safe Drinking Water Act, all states are required to develop a WHPP. The goal of the WHPP is to prevent contamination of public drinking water supplies. In Washington, the State Department of Health (DOH) is the lead agency for developing and administering the WHPP. A key element of the WHPP includes mapping the WHPA. A WHPA is the geographic area that directly contributes water in the short term to the drinking water supply. In Washington WHPAs are primarily based on 1, 5, and 10 year TOT zones.

There are several WHPA delineation methods. These range from simple arbitrary or calculated fixed radii, to analytical solutions and relatively complex numerical modeling programs coupled with hydrogeologic mapping. Due to the critical sole source nature of the Sumas outwash aquifer and hydrogeologic complexities, the Everson WHPA delineation incorporated hydrogeologic mapping and numerical modeling. This delineation methodology exceeded DOH requirements and expectations for the City of Everson's WHPP.

Delineation Approach - Modeling

Ground water flow in the Sumas outwash aquifer was simulated by using a numerical model, MODFLOW, developed by the United States Geological Survey (McDonald, M.G. and Harbaugh, A.W., 1988). The primary purpose of the model developed for this study was to delineate the 1, 5, and 10 TOT zones under existing and potential future pumping rates. Currently the City of Everson pumps up to 400 gpm. Future needs are projected to approach

the City's current water right of 800 gpm. This was the pumping rate used for the delineation process. The results are shown in Figure 2-3.

Input into the numerical model was based on existing information determined during pump tests and other hydrogeologic investigations. Primary information sources included a report on the Strandell wellfield (Converse, 1993) and other documents (Landau, 1992 and 1993, and GeoEngineers, 1994). Conservative assumptions were incorporated into the modeling as necessary to reflect potential variations in ground water conditions.

MODFLOW Features

Mathematical modeling simulates ground water flow indirectly by using numerical approximations for flow equations designed to represent the physical properties and processes of aquifer systems, boundary conditions, and head distribution (Anderson, M.P. and Woessner, W.W., 1992). MODFLOW is a modular, three dimensional, block centered finite-difference computer program. This program simulates the flow of ground water in 3 dimensions and provides a realistic understanding of ground water movement in aquifer systems.

The finite-difference method solves a set of differential-flow equations to find the distribution of "heads" (ground water elevations or "potentiometric surface") over the aquifer flow system. This is accomplished by placing a network of grid cells over the flow system and calculating the heads at each cell node by trial and error. Additionally, at the end of a simulation, the program calculates the water budget for the entire model showing inflow and outflow rates specified for the different sources and sinks. Sources include recharge areas and rivers, and sinks may include wells or other discharge points such as return flow to the Nooksack River.

The computer program is divided into "packages". A package is that part of the program that represents a particular hydrologic or mathematical feature. The Block Centered Flow package calculates terms in the finite-difference equation that represent flow between cells. "Stress" packages calculate terms that represent flow into or out of the aquifer. The stresses include the River, Evapotranspiration, Drain, Recharge, Well, and General Head Boundary packages. The Solver package solves the system of finite-difference equations. The Basic package performs those tasks which belong to the model as a whole, such as specification of boundaries and initial conditions. The printing code for model results is given in the Output Control package. Ground water flow paths were obtained from FLOWPATH.

Additional information documenting input parameters, calibration and sensitivity, and simulation and model results is presented in Appendix A.

Delineation Results

The hydrogeologic mapping and numerical modeling results for the future pumping rate of 800 gpm indicate that the TOT zones around the wellfield are highly elliptical (Figure 2-3). The 10 year TOT extends nearly 1-1/2 miles south of the wellfield, but only about 1/4 mile to the north. The 10 year TOT is approximately 4000 feet wide in an east-west direction covering almost 700 acres.

The elongated shape of the 5, 10, and 25 year TOT zones is controlled by the south to north flows in the Sumas outwash aquifer. The width reflects both summer and winter flow conditions, and accounts for variations in the regional flow pattern.

The 1 year TOT encompasses an area of less than 90 acres, but does not exhibit the strong elliptical shape observed in the 5, 10, and 25 year TOT zones. This is interpreted to reflect the localized drawdown of the water surface due to pumping stresses.

The 25 year TOT zone extends beyond the southern boundary of the ground water model, but is considered useful as a guide to delineate the ZOC. Based on geologic (Easterbrook, 1976) and topographic (USGS, 1972) data the ZOC is interpreted to include portions of the surface drainage area surrounding Lake Fazon and the uplands just north of the town of Goshen.

2.2.2 Management Zones For Everson's WHPA

The City of Everson's WHPA has been divided into two zones. The primary management zone is the 1 year TOT zone. The second zone encompasses the remaining area within the 10 year TOT zone. Management of the 5 and 10 year TOT zones as a single area is desirable for the City of Everson for several reasons.

- Multiple management zones add complexity and require additional resources;
- The 10 year TOT area is relatively small;
- Multi-jurisdictional issues must be addressed for each of the delineated TOT areas; and
- The sole source nature of the water supply and high aquifer susceptibility to potential contamination sources within each TOT zone required integrated management strategies.

SECTION 3.0
INVENTORY OF POTENTIAL SOURCES OF GROUND WATER CONTAMINATION

3.1 WHPA INVENTORY METHODOLOGY

3.1.1 Introduction

The next step of the process was to identify potential sources of contamination within the wellhead protection area. The 10 year TOT area, shown in Figure 2-3, was the focus of the inventory effort.

Data regarding potential contaminants were compiled for 182 parcels in the 10 year TOT area for the wellfield of the City of Everson. The parcels were identified by Township, Range, and Section, and Whatcom County tax parcel x and y codes. The data were entered into a Quattro Pro for Windows spreadsheet and summary statistics were calculated (see Appendix B).

A Water Resources class at Western Washington University assisted with the initial compilation of data. In order to meet the needs of a concise class project, the inventory work was divided into four groups based on category of potential pollutant: septic group, agriculture group, well group, and underground storage tank group. The groups also inventoried parcels of concern to their group interest.

Data was collected on some parcels outside of but adjacent to the 10 year TOT area due to proximity to the area, potential for contamination, and refinements during the course of the work in the delineated zone of contribution. Results of the inventory process are summarized in Figures 3-1, 3-2, and 3-3.

3.1.2 Inventory Forms and Data Collection

As part of this project, in March 1994 inventory forms were developed to address the particular setting for the source inventory for the City of Everson. Categories of potential contaminants considered insignificant were not addressed directly; for example, none of the information sources indicated that there were, or had been, any dumps or landfills in the zone of contribution.

The categories were modified in response to user comments and comments from the City and Wellhead Protection Advisory Committee. A data collection plan was developed at this time. The inventory process covered existing data and information sources such as federal, state, and county data bases, archival material, air photo information on land use, field reconnaissance via vehicles, and interviews by telephone and in person with residents of the lands in question.

3.1.3 Analysis and Summary of Results

The university inventory effort was supplemented by the consultant team. These efforts filled in data gaps in information collected by the class effort.

The data was compiled and analyzed in an electronic spreadsheet. A unique identifier for each land parcel in the 10 year TOT area was adopted, and data associated with each parcel was tabulated in the spreadsheet. This section of the discussion summarizes the inventory results.

Land Use Summary: The land use of the 182 sites inventoried were categorized as follows: 155 were residential, 18 agricultural, and 9 were industrial or commercial.

Water Source Summary: Ground water conditions in the zone of concentration are such that shallow dug wells have been widely used since the area was first settled. Numerous long-time residents relate first-hand experience of digging and using large-diameter wells that are less than 30' deep, with static water levels less than 20' deep, and that yielded as much water as the pumping equipment of the time could produce. Many of these wells were constructed before the State began collecting systematic records of well construction. Because of the apparent abundance of abandoned wells, and their potential as an avenue for aquifer contamination, this part of the inventory deserves high priority for additional work.

Thirteen domestic wells, 6 irrigation wells (in use), and at least 18 abandoned wells were identified by long-time residents in the 10 year TOT area. These numbers probably do not reflect a complete inventory of all the wells that may exist in the area. The areas where a house-by-house inventory was not carried out may have either operating or abandoned wells. Of the 182 inventoried parcels, 51 were not surveyed for wells.

Because of the structure of the data base (Appendix B), the first column can represent only the current water supply. If there is a well on a parcel that is also connected to a public water main, the well would show in the secondary water source column. If more than two sources were present on one parcel of land the remaining information was recorded in the comment column and tabulated at the base of the spreadsheet. Five parcels whose primary water supply is municipal water also had a domestic, irrigation, or abandoned well on the property.

Of the 131 parcels inventoried for well information 105 are on municipal water. Again, this number reflects only what was inventoried. Due to gaps in areas not inventoried the precise total number of parcels on municipal water is not known.

Waste Summary: In the waste disposal category, there were 62 septic tanks (2 tanks on one parcel) and 82 parcels on municipal sewer. Of the 182 parcels inventoried 36 have not been surveyed for waste disposal.

Dumps Summary: No dumps or landfills were found or reported to be in the 10 year TOT area.

Agricultural Land Use Summary: A summary of the agricultural category shows a total of 18 parcels in the 10 year TOT zone. On these parcels 7 dairy or cattle operations and 17 crop farm enterprises were identified. The total of the farming activities exceeds the number of agricultural land parcels because most of the farms have more than one kind of activity. For example, a dairy farmer can also have acreage in crops. The category of farming activity was accounted for separately because the potential for contamination varies among the activities.

Agricultural Practices Summary: Fertilizers, herbicides, insecticides, and nematicide were the type of agricultural chemicals that may have been used. Fertilizer application (mostly manure) was the primary practice used by the parcels that grew crops. Thirteen of the 17 crop farms used fertilizers. In addition to fertilizers, 3 farms used some type herbicides, 2 farms used insecticides, and 1 farm used a nematicide. One farm was totally organic. Licensing is required for commercial pesticide applicators. Therefore many farmers contract for spray services to Nooksack Valley Spray or Lynden Cenex.

Hazardous Material Transport Summary: State Route 544 was identified as a potential source of contamination from spillage of petroleum and other products. This road is the main access route for delivery of gasoline to Sumas, one of the largest distribution points in the county.

Trans Mountain Pipeline Company has a petroleum product pipeline that crosses the zone of contribution. Its main product is crude oil. The pipeline has one valve in the 10 year TOT zone. This was also identified as a potential source of contamination from spillage.

Fuel Storage Summary: The inventory of fuel storage identified two underground storage tanks for diesel fuel and two for gasoline, as well as two above-ground tanks. These small numbers are not an accurate reflection of the total fuel storage inventory in the 10 year TOT area. There is considerable reluctance in the community to share information about underground home heating oil tanks, because of concern over how the information will be used. The inventory team did not pursue the issue due to the level of effort available and its obvious sensitivity. However, a high priority in future work should be given to a more complete inventory of underground fuel tanks, perhaps in conjunction with an incentive program to adopt best management practices.

Chemical Storage Summary: One site was identified (Proform) that stored chemical onsite, in fireproof and spillproof containment. Proform has substantial state-mandated requirements for best management practices, reporting, and spill containment and cleanup planning. Selco Lumber also stores recycled oil onsite; state-mandated requirements govern this storage.

Gravel Mining Summary: Three tax parcels are proposed for gravel mining in the 10 year TOT area. The potential extent of gravel mining can be more readily appreciated from the land use map (Figure 3-1). A 1986 air photo was used to determine the extent of the existing Wilder pit. Other information was provided by Boundary Aggregate.

More detailed results of the inventory are presented in Appendix B, Inventory Results.

3.2 CHARACTERIZATION OF POTENTIAL SOURCES

3.2.1 Onsite Sewage Disposal Systems

Septic tanks store and treat domestic waste from residences and businesses that are not connected to a public sanitary sewer. Local regulation requires anyone within 200' of a collector line to connect their dwelling to the sewer system. Septic tanks, unlike underground fuel tanks, do not maintain a high degree of contamination potential after they have been abandoned, so the old ones are not of great concern.

Septic systems present three kinds of risk of contamination: bacterial loading, nitrate, and unknown materials flushed down the line.

3.2.2 Storage Tanks

This inventory effort was not able to acquire comprehensive data on underground fuel tanks as discussed in the previous section. Available data bases were not extensive or complete. The largest gap in data relates to residential home heating oil tanks. In a few instances, owners informed the surveyors about tanks they have; but most residents were reluctant to share information, not knowing what financial implications the information would present.

The inventory surveyors contacted the Washington Department of Ecology for information in the state list of storage tanks. The state inventory has a lower capacity limit of 1,100 gallons. No tanks of greater capacity showed up in the inventory for the Everson 10 year TOT area. A Whatcom County Office of Emergency Management list of hazardous chemicals pursuant to federal "right to know" requirements was also reviewed; this list also turned up no storage tanks.

Heating oil distributors who serve the Everson area were contacted. They do not keep systematic records of kinds of storage tanks, and were reluctant to share what they perceive as private customer information.

An indirect approach to determining possible tank locations was examined. The service area for natural gas offers some estimate of where there is a low likelihood of fuel tanks. Fuel tanks would not be expected in subdivisions built since 1973, when the price of heating oil increased dramatically, and in areas where natural gas was available. On the other hand, older residential areas where gas service may have become available later would be good candidates for finding old or abandoned fuel tanks. This inventory category should be examined further in the next phase of planning.

3.2.3 Agricultural Sources

Because livestock and agricultural waste can contribute to elevated levels of nitrates within the aquifer recharge zone, agricultural practices which could contribute harmful waste to the Everson area wells were examined. The objective was to identify and map potential agricultural ground water contaminants within the Everson WHPA.

The first step in gathering information was to access state and local organizations and data bases they maintain. Examples are the Washington Department of Ecology, Whatcom County Planning and Development Services, Whatcom County Health Department, and the Soil Conservation Service.

The Soil Conservation Service and Washington State University Cooperative Extension have detailed information about individual farm operations. They were reluctant to disclose what may be regarded as private information. The inventory consequently relied on air photo interpretation, County Assessor's records, and phone or direct interviews with land owners for determination of agricultural land uses, number of livestock, dairy and agricultural management

practices, and size of farms. The inventory identified 18 agricultural sites including four dairy farms, and three non dairy related cattle grazing farms. Hay, grass, corn, peas and Christmas trees were the only crops found within the zone. Fertilizers used are "Triple 16" and manure; farmers report that no manure is applied during winter months.

Because of state and federal requirements that insecticide and herbicide operators be licensed, commercial farmers within the WHPA rely on commercial distributor-applicators such as Cenex in Lynden, or Nooksack Valley Spray to apply herbicides. Information about herbicide types and application rates for the current year were not available.

Some agricultural land uses are highly compatible with wellhead protection areas because they pre-empt other uses with higher contamination potential, and involve application of few if any contaminants to the land. This would be true of grass pasture and hay land, provided nutrients are supplied at or below the seasonally varying rate of uptake by plants. This makes the continuation of agriculture in some locations desirable from a ground water protection point of view.

3.2.4 Gravel Mining

The area south of Everson is extensively underlain by Sumas outwash deposits, sand and gravel beds that were left by meltwater as the glaciers retreated. Boundary Aggregate, a combination of three sand and gravel operators, has proposed the annexation of unmined gravel deposits into the City of Everson and a long-term gravel mining operation to the southwest of the 10 year TOT area. No gravel mining is currently taking place within the 10 year TOT area.

The area delineated as gravel mining on Figure 3-2 represents the external boundaries of the property owned by Boundary Aggregate; the area that will actually be proposed to be mined will be somewhat smaller.

3.2.5 Hazardous Waste Sites

There are two recognized hazardous waste sites in the Everson vicinity, neither one of them in the 10 year TOT area. Both are Superfund sites resulting from past handling of electrical transformers and capacitors containing polychlorinated biphenyl (PCB) oils. PCB's are not highly mobile in water and tend to bind to soils. Monitoring of residential wells within 1/4 mile of the Mission Road site has not indicated a ground water problem. Both sites are being addressed under state and federal cleanup programs.

3.2.6 Household Hazardous Products

Typical households have a broad array of materials that could cause significant water quality problems if improperly used, stored, or disposed of: cleaners, solvents, fuel, lubricants, paints, insecticides, medicines. The state of Washington has a number of educational materials and programs in place to help reduce household hazardous wastes and their improper disposal.

3.2.7 Unprotected and Improperly Abandoned Wells

The inventory process was not able to systematically identify all unprotected wells in the area, because of limitations of time and budget as well as informant's reluctance to share information. It is likely that increasing landowner cooperation can be anticipated as the program's purposes become better understood.

Wells that do not have adequate protection are a potential avenue for very rapid pollution of the aquifer, from a wide variety of materials. An untended hole in the ground may capture contaminated storm water runoff or be regarded as a convenient waste disposal site.

3.2.8 Commercial and Industrial Activities

The wellhead protection area contains a small number of economically important manufacturing operations. The key ones are Selco and Proform. Selco re-manufactures cedar dimension lumber. Proform fabricates plastic shapes from flat sheet stock in a vacuum press. These operations have a variety of materials onsite, such as used oil waiting for pick-up by a recycler. Both companies are subject to Washington state and federal occupational health and safety requirements that cover reporting, spill containment and clean-up, and materials storage. These requirements have already reduced the risk of a contaminant spill at the two manufacturing operations.

3.2.9 Storm Water Management

Storm water handling facilities have not been systematically incorporated into the newer housing subdivisions in South Everson. Some plats have underground storm water conveyance facilities, and some areas have french drains to intercept street runoff. A french drain in the gravelly outwash terrace soils is likely to work exceptionally well at disposing of runoff, but it has the drawback of creating a window for immediate contamination of the aquifer by any materials carried by the runoff. Because the system has not been designed according to an overall plan, the downstream conveyance has insufficient capacity to handle the runoff from the upstream catchment area. The parts of the wellhead area where storm drainage is an issue are subdivisions within the 1 year time of travel to the wellfield.

3.2.10 Hazardous Materials Transportation Sources

There are two major transportation routes through the Everson wellhead protection area: State Route 542 (544) and the Trans Mountain Pipeline.

State Route 542, locally known as the Everson-Goshen Road, passes within 1/4 mile of the City's wellfield. The route is a main transportation artery to Sumas and beyond, into Canada. A wide variety of potential ground water contaminants are shipped by tanker truck over this road, and although the exact types and quantities of materials are not known, they include gasoline bound for distribution points near the border. A partial spill of a tanker load of gasoline could force an immediate shut-down of the City's wells.

Trans Mountain Pipeline Company operates a petroleum product pipeline that crosses the southern part of the wellhead protection area (in the zone between the 5 year and 10 year TOT areas). The line carries crude oil and condensate to refineries at Cherry Point in Whatcom County and March Point near Anacortes in Skagit County. There are isolation valves on either side of the Nooksack River, one of which is in the wellhead protection area on Mission Road. There are no pumping facilities in the area. Trans Mountain monitors corrosion in the pipe to detect an impending failure of the pipe. The lowest viscosity products carried by the pipeline are similar to diesel and heating oil.

3.3 SOURCE PRIORITIZATION

3.3.1 Contaminant Source Priority Setting – Approach

After the inventory of potential ground water contaminant sources was completed, an assessment of relative risk of the different potential contaminant sources identified in the inventory phase was performed prior to development of management options. The relative risk assessment combines the judgments of the consulting team, input from the Wellhead Protection Advisory Committee, and the residents of the community.

Due to the limited size of the WHPA and the fact that none of the potential sources emerged as much higher risk than the others, the ranking process was not used to screen out sources for further consideration, but was used to address relative priorities. The significant categories of activity identified in the inventory that have potential to contaminate ground water in the Everson wellhead protection area are the following:

- Household hazardous products
- Onsite sewage disposal systems
- Underground and above ground fuel storage tanks
- Gravel mining
- Unprotected and improperly abandoned wells
- Commercial and industrial activities
- Agricultural practices
- Storm water management
- Hazardous materials transportation

The risk assessment method used by the consulting team and Wellhead Protection Advisory Committee consists of best professional judgment of the personnel involved. A rationale for these judgments is provided below. It is important that this approach be meaningful and assist in the decision making process by assuring that reasonable alternatives are being addressed and

that no major problem sources are overlooked. Individual judgments were made for each activity in the list above, based on four criteria:

- Physical characteristics of source
- Relative hazard of the source
- Geographical distribution
- Manageability

These criteria are described briefly below.

Physical characteristics of source: How significant is the potential for contamination to occur from the activity in question? Are there inherent safeguards or mitigating factors? A score of 3 would indicate a high potential for contamination to occur.

Relative hazard: What is the relative bacteriological hazard or toxicity of the potential contaminant in question? A high relative hazard would rate a score of 3.

Geographical distribution: How widespread is the activity within the 10 year TOT area? A widespread source of contamination would receive a score of 3.

Manageability: How difficult would it be for the City to manage the activity to minimize the threat posed to ground water? If the problem is relatively easily managed, it would rate a 3, thus increasing its priority for action.

Each criterion was quantitatively scored a 1, 2, or 3; the scores were summed, and rank order established.

3.3.2 Priority Contaminant Sources

The consulting team and Wellhead Protection Advisory Committed applied this ranking system to the activities in the Everson wellhead area. The resulting ranking is shown in the accompanying table. All of the categories of potential sources of contamination are addressed at varying levels in the development of the management plan and the resulting recommendations.

TABLE 3-1
SAMPLE PRIORITY MATRIX

	Source Characteristics	Relative Hazard	Geographic Distribution	Manageability	Sum	Rank
Gravel Mining	2	2	1	3	8	3
Unprotected and Improperly Abandoned Wells	2	3	3	2	10	1
Storm Water Management	3	3	3	1	10	1
Agricultural Practices	2	2	2	3	9	2
Household Hazardous Products	2	2	3	2	9	2
Storage Tanks	3	3	1	2	9	2
Onsite Sewage Disposal Systems	1	2	2	2	7	4
Commercial and Industrial Facilities	1	1	1	3	6	5
Hazardous Materials Transportation	3	3	2	2	10	1

SECTION 4.0
WELLHEAD MANAGEMENT OPTIONS

In this section, existing jurisdictional responsibilities for wellhead protection are summarized. In addition, potential management options to address the potential sources of contamination identified in Section 3.0 are presented. Finally, the process used to review the potential strategies and identify those that are recommended for the City of Everson is described.

4.1 JURISDICTIONAL RESPONSIBILITIES FOR WELLHEAD PROTECTION

The City of Everson has the primary responsibility for developing and implementing the local wellhead protection program. However, due to the City's limited jurisdictional and regulatory authority, ground water protection will occur through a coordinated effort between a variety of local, state and federal agencies.

In this section, existing jurisdictional responsibilities for wellhead protection are described. Many of the wellhead management options described in Section 4.2 relate to or build on these existing programs.

4.1.1 City of Everson

The City of Everson is responsible for developing and implementing the wellhead protection program. These responsibilities include delineating the wellhead protection area, inventorying potential contaminant sources, and developing a strategy to manage the identified ground water quality threats.

The City's other responsibilities include:

- Working with local first responders (police and fire officials) to develop an effective spill response plan.
- Developing a contingency plan for dealing with long term replacement of a contaminated well or wellfield.
- Preparing a water system plan pursuant to Washington Administrative Code (WAC) 246-290-100, that includes wellhead protection components.

The City has clear regulatory authority to protect ground water through zoning decisions, building and operating standards, land use controls, and other measures. The City is responsible for ensuring wellhead protection is integrated with overall planning occurring within the community, including the Growth Management Act (GMA) planning. The GMA provides an interjurisdictional planning mechanism to protect critical areas.

The City can also implement non-regulatory measures, such as public educational programs, and encourage the voluntary implementation of best management practices (BMPs) to protect ground water quality.

4.1.2 Whatcom County

The **Whatcom County Health Department** maintains records on approvals of individual septic systems. The County is also responsible for review and approval of permits to install new septic systems.

The **Whatcom County Planning and Development Services Department** is responsible for zoning, building and operating standards, land use controls, and other ordinances. The Planning Division plays an active role in Growth Management Act planning through coordination with local jurisdictions. The Building and Permits Division is responsible for permitting sand and gravel operations less than 3 acres in size, and conditional use permits for larger operations.

The **Whatcom County Fire Marshal** has been delegated the responsibility for implementing County Ordinance 91-053, governing above- and below-ground fuel storage tank regulations. This ordinance governs storage tanks currently exempt from Washington State Department of Ecology (Ecology) regulations.

The **Whatcom County Department of Public Works** operates a household hazardous waste collection program. A collection center is available periodically in the Bellingham area.

The **Whatcom County Conservation District** provides technical assistance to landowners related to agricultural best management practices.

4.1.3 Nooksack Tribal Government

Nooksack Tribal Government is responsible for oversight of activities on tribal lands located in the southeast corner of the WHPA. Implementation of wellhead protection strategies in these areas is the responsibility of the Nooksack Tribal Government which maintains government-to-government relations with other jurisdictions.

4.1.4 State Agencies

A variety of state agencies have ground water protection responsibilities and authorities.

The **Washington State Department of Health** (DOH) is responsible for protecting public health by assuring safe drinking water supplies. DOH monitors water supplies, conducts pollution prevention efforts, and establishes a cooperative relationship with water utilities and local health departments. DOH has primary responsibility for implementation of the federal wellhead protection program requirements of the federal Safe Drinking Water Act in Washington. The DOH is also responsible for oversight of the engineering and operational functions of public water systems, including the review of water system plans based on the criteria established in WAC 246-290-100. The DOH coordinates and promotes pollution control measures within the wellhead protection areas. Coordination efforts include hosting inter-agency meetings and helping to develop inter-agency agreements as appropriate.

The **Washington State Department of Ecology** (Ecology) is the primary environmental protection agency in Washington. Several of Ecology's programs are directly related to the

implementation of wellhead protection programs. Ecology's Water Quality Program has the lead role for implementing ground water quality standards, including the establishment of discharge and monitoring requirements on permitted facilities discharging to the ground water pursuant to WAC 173-200. The Water Quality Program also has the lead role for management and control of point and nonpoint sources of pollution.

Ecology's Water Quality Financial Assistance Program is responsible for administering the state Centennial Clean Water Fund. This fund provides competitive grants to local governments for ground water quality protection efforts, including the implementation of wellhead protection programs.

Ecology's Water Resources Program is responsible for establishment of ground water management areas to protect and manage ground water resources over large areas for all beneficial uses (not just drinking water). The Water Resources Program is also responsible for issuing water rights, permitting well drillers, enforcing minimum well construction standards, and other programs relating to ground water management and protection. This program also maintains an inventory of wells in the state.

Ecology's Hazardous Wastes and Toxics Reduction Program offers technical assistance to local governments and businesses on pollution prevention measures. Ecology's Solid and Hazardous Waste Section is responsible for the state Resource Conservation and Recovery Act (RCRA) program, which regulates hazardous waste generators, transporters, and treatment, storage, and disposal facilities. The Spill Response Section is developing a standard operating procedures guide for emergency first responders to use when reacting to a chemical spill or potential release within susceptible ground water areas.

The **Washington State Department of Agriculture** (WSDA) is the state agency with primary authority and responsibility for regulating pesticide and agricultural chemical use. WSDA is responsible for regulating confined animal operations; pesticide use, storage and application; and commercial fertilizer storage, transportation and use. WSDA can classify wellhead protection areas as "special use areas," and require additional application or monitoring requirements or restrict the use of certain agricultural chemicals within these areas (WAC 16-230).

The **Washington State University Cooperative Extension** provides technical assistance and information to community residents on water quality issues.

The **Washington State Conservation Commission** gives administrative and program assistance to local conservation districts. Conservation districts are responsible for education and providing technical assistance to landowners related to best management practices, including those that reduce or eliminate the leaching of pollutants into ground water supplies.

The **Washington Department of Community, Trade, and Economic Development** is responsible for carrying out the Growth Management Act, which requires local jurisdictions identify and protect critical areas, including critical recharge areas for aquifers used for potable water. Wellhead protection areas are one type of critical aquifer recharge area.

The **Washington State Department of Natural Resources** is responsible for permitting and oversight of sand and gravel operations greater than three acres in size.

4.1.5 Federal Agencies

The **U.S. Environmental Protection Agency** (EPA) is the lead federal agency for wellhead protection. It provides funding and technical assistance for state wellhead protection programs. EPA is also responsible for overseeing investigations and cleanups of hazardous waste sites on the federal Superfund list.

The U.S. Department of Agriculture **Soil Conservation Service** (SCS) offers technical assistance for ground water quality protection to landowners located within wellhead protection areas. The SCS works on programs in conjunction with local conservation districts, and is a good source of information on water quality protection from agricultural operations.

The **U.S. Geological Survey** (USGS) is a research oriented agency with technical expertise in ground water hydrogeology. The USGS conducts ground water studies in local areas across the country.

4.1.6 Interjurisdictional Coordination

Figure 3-2 shows the existing jurisdictional boundaries of the City of Everson wellhead protection area. Some of the wellhead protection area lies outside the direct jurisdiction of the City. Most of the western half of the area is currently within City limits, with the remainder designated as the City's interim urban growth area subject to joint City and County jurisdiction. In contrast, most of the eastern half of the wellhead protection area is under county jurisdiction, and the southeast corner is Nooksack tribal lands.

Interjurisdictional cooperation is essential for effective wellhead protection. To help resolve multi-jurisdictional issues, the City has established a Wellhead Protection Advisory Committee. Representatives of affected jurisdictions and other constituencies (agriculture, mining, citizens) are participants. The Committee plays a major role in wellhead protection, from overseeing the delineating and inventory efforts to prioritizing potential contaminant sources and selecting and implementing management options.

4.2 POTENTIAL MANAGEMENT OPTIONS

The identification of potential sources of contamination is essential to facilitate the development of management options to prevent potential threats from becoming problems. In this section, management options for future development are identified. Potential management strategies for specific sources of contamination are also identified. The option selection process is described in Section 4.2.3. The recommended management plan is presented in Section 5.0.

4.2.1 Future Development Issues

The City of Everson's interim growth boundary extends south and west into the WHPA. Updating of the City's comprehensive plan and associated ordinances is underway. Integration

of growth management and wellhead protection planning is necessary to ensure consistent goals are established and efficient use of resources required for implementation.

Table 4-1 presents management options related to future development in the WHPA. These issues are discussed in more detail in Section 5.0.

4.2.2 Strategies for Specific Sources

Potential wellhead management options have been identified for each of the potential sources of contamination identified in the source inventory. Emphasis has been placed on the sources that present the greatest threat to the ground water supply. These potential sources of contamination include:

- Unprotected and improperly abandoned wells
- Hazardous household products
- Storage tanks
- Storm water management
- Gravel mining
- Agricultural practices
- Onsite sewage disposal systems
- Commercial/industrial activities
- Hazardous materials transport
- Other sources

Potential management strategies for specific sources are summarized in Tables 4-2 through 4-11. Each table is organized in the same way. At the top, the overall management goal and a description of the potential contaminant source and contaminants of concern are provided. Management strategies are then summarized in a matrix format. The first column of the matrix summarizes each potential management strategy. The type of strategy is then indicated: regulatory/institutional or voluntary/educational. A regulatory strategy involves development and enforcement of local, state, or federal regulations. An institutional policy is an action taken by a public agency such as entering into an interjurisdictional agreement or purchasing land. Voluntary/educational strategies include technical assistance, dissemination of public information materials, sponsoring workshops, or other actions designed to promote ground water protection. The final column provides additional information on the management strategies.

4.2.3 Option Selection Process

In selecting which management options were appropriate for further action, draft alternatives were developed based on the inventory results, the time of travel zones, distinction between existing and future land uses, financial viability and the ease of implementation.

Draft options were discussed at each of four meetings of the Wellhead Protection Advisory Committee. The third meeting was designed as a public workshop to facilitate the broadest possible input to the final recommendations. As the process continued, the following factors were considered in the evaluation of the alternative strategies and their appropriateness for Everson:

- Acceptability to the general public.
- Potential negative impacts on local business or property owners.
- Level of public or private sector investment required.
- Ease of implementation based on financial and political issues.
- Appropriate protection of the Everson Wellhead Protection Area provided.

Table 4-1

Future Development Issues

Goal: Establish comprehensive and coordinated approach to address all emerging ground water protection issues.

Potential Management Strategies	Type of Strategy		Comments
	Regulatory/ Institutional	Voluntary/ Educational	
1. Modify the City's interim critical areas ordinance to more adequately protect the WHPA	X		
2. Establish design standards for potential sources of contamination (e.g., use/storage of hazardous substances, tanks, etc.)	X		
3. Modify the City's comprehensive land use plan and ordinances to encourage future land uses that minimize potential impacts on ground water supplies (e.g., large lot residential, open space)	X		
4. Prohibit land uses that are incompatible with ground water protection (e.g., industrial, solid waste disposal, sludge application, hazardous waste facilities, etc.)	X		
5. Establish an overlay zone to impose special development restrictions on the wellhead protection area. The underlying uses of the area would remain unchanged. The area overlay zone would impose additional ground water protection standards than those that would otherwise apply.	X		

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Table 4-2

Potential Contaminant Source: Abandoned Wells

Goal: Eliminate unprotected and improperly abandoned wells.

Description: Improper disposal in abandoned wells (water supply, industrial, irrigation, livestock, or monitoring wells), or unplugged test holes.

Contaminants of Concern: Any contaminant entering a well (waste water, storm drainage petroleum products, chemicals, etc.).

Potential Management Strategies	Type of Strategy		Comments
	Regulatory/ Institutional	Voluntary/ Educational	
A. Existing and Future Sources			
1. Encourage landowners to identify and eliminate existing abandoned wells		X	
2. Enforce regulations requiring all abandoned wells to be capped to prevent entry of contaminants	X		Existing state regulations in place
3. Develop and implement a program for proper abandonment	X		

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Table 4-3

Potential Contaminant Source: Household Hazardous Products

Goal: Minimize the use and improper management of hazardous chemicals and generation of hazardous waste by households and small businesses.

Description: Use of hazardous products for equipment maintenance, cleaning, gardening, painting, furniture stripping, etc., by residents and small businesses. Also, generation and improper management of hazardous wastes by unregulated small quantity generators.

Contaminants of Concern: Nitrates and other nutrients, fertilizers, pesticides, petroleum products, other chemicals.

Potential Management Strategies	Type of Strategy		Comments
	Regulatory/ Institutional	Voluntary/ Educational	
1. Provide information to businesses and residents regarding pesticide and fertilizer application rates		X	Existing materials available from Ecology and other agencies
2. Provide information to businesses and residents regarding pollution prevention programs (source reduction, recycling, treatment)		X	Existing materials available from Ecology
3. Promote participation by businesses and residents in the small quantity generator and household hazardous waste collection programs of Whatcom County (ensure availability of a collection site convenient to Everson)		X	Existing program sponsored by County
4. Sponsor community event to promote proper management of hazardous household products and wastes		X	

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Table 4-4

Potential Contaminant Source: Storage Tanks

Goal: Eliminate potential releases (spills or leaks) from storage tanks. For existing tanks, ensure proper management, upgrade, or closure. Prohibit new tank installations or require acceptable leak detection and containment systems.

Description: Above- or underground storage tanks (USTs) for fuels or other chemicals.

Contaminants of Concern: Gasoline, diesel, heating oil, other chemicals.

Potential Management Strategies	Type of Strategy		Comments
	Regulatory/ Institutional	Voluntary/ Educational	
A. Existing Storage Tanks			
1. Evaluate the number of home heating oil tanks in the WHPA	X		
2. Provide information to tank owners to regarding their potential to contaminate ground water and measures to avoid contamination (e.g., remove oil from abandoned tanks)		X	
3. Require inspection and maintenance program for high risk tanks, including site monitoring for potential leakages	X		Existing state and county programs
4. Require county notification for reactivating existing fuel storage tanks	X		Existing county programs
5. Require reporting and cleanup of leaks, spills and overfills	X		Existing state and county programs
6. Require annual inspection of all fuel storage tanks	X		Existing state and county programs
7. Require upgrading of tanks more than 10 years old, and removal of tanks more than 40 years old	X		Existing state and county programs
8. Develop a program for closure and upgrading of all storage tanks in WHPA	X		
B. Future Development			
9. Develop siting limitations for new USTs located within the WHPA	X		
10. Establish notification, performance standards, and operating requirements for new heating oil, gasoline, and diesel fuel above and below ground storage tank systems	X		Existing county program
11. Require registration, performance standards and operating requirements for gasoline, diesel and chemical USTs	X		Existing state program

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Table 4-5

Potential Contaminant Source: Source Water Runoff

Goal: Prevent uncontrolled storm water runoff from contaminating the ground water supply.

Description: Storm water runoff from impermeable surfaces such as parking lots, road, and roof tops into roadside ditches, catchbasins and drywells, ultimately infiltrating into the ground.

Contaminants of Concern: Any materials on parking lots, roof tops, roads (nitrates and other nutrients, fertilizers, pesticides, petroleum products, chemicals).

Potential Management Strategies	Type of Strategy		Comments
	Regulatory/ Institutional	Voluntary/ Educational	
A. Existing and Future Sources			
1. Develop comprehensive storm water management plan to describe drainage system and needed improvements	X		
2. Conduct periodic monitoring of drywells located within the WHPA	X		
3. Provide information materials to residents and businesses in vicinity of storm water facilities (e.g., drywells) regarding proper/improper uses		X	
4. Conduct workshops for public works crews, building inspectors, contractors and others on best management practices for controlling erosion and storm water runoff		X	Workshops would be sponsored/led by the county or a state agency
5. Establish minimum storm water requirements for new developments and redevelopment projects	X		Ecology's Stormwater Management Manual for the Puget Sound Basin (February 1992) can be used as a basis for developing such standards

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Table 4-6

Potential Contaminant Source: Gravel Mining

Goal: Prevent contamination of water supply through gravel mining operations.

Description: Surface mining of gravel, and mine drainage.

Contaminants of Concern: Any contaminant that flows into or is disposed in pits or ponds.

Potential Management Strategies	Type of Strategy		Comments
	Regulatory/ Institutional	Voluntary/ Educational	
A. Existing and Future Sources			
1. Develop requirements for fencing or restricting access to surface mines	X		
2. Prohibit future sand and gravel mining within the wellhead protection area	X		
3. Actively pursue authority to permit sand and gravel operations through the County conditional use permit process	X		
4. Modify zoning and subdivision ordinances to address transition of mining areas to other uses compatible with ground water protection (e.g., open space, low density residential)	X		

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Table 4-7

Potential Contaminant Source: Agricultural Sources

Goal: Manage agricultural activities to prevent potential impacts on ground water.

Description: Non-commercial "hobby" farms and commercial farms. Chemical application and storage areas; animal feedlots; manure spreading areas and pits.

Contaminants of Concern: Agricultural chemicals (e.g., pesticides, herbicides, fertilizers, fungicides, nematicides, etc.), nitrates, bacteriological contaminants.

Potential Management Strategies	Type of Strategy		Comments
	Regulatory/ Institutional	Voluntary/ Educational	
A. Existing Sources			
1. Provide information on best management practices, proper use and handling of fertilizers and pesticides, and names and phone numbers for agencies for technical assistance		X	
2. Coordinate with the Whatcom County Conservation District and Soil Conservation Service to ensure conservation plans are implemented on commercial farms in the WHPA		X	
3. Amend the current City zoning ordinance for agricultural uses to make property owners with domestic animals responsible for implementation of best management practices that protect water quality (e.g., keep all animal waste out of surface or ground water)	X		
4. Encourage commercial agriculture operations to switch from high intensity crops (e.g., fruits, vegetables) to low chemical use operations (e.g., pasture)		X	
5. Recommend that the Whatcom County Health Department conduct a survey of leachable pesticide and fertilizer use and animal wastes on commercial agricultural operations within the WHPA	X		
B. Future Sources			
6. Update the City ordinance to prohibit new high intensity commercial agricultural operations (e.g., fruits and vegetables, concentrated animal operations) within the WHPA	X		
7. Update the City ordinance to require new agricultural operations to protect water quality	X		

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Table 4-8

Potential Contaminant Source: Onsite Sewage Disposal Systems

Goal: Prevent onsite sewage disposal (septic) system contamination of ground water; eliminate future unsewered development.

Description: Domestic waste water treatment systems for homes or business establishments.

Contaminants of Concern: Nitrates, bacteriological/viral organisms, chemical cleaners.

Potential Management Strategies	Type of Strategy		Comments
	Regulatory/ Institutional	Voluntary/ Educational	
A. Existing Systems			
1. Seeking funding for and undertake a septic system inventory to identify failing systems	X		
2. Provide information to encourage proper system maintenance		X	
3. Source prohibition (e.g., eliminate local sale of septic system cleaners)	X		
4. Require proof of system inspection and maintenance every five years	X		
5. Establish program for low or fixed-income homeowners for septic system replacement or sewer connection	X		
6. Conduct an economic and environmental analyses of the feasibility of hooking up to City sewers in the WHPA	X		
7. Require sewer hook-up for existing homes on septic systems	X		
B. Future Development			
8. Increase lot size limitations to decrease number of systems	X		
9. Require sewer hook-up for all new construction	X		

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Table 4-9

Potential Contaminant Source: Commercial and Industrial Activities

Goal: Eliminate future unsewered commercial or light industrial development; ensure proper design and operating standards are in place to minimize potential threats to the water supply.

Description: Hazardous materials and waste handling, storage, and transport; lawn maintenance.

Contaminants of Concern: Bacteriological contaminants, nitrates, petroleum products, chemicals, fertilizers, pesticides, metals, nutrients.

Potential Management Strategies	Type of Strategy		Comments
	Regulatory/ Institutional	Voluntary/ Educational	
A. Existing and Future Sources			
1. Develop design standards for new buildings to control spills, manage contaminated runoff, and control storage of hazardous substances	X		
2. Implement a program for consultation with commercial, institutional or recreational facilities concerning best management practices for fertilizer and pesticide usage		X	
3. Develop operating procedures (best management practices) to minimize threat of ongoing activities (e.g., storage/use of hazardous substances)	X		
4. Provide information to encourage businesses to implement pollution prevention programs		X	

Everson.Tab
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Table 4-10

Potential Contaminant Source: Hazardous Materials Transport

Goal: Minimize risk of transportation spills in the WHPA; coordinate spill response and storm water management planning.

Description: Accidental spill during hazardous materials transport.

Contaminants of Concern: Petroleum products, chemicals, fertilizers, pesticides, metals, nutrients.

Potential Management Strategies	Type of Strategy		Comments
	Regulatory/ Institutional	Voluntary/ Educational	
A. Existing and Future Sources			
1. Routinely monitor traffic on roads in the WHPA to determine the frequency and magnitude of hazardous materials transportation; if necessary, explore feasibility of routing hazardous materials away from roads overlying the WHPA		X	
2. Review and update spill response/contingency plan to ensure proper spill response procedures are in place	X		
3. Provide information materials to trucking firms known to service the area		X	
4. Provide signs to mark wellhead protection boundaries to encourage safe driving or early notification of authorities in event of a spill	X		
5. Provide Whatcom County Department of Emergency Management, state patrol, local authorities, and other emergency responders with information concerning location of City's wells and WHPA		X	
6. Develop a coordinated spill response plan for transportation corridors (e.g., highways, pipelines). Include the City, County, WA Department of Transportation, WA Department of Ecology, and pipeline company	X		

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Table 4-11

General Policy Issues

Potential Management Strategies	Type of Strategy		Comments
	Regulatory/ Institutional	Voluntary/ Educational	
1. Update City Comprehensive Water System Plan to address water conservation and source protection	X		
2. Acquire land in the immediate vicinity of the City's wells	X		
3. Work with Fire Department to establish emergency response procedures that protect ground water from contamination (e.g., use of drying agents rather than flushing techniques)	X		
4. Modify the City's interim critical areas ordinance to more adequately protect the WHPA	X		
5. Develop and implement a ground water monitoring program to provide early warning of impacts from all potential contaminant sources	X		
6. Prevent or limit use of chemical vegetation control along roads and utility right-of-ways in WHPA	X		
7. Encourage water conservation through public education and technical assistance		X	
8. Require water conservation measures for all new construction (e.g., consumption efficient plumbing fixtures and native vegetation in landscaping	X		

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SECTION 5.0
CITY OF EVERSON WELLHEAD PROTECTION PLAN

The recommended wellhead protection plan addresses the significant issues related to the protection of the City of Everson's ground water supply, and provides suggestions for implementation. Section 5.1 presents the major findings of the planning process and lays the groundwork for the recommended management strategies. Sections 5.2 through 5.4 present the recommendations which are organized as follows: overall recommendations; future development issues; and specific sources. Sections 5.5 and 5.6 present a discussion of the contingency and spill response plan. The plan approval process is described in Section 5.7. Suggestions related to plan implementation, including priorities for action and financing options, are presented in Section 5.8.

5.1 FINDINGS

1. The City's water supply comes from a sole source aquifer and alternative sources would be difficult to locate and develop. The aquifer is vulnerable to contamination due to the shallow depth to ground water and lack of natural layers to protect the aquifer from contamination.

2. Although there is limited ground water quality data available for the Everson aquifer, there is no indication of current levels of contamination of significant concern to the water supply.

3. The inventory of potential sources of ground water contamination indicates that a number of specific sources may pose a threat to ground water quality. However, limited inventory information is available on a number of sources (e.g., storage tanks, storm water, unprotected and improperly abandoned wells) and it is not possible to determine the magnitude of the potential threat posed by these sources without further study.

4. The appropriate wellhead protection area for management purposes is shown in Figure 2-3. This delineation is based on a pumping rate of 800 gallons per minute, the future capacity of the City of Everson's water supply.

5. The City's wellhead protection area should be divided into two zones for management purposes: the 1 year time of travel zone and the 10 year time of travel zone. Within both zones, control of existing sources and future development are necessary. However, the one year time of travel zone is the highest priority, due to the limited response time available, in the event that a problem develops

6. Much of the wellhead protection area is outside the City's jurisdiction. Part of the area outside the City is located within the interim urban growth boundary, (see Figure 3-2). Therefore, increased coordination and cooperation with other jurisdictions will be required to implement wellhead protection measures.

5.2 OVERALL RECOMMENDATIONS

1. The City should develop a formal resolution adopting the Everson Wellhead Protection Plan.

2. A Wellhead Protection Advisory Committee should remain active to facilitate local action and interjurisdictional cooperation.

3. Additional studies should be undertaken within 12 months of plan adoption to add to the inventory and further quantify the potential threat posed by specific sources (e.g., storage tanks, storm drainage, unprotected or improperly abandoned wells).

4. The City should review existing local ordinances and state regulations related to wellhead protection. Enforcement of existing local and state regulations should take priority over adoption of new regulations related to wellhead protection.

5. The City's Growth Management Act planning should be fully integrated with the wellhead protection plan. Amendments to existing ordinances and policies should be adopted to accomplish mutual goals.

6. Pollution prevention, accomplished through technical assistance and education, should be the highest priority. A public education and involvement plan that addresses all potential sources of contamination should be developed in conjunction with the Everson Wellhead Protection Advisory Committee. This plan should be built on existing state and local programs.

7. The City should explore available financing options for wellhead protection. State matching grants may be available to fund additional phases of wellhead protection.

8. Source-specific recommendations should be implemented in accordance with this plan.

9. The City should revise and update the plan on an ongoing basis.

5.3 FUTURE DEVELOPMENT RECOMMENDATIONS

1. The City should establish a wellhead protection ordinance that incorporates all WHPA design and operating standards in one place. This ordinance should also define the geographic boundary of the WHPA.

2. The City's comprehensive plan and zoning ordinances should be modified to prohibit land uses that are incompatible with ground water protection (e.g., heavy industrial, solid waste disposal, biosolids application, hazardous waste facilities, etc.).

3. In addition, within the 1 year time of travel zone, the City should encourage uses that pose minimal threat to the water supply (e.g., large lot residential, open space, low chemical use agricultural).

4. The City should pursue inter-local agreements with other jurisdictions to encourage adoption of plans and zoning ordinances to prohibit land uses incompatible with ground water protection and encourage uses that pose minimal threat to water supply.

5. All new development within the City of Everson, should be connected to the sewer system.

6. Outside the City limits, septic system impacts on the ground water supply should be researched and mitigated as appropriate. This can be accomplished through inter-local agreements.

7. All commercial, industrial, and other activities within the wellhead protection area that use or store fuel or hazardous materials should be required to comply with existing regulations governing secondary containment, leak detection, and monitoring requirements, as well as the additional provisions contained in this plan.

8. The City should review and compare its interim critical areas ordinance to this plan. If necessary the ordinance should be modified, to more adequately protect the WHPA.

5.4 RECOMMENDED STRATEGIES FOR SPECIFIC SOURCES

5.4.1 Unprotected or Improperly Abandoned Wells

1. The City, County, and Washington State Department of Ecology (Ecology) should work together to encourage landowners to identify and eliminate abandoned wells, or protect existing wells.

   A public outreach program and technical assistance should be developed to explain why unprotected and improperly abandoned wells are a concern and how they can be properly managed or abandoned.

2. The City should undertake an informal survey to try to determine the number of abandoned wells within the wellhead protection area. If the survey determines there are a significant number of wells, the City should develop and implement a formal program with proper prevention measures.

5.4.2 Household Hazardous Products

1. Information should be provided to businesses and residents regarding pollution prevention programs (source reduction, recycling, treatment).

   Existing information on pollution prevention is available from the Washington State Department of Ecology (Ecology), Hazardous Waste and Toxics Reduction Program, as well as a number of other state and local agencies.

   Information should be provided to businesses and residents regarding pesticide and fertilizer application rates.

Existing information is available from the Washington State University Cooperative Extension, as well as other state and local agencies.

2. Participation by businesses and residents in the small quantity generator and household hazardous waste collection programs in Whatcom County should be encouraged.

   The City should contact the County to determine the locations and dates of existing collection programs. The City may also want to pursue the possibility that a collection site convenient to Everson could be made available, and assist in local publicity.

5.4.3 Storage Tanks

1. The City should provide information to businesses and residents regarding the potential for storage tanks to contaminate ground water, and measures to avoid contamination (e.g., remove oil from abandoned tanks, upgrade in-use tanks).

2. The City should seek funding for a study to evaluate the number and condition of home heating oil tanks in the WHPA. The 1 year time of travel zone should be the highest priority for study. Based on the results of the study, the City should explore funding for a program for closure or upgrading of all storage tanks in the WHPA.

3. The City should amend its ordinance to prohibit siting of new underground storage tanks and standards for new facilities within the 1 year time of travel zone.

4. The City should support implementation of existing state regulations governing registration, performance standards and operating requirements for gasoline, diesel and chemical underground storage tanks greater than 1,100 gallons in capacity.

5. The City should support implementation of the existing county ordinance addressing storage tanks that are exempt from existing state regulations.

   The County ordinance governs home heating oil tanks, and above ground storage tanks for heating oil, gasoline, and diesel fuel. Most tanks in Everson's WHPA are governed by the county program. The Whatcom County Fire Marshal is responsible for enforcement of the ordinance. However, due to funding limitations the ordinance has not been aggressively enforced. The practicality of enforcing the ordinance, and the ground water quality ramifications of failing to enforce it, should be evaluated.

5.4.4 Storm Water Management

1. The City should develop a comprehensive storm water management plan to evaluate the drainage system and identify needed improvements.

   The storm water management plan will be a key component in developing and implementing an effective spill response and contingency plan. In addition, existing storm water management facilities (e.g., dry wells, detention ponds) should be evaluated to determine the likelihood that they pose a potential threat to ground water. The need

for capital facility improvements or installation of new facilities should also be determined.

The storm water management plan will be the basis for developing and implementing overall ground water quality protection measures related to storm water for the Everson area. It can be used to establish minimum storm water management requirements for the City of Everson.

2. Existing City and County ordinances should be amended to establish minimum storm water management requirements for new developments and redevelopment projects.

   The Washington State Department of Ecology has developed a Stormwater Management Manual for the Puget Sound Basin, (February 1992) that contains minimum requirements for all new development and redevelopment projects. This manual can be used as a basis for establishing standards for the City of Everson. Such standards might address: control of erosion and sedimentation during construction; preservation of natural drainage systems; best management practices to capture and treat storm water runoff; and operation and maintenance of storm water facilities. The storm water management plan would serve as the basis for developing and implementing related ground water quality protection measures appropriate for the City of Everson.

3. The City should provide information materials to residents and businesses in the vicinity of storm water facilities (e.g., dry wells) regarding proper/improper uses.

4. The City and County should consider conducting workshops for public works crews, building inspectors, contractors, and others on best management practices for controlling erosion and storm water runoff.

5.4.5 Gravel Mining

1. The City should regulate sand and gravel mining operations through the County conditional use permit process, and adopt associated design and operating standards (e.g., monitoring, runoff control, mitigation requirements, hazardous materials containment, and redevelopment). Until these standards and associated mitigation requirements have been established, no new gravel mining operations should be permitted within the WHPA.

2. The City should modify zoning and subdivision ordinances to address transition of mining areas to other uses compatible with ground water protection (e.g., open space, low density residential).

5.4.6 Agricultural Sources

1. Information on water quality, best management practices, proper use and handling of fertilizers and pesticides, and names and phone numbers for agencies for technical assistance should be provided to non-commercial farms.

The WSU Cooperative Extension may have existing information on agricultural best management practices that can be packaged for distribution.

2. The City should meet with the Whatcom County Conservation District and Soil Conservation Service to ensure conservation plans are developed and implemented on commercial farms in the WHPA.

3. Working through the WSU Cooperative Extension and the Whatcom County Conservation District, the City should encourage commercial agricultural operations to switch from high chemical use crops (e.g., fruits, vegetables) to low chemical use operations (e.g., pasture).

4. The current City and County zoning ordinances for agricultural uses should be amended to make property owners with domestic animals and cultivated land responsible for implementing best management practices that protect water quality. Inter-local agreements should be developed to implement this provision.

5. The City and County ordinances should be updated to prohibit new high intensity commercial agricultural operations (e.g., fruits and vegetables, concentrated animal operations) within the WHPA. Inter-local agreements should be developed to implement this provision

5.4.7 Onsite Sewage Disposal Systems

1. Information should be provided to residents and businesses to encourage regular maintenance of onsite sewage disposal systems, and discourage the use of septic system cleaners.

2. The City should request the County Health Department to undertake an inventory and evaluation to characterize existing onsite sewage disposal systems and identify failing systems. The 1 year time of travel area should be the focus of this investigation.

   Further evaluation of the number of systems in the WHPA and the effectiveness of their operation is needed to determine if requiring existing systems to be connected to the City sewer system is necessary or appropriate.

3. Existing state regulations governing the installation, operation and maintenance of septic systems should be fully enforced (WAC 246-272). These regulations require owners of existing septic systems to provide proof of system inspection and maintenance at least once every three years, and to have the tank pumped if necessary.

   If the results of the septic system survey determine it is necessary, the City should work with the County to explore the possibility of establishing more stringent local performance monitoring requirements and "Area of Special Concern" for the purpose of protecting the ground water supply. The Whatcom County Health Department should take the lead in developing such a program, which is designed to reduce the number of failing systems.

4. Based on the results of the septic system survey, the City should seek funding to conduct an economic and environmental analysis of the feasibility of hooking up existing homes and businesses in the WHPA to City sewers. The 1 year time of travel area should be the highest priority for investigation.

   If the feasibility study determines it is necessary, the City should establish a program for financial assistance to low- or fixed-income homeowners for septic system replacement or sewer connection. State Revolving Fund loans may be available to provide low-interest loans for improving or replacing systems.

5. The City should amend ordinances and comprehensive plans to: (1) require sewer hook-up for all new construction; or (2) increase the allowable lot size to limit the number of future septic systems in the WHPA.

5.4.8 Commercial and Industrial Activities

1. Information should be provided to inform businesses they are located in the WHPA and encourage them to implement pollution prevention programs.

   Existing information on pollution prevention is available from the Washington State Department of Ecology (Ecology), Hazardous Waste and Toxics Reduction Program. The availability of information concerning best management practices for fertilizer and pesticide usage should also be verified.

2. The City ordinance should be amended to include design and operating procedures (best management practices) for existing and proposed commercial and industrial uses to minimize threat of ongoing activities (e.g., storage/use of hazardous substances).

3. The City ordinance should be amended to include design and operating standards for new buildings to control spills, manage contaminated runoff, and control storage of hazardous substances.

5.4.9 Hazardous Materials Transport

1. The City should routinely monitor traffic on roads in the WHPA to determine the frequency and magnitude of hazardous materials transportation; if necessary, the feasibility of routing hazardous materials away from roads overlying the WHPA should be explored.

2. The City, in conjunction with other state and local emergency responders, should review and update their spill response/contingency plan to ensure that procedures are in place to minimize potential ground water contamination.

   The City should provide the Whatcom County Department of Emergency Management, state patrol, local authorities, and other emergency responders with information concerning location of City's wells and WHPA. A coordinated spill response plan should be developed for transportation corridors (highways, pipelines). Participants should

include the City, County, State Department of Transportation, the Department of Ecology, trucking firms, and pipeline company.

3. Information on wellhead protection and spill response/reporting should be provided to trucking firms known to service the area.

4. The City should post signs to mark the boundaries of the wellhead protection area, and to encourage safe driving and the early notification of authorities in the event of a spill.

5.4.10 Other Sources and General Policy Issues

1. The City should develop a comprehensive water system plan to address water conservation and source protection pursuant to state regulations.

2. The City should support the purchase or acquisition of conservation easements to protect land in the immediate vicinity of the City's wells from development.

3. The City should work with the Fire Department to update and implement emergency response procedures that protect ground water from contamination (e.g., alternatives to flushing).

4. The City should update and implement a ground water monitoring program to provide early warning of impacts from all potential contaminant sources.

5. The City should contact the State and County highway departments to encourage them to stop or limit use of chemical vegetation control along roads and utility right-of-ways in the WHPA.

5.5 CONTINGENCY PLAN FOR WATER SUPPLY

The City of Everson has no comprehensive water plan at this time but hopes to have one in the near future. The City's water comes from two new wells located south of the Nooksack River. Because the City is divided by the river, the water lines must cross on the bridge to serve the north side of the City.

The City of Nooksack adjoins Everson's city limits on the northeast. Everson and Nooksack have an agreement to provide emergency water to each other when needed. There is a connecting valve between the two cities which is used in case of emergencies. The City has emergency generators to operate the pumps when the electricity fails. The City's water is tested once a month for bacteria and quarterly or semi-annually for other required tests.

5.6 SPILL RESPONSE PLANNING

A hazard analysis has shown that transportation of hazardous materials, as well as the facilities that process, store or handle hazardous materials and chemicals, create a need for emergency response, planning, training and mitigation. Therefore, the officials of the County, Cities and Towns together have instituted a Whatcom County Hazardous Materials Contingency Plan for

the protection of life, property and environment. The Plan meets the requirements of Section 303 of the Superfund Amendments and Reauthorization Act of 1986 (SARA, Title III).

The Whatcom County Division of Emergency Management (DEM) maintains a resource data bank in its Emergency Information System (EIS) computer program. The data bank includes: community and private industry material resources; fixed facilities subject to SARA Title III requirements; fixed facilities subject to SARA Title III requirements; pre-plotted Extremely Hazardous Substance (EHS) and NOAA Data Safety Sheets for more than 2800 hazardous chemicals. A portable computer with the EIS program is maintained by the DEM for use by the Duty Officer and at on-scene command posts. A supplementary resource management information is located in the Duty Officer books in the EOC and carried by DEM staff. The Plan has on-scene management strategies and clean-up operations.

To provide an adequate means of evaluating the effectiveness and feasibility of the Plan and its standard operating procedures and to ensure maximum readiness of agencies, facilities and citizens involved in hazardous material incident response, all or parts of the Plan are regularly exercised to ensure all elements work in harmony. Upon request of a first response Agency, notification will be made by WHAT-COMM to the proper agency from a list provided by type of incident. Individuals likely to witness or discover hazardous materials release have been trained to initiate emergency response with proper notification procedures. The Plan also has requirements and training for first responder at the operational level and requirements for Hazardous Materials Technicians, Hazardous Materials Specialist, and on the scene Incident Commander. The City of Everson would rely on this cooperative Plan when needed to protect its water supply.

5.7 PLAN APPROVAL

The formal approval process for the plan must come as a result of an approval action by the Everson City Council. As a means to this end a draft Resolution for consideration by the council has been prepared (page vii) for consideration by the City.

5.8 PLAN IMPLEMENTATION

As indicated above, the first step in implementation is action by the City council to adopt the plan. Following that step it will be necessary to periodically review the status of the Wellhead Protection Program and update it as appropriate. Periodic review on at least an annual basis is recommended, as there are steps remaining to be taken in developing a comprehensive long term plan for the WHPA.

For the purpose of prioritizing recommended actions for implementation, the following 3 time frames have been considered; phase 1 (within 12 months of plan adoption), phase 2 (within 1 to 5 years of plan adoption) and phase 3 (within 10 years of plan adoption). The recommended actions are summarized by phase in Table 5-1.

In the short term (within 12 months of plan adoption) the following categories of recommendations should be implemented:

1. Pollution prevention steps involving public education and participation. This activity is addressed in the recommendations specific to every potential category of source contamination.

2. Further evaluations of issues relevant to effective long range program development. This would include study of issues such as: storm water management, storage tank occurrence and condition, and the location of unprotected or abandoned wells.

3. Coordination with implementation of the Growth Management Act.

In addition financing for the actions to be taken should be secured. Among the potential sources of financing to be pursued are: grants under the Centennial Clean Water Fund, emerging federal SDWA reauthorization or Farmers Home Administration; water utility rates, or special purpose district establishment such as an Aquifer Protection District.

As the next steps in the process are taken, amendments to the plan should be made formally through council action, and council approvals should take place before formal implementation of the plan occurs.

TABLE 5-1
RECOMMENDED MANAGEMENT STRATEGIES

RECOMMENDED MANAGEMENT STRATEGY	SCHEDULE (from date of Plan adoption)
OVERALL RECOMMENDATIONS	
Formal adoption of the Wellhead Protection Plan.	Within 12 months
Wellhead Protection Advisory Committee facilitates local action and inter-jurisdictional cooperation.	Within 12 months, ongoing
Inventory and further quantify the potential threat posed by specific sources (e.g., storage tanks, storm drainage, unprotected or improperly abandoned wells).	Within 12 months
Review existing ordinances and state regulations to identify needs related to wellhead protection.	Within 12 months, ongoing
Fully integrate Growth Management Act planning with the wellhead protection plan.	Within 12 months
Develop public education/technical assistance plan for pollution prevention in conjunction with the Everson Wellhead Protection Advisory Committee.	Within 12 months, ongoing
Explore available grant programs for wellhead protection.	Within 12 months, ongoing
Revise and update the plan on an ongoing basis.	Within 12 months, ongoing
FUTURE DEVELOPMENT	
Modify City's comprehensive plan and zoning ordinances to prohibit land uses in the WHPA that are incompatible with ground water protection.	Within 12 months
Within the 1 year time of travel zone, encourage land uses that pose minimal threat to the water supply.	Within 12 months
Require all new development within the City to be connected to the sewer system.	Within 12 months, ongoing
Research and mitigate septic system impacts in the WHPA outside the City limits.	Within 5 years
Require all entities that use or store fuel or hazardous materials within the WHPA to comply with existing State and County secondary containment, leak detection, and monitoring regulations, as well as the provisions of this plan.	Within 12 months
Establish and implement a wellhead protection ordinance that incorporates all WHPA design and operation standards in one place.	Within 12 months, ongoing
Compare WHP plan with the City's interim critical areas ordinance; modify it as necessary to more adequately protect the WHPA.	Within 5 years
STRATEGIES FOR SPECIFIC SOURCES	
Unprotected or Improperly Abandoned Wells	
Work with County and State agencies to encourage landowners to identify and eliminate abandoned wells, or protect existing wells.	Within 12 months, ongoing
Undertake an informal survey to determine the number of abandoned wells within the wellhead protection area. If necessary, develop and implement a formal pollution prevention program.	Within 5 years
Household Hazardous Products	
Provide pollution prevention information to businesses and residents.	Within 12 months, ongoing
Encourage participation by businesses and residents in small quantity generator and household hazardous waste collection programs.	Within 12 months, ongoing

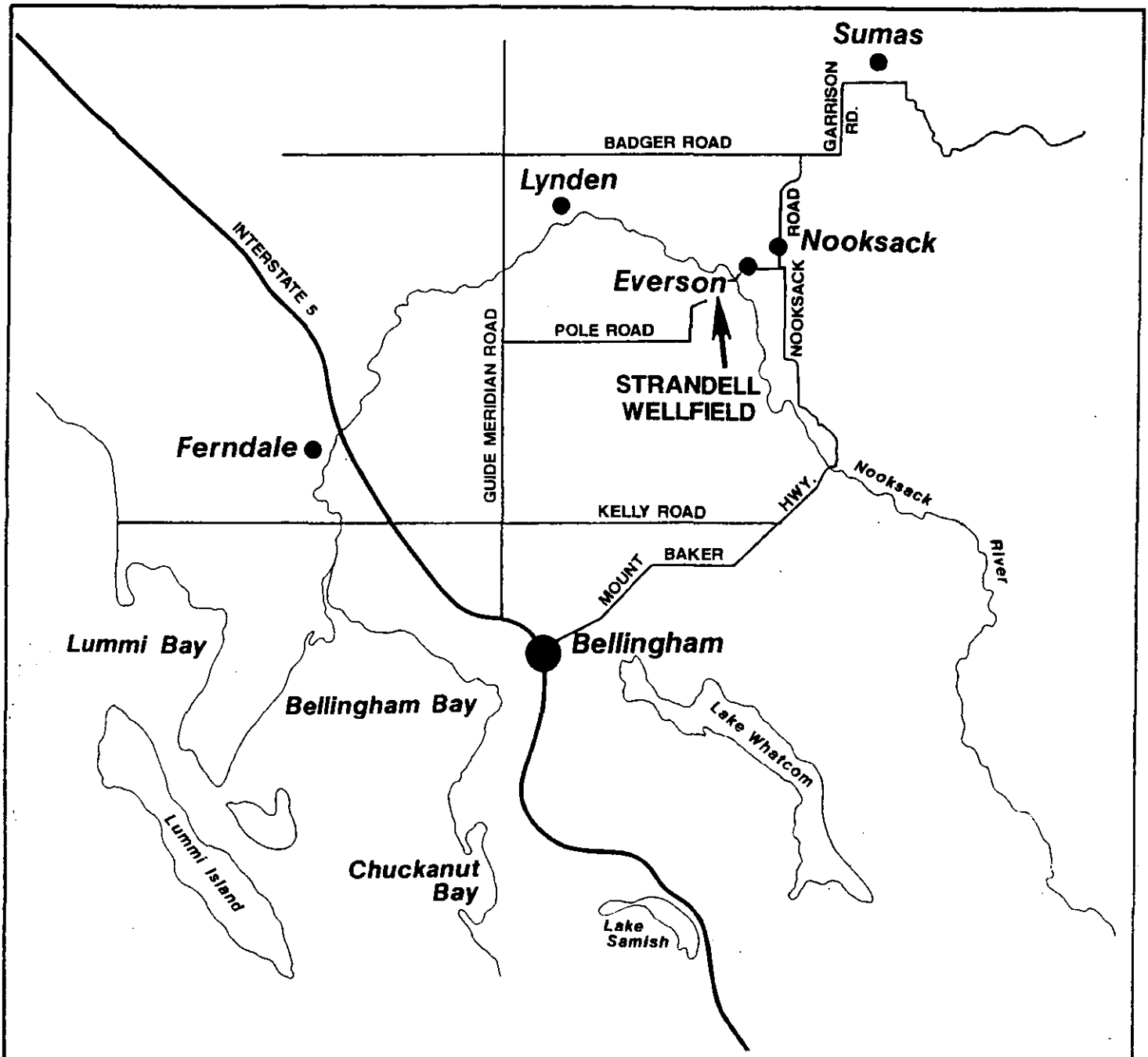
TABLE 5-1 (continued)

RECOMMENDED MANAGEMENT STRATEGY	SCHEDULE (from date of Plan adoption)
Storage Tanks	
Provide pollution prevention information to businesses and residents.	Within 12 months, ongoing
Seek funding for a study to evaluate the number and condition of home heating oil tanks in the WHPA.	Within 12 months
If necessary, explore funding for a program for closure or upgrading of all storage tanks in the WHPA.	Within 5 years
Amend ordinance to prohibit siting of new underground storage tanks and standards for new facilities within the 1 year time of travel zone.	Within 12 months
Support implementation of existing state regulations governing registration, performance and operation of underground storage tanks >1,100 gallons in capacity.	Within 5 years
Support implementation of county ordinance addressing tanks exempt from state regulation.	Within 5 years
Storm Water Management	
Develop a comprehensive storm water management plan.	Within 5 years
Amend existing City and County ordinances to establish minimum storm water management requirements for new developments and redevelopment projects.	Within 12 months
Provide pollution prevention information materials to businesses and residents.	Within 12 months, ongoing
Conduct workshops on best management practices for controlling erosion and storm water runoff.	Within 5 years
Gravel Mining	
Pursue authority to regulate sand and gravel mining operations through the County conditional use permit process, and adopt associated design and operating standards.	Within 5 years
Modify zoning and subdivision ordinances to address transition of mining areas to other uses.	Within 12 months
Agricultural Sources	
Provide information on best management practices, pollution prevention and sources of technical assistance to non-commercial farms.	Within 12 months, ongoing
Encourage development and implementation of conservation plans on commercial farms in the WHPA.	Within 5 years
Encourage commercial operations to switch from high chemical use crops to low chemical use operations.	Within 5 years
Amend existing zoning ordinances for agricultural uses to make property owners with domestic animals and cultivated land responsible for implementing best management practices that protect water quality.	Within 5 years
Update existing ordinances to prohibit new high intensity commercial agricultural operations within the WHPA.	Within 5 years
Onsite Sewage Disposal Systems	
Provide information to residents and businesses to encourage regular maintenance of onsite sewage disposal systems, and discourage the use of septic system cleaners.	Within 12 months, ongoing
Undertake inventory and evaluation of existing onsite sewage disposal systems and identify failing systems. Focus on the 1 year time of travel area.	Within 12 months

TABLE 5-1 (continued)

RECOMMENDED MANAGEMENT STRATEGY	SCHEDULE (from date of Plan adoption)
Onsite Sewage Disposal Systems (continued)	
Support enforcement of existing state and local regulations governing the installation, operation, and maintenance of septic systems. If necessary, develop more stringent local regulations as provided by state law.	Within 5 years
Seek funding to conduct an economic and environmental analysis of the feasibility of hooking up existing homes and businesses in the WHPA to City sewers. The 1 year time of travel area should be the highest priority.	Within 5 years
Amend ordinances and comprehensive plans to: (1) require sewer hook-up for all new construction; or (2) increase the allowable lot size to limit the number of future septic systems in the WHPA.	Within 12 months
Commercial and Industrial Activities	
Provide pollution prevention information to businesses.	Within 12 months, ongoing
Amend City ordinance to include design and operating procedures for existing operations (e.g., storage/use of hazardous substances).	Within 5 years
Amend City ordinance to include design and operating standards for new buildings to control spills, manage contaminated runoff, and to control storage of hazardous substances	Within 10 years
Hazardous Materials Transport	
Routinely monitor traffic on roads in the WHPA to determine the frequency and magnitude of hazardous materials transportation; if necessary, explore the feasibility of routing hazardous materials away from roads overlying the WHPA.	Within 5 years
In conjunction with other state and local emergency responders, review and update spill response/contingency plan to ensure that procedures are in place to minimize potential ground water contamination.	Within 5 years, ongoing
Provide the County, local authorities, and other emergency responders with information concerning location of City's wells and WHPA.	Within 12 months
Provide information on wellhead protection and spill response/reporting to trucking firms known to service the area.	Within 12 months, ongoing
Post signs to mark the boundaries of the wellhead protection area, and to encourage safe driving and the early notification of authorities in the event of a spill.	Within 12 months
Other Sources and General Policy Issues	
Develop a comprehensive water system plan to address water conservation and source protection pursuant to state regulations.	Within 5 years
Support the purchase or acquisition of conservation easements to protect land in the immediate vicinity of the City's wells from development.	Within 5 years
Establish procedures for response to fires that protect ground water from contamination (e.g., alternatives to flushing).	Within 12 months, ongoing
Develop and implement a ground water monitoring program to provide early warning of impacts from all potential contaminant sources.	Within 12 months, ongoing
Contact the State and County highway departments to encourage them to stop or limit use of chemical vegetation control along roads and utility right-of-ways in the WHPA.	Within 5 years

FIGURES



NO SCALE

VICINITY MAP

CITY OF EVERSON, WASHINGTON
WELLHEAD PROTECTION PLAN

ASSOCIATED EARTH SCIENCES, INC

W94016A	8/94	FIGURE 1-1

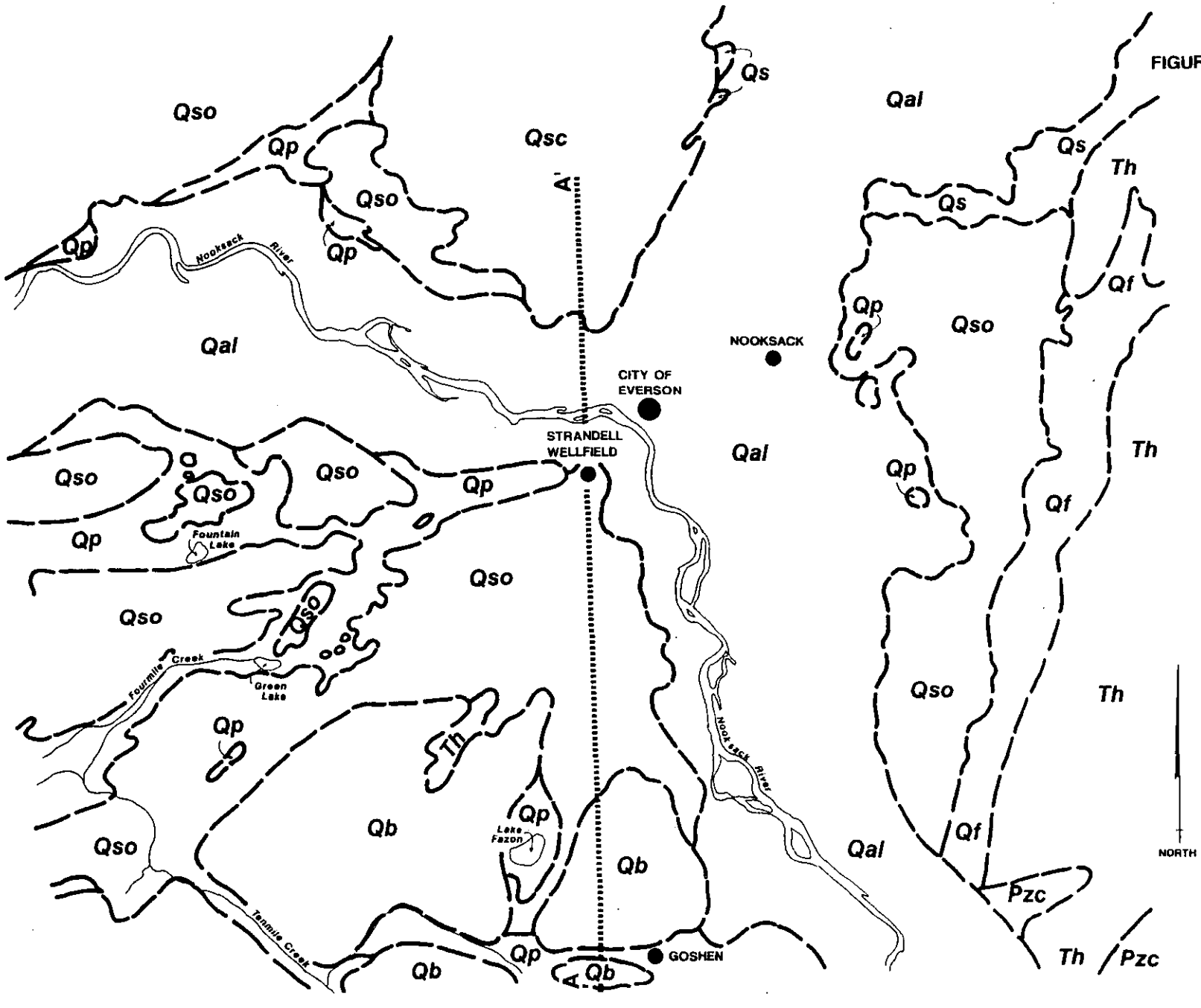


FIGURE 2-1: SURFICIAL GEOLOGIC MAP

LEGEND

Qal	Alluvial deposits
Qp	Peat
Qf	Undifferentiated glacial deposits
Qsc	Sumas silt and clay
Qso	Sumas outwash
Qs	Till and ice-contact deposits
Qb	Bellingham drift
Th	Huntingdon formation of Daly
Pzc	Chilliwack series of Daly

SOURCE: EASTERBROOK, D.J., 1976. GEOLOGIC MAP OF WESTERN WHATCOM COUNTY, WASHINGTON: U.S.GEOLOGICAL SURVEY, MISCELLANEOUS INVESTIGATIONS SERIES MAP I-884-B, SCALE 1:62,500.

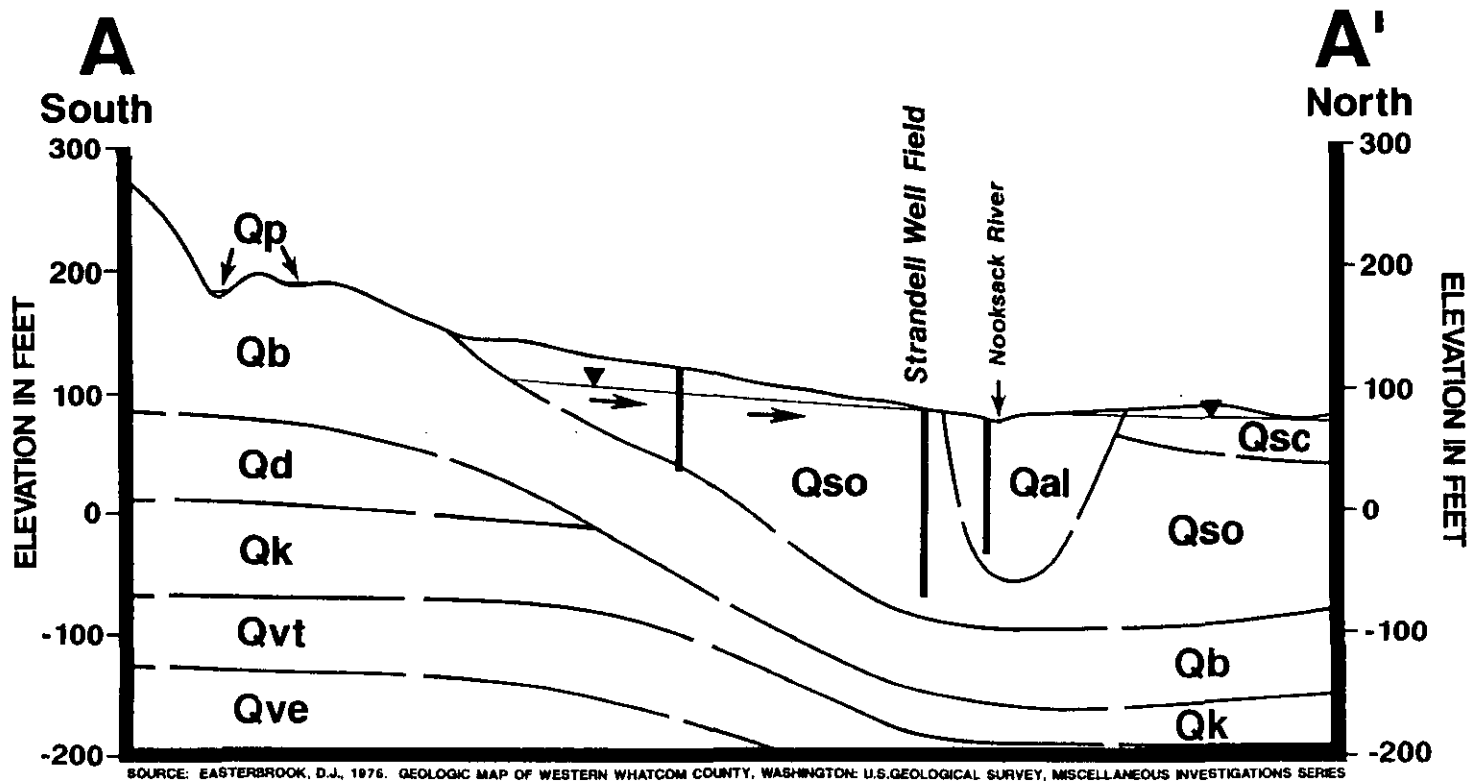
0 4000 8000
SCALE IN FEET

NORTH

CITY OF EVERSON, WASHINGTON
WELLHEAD PROTECTION PLAN
PROJECT NO. W94016A
AUGUST 1994

ASSOCIATED EARTH SCIENCES, INC
911 - 5th Avenue, Suite 100, Kirkland, WA 98033
(206) 827-7701

FIGURE 2-2: SCHEMATIC HYDROGEOLOGIC CROSS SECTION



SOURCE: EASTERBROOK, D.J., 1976. GEOLOGIC MAP OF WESTERN WHATCOM COUNTY, WASHINGTON: U.S.GEOLOGICAL SURVEY, MISCELLANEOUS INVESTIGATIONS SERIES MAP I-854.B, SCALE 1:62,500.

LEGEND

Qal	Alluvial deposits	Qd	Deming sand
Qp	Peat	Qk	Kulshan drift
Qsc	Sumas silt and clay	Qvt	Vashon till
Qso	Sumas outwash	Qve	Vashon drift - Esperance sand member
Qb	Bellingham drift	→	Ground water flow direction
		▼	Water surface

CITY OF EVERSON, WASHINGTON
WELLHEAD PROTECTION PLAN
PROJECT NO. W94016A
AUGUST 1994

ASSOCIATED EARTH SCIENCES, INC
911 - 5th Avenue, Suite 100, Kirkland, WA 98033
(206) 827-7701

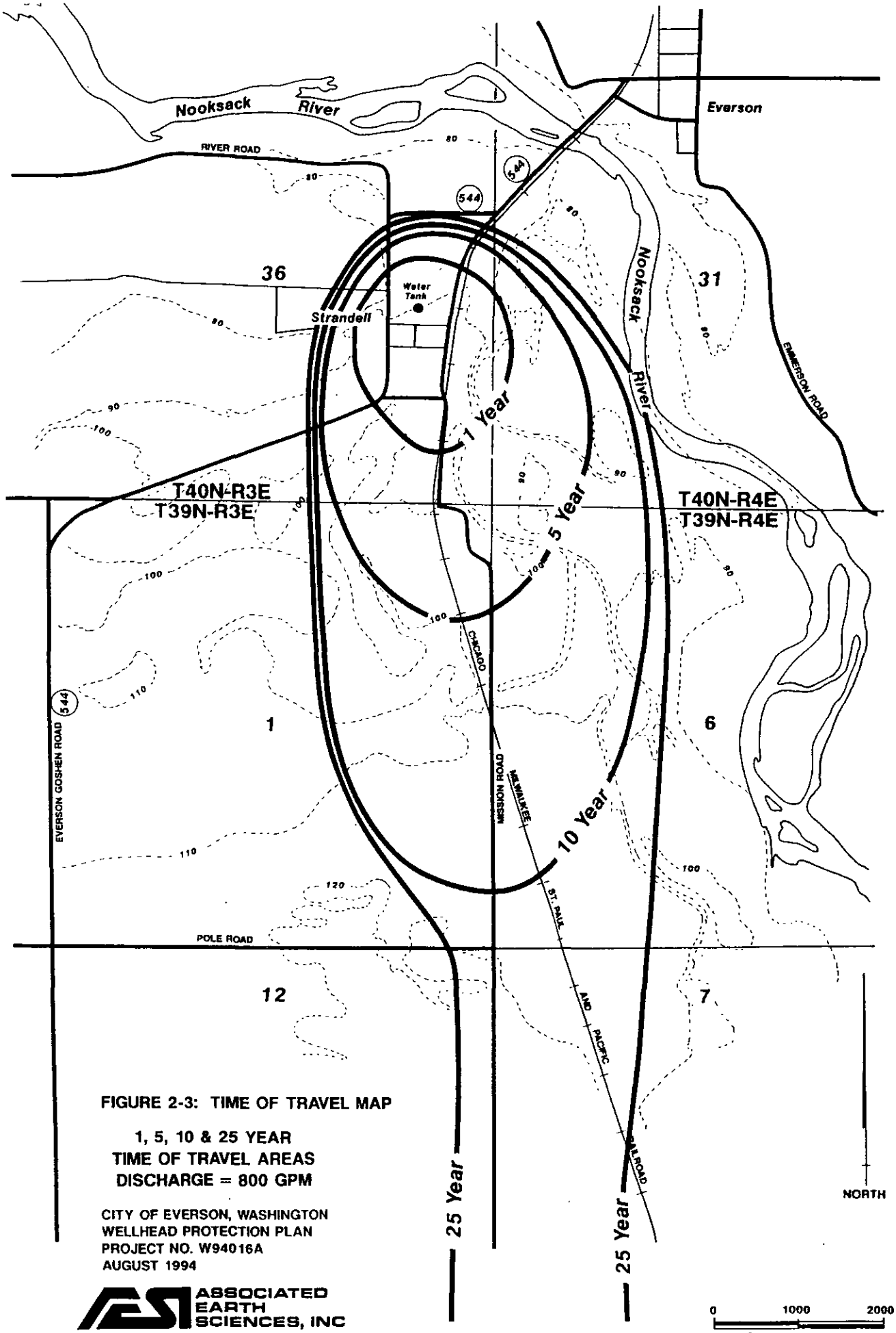


FIGURE 2-3: TIME OF TRAVEL MAP

1, 5, 10 & 25 YEAR TIME OF TRAVEL AREAS DISCHARGE = 800 GPM

CITY OF EVERSON, WASHINGTON
WELLHEAD PROTECTION PLAN
PROJECT NO. W94016A
AUGUST 1994

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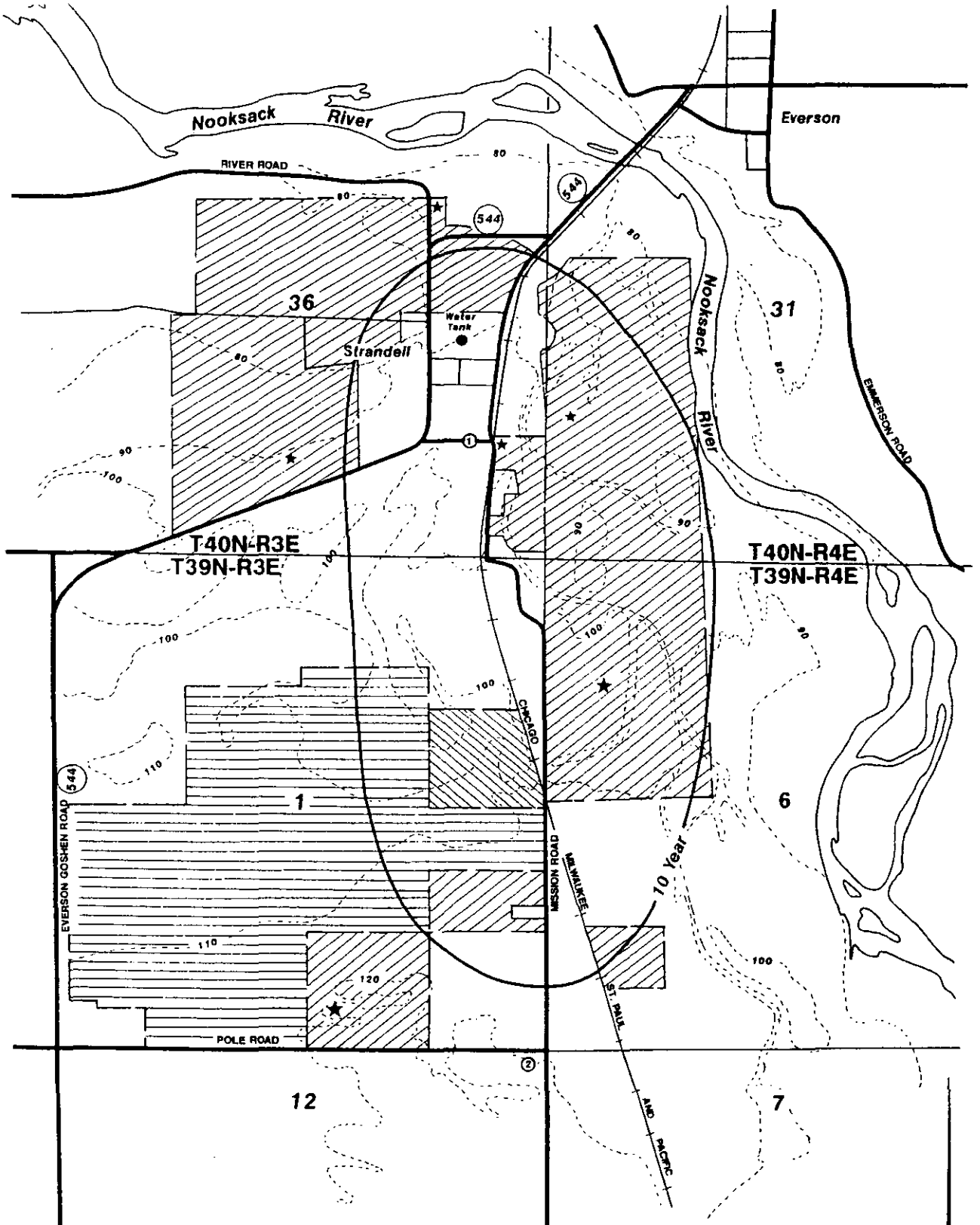

FIGURE 3-1

POTENTIAL CONTAMINANT INVENTORY
LAND USE

CITY OF EVERSON, WASHINGTON
WELLHEAD PROTECTION PLAN
PROJECT NO. W94016A
AUGUST 1994

Water Resources Consulting

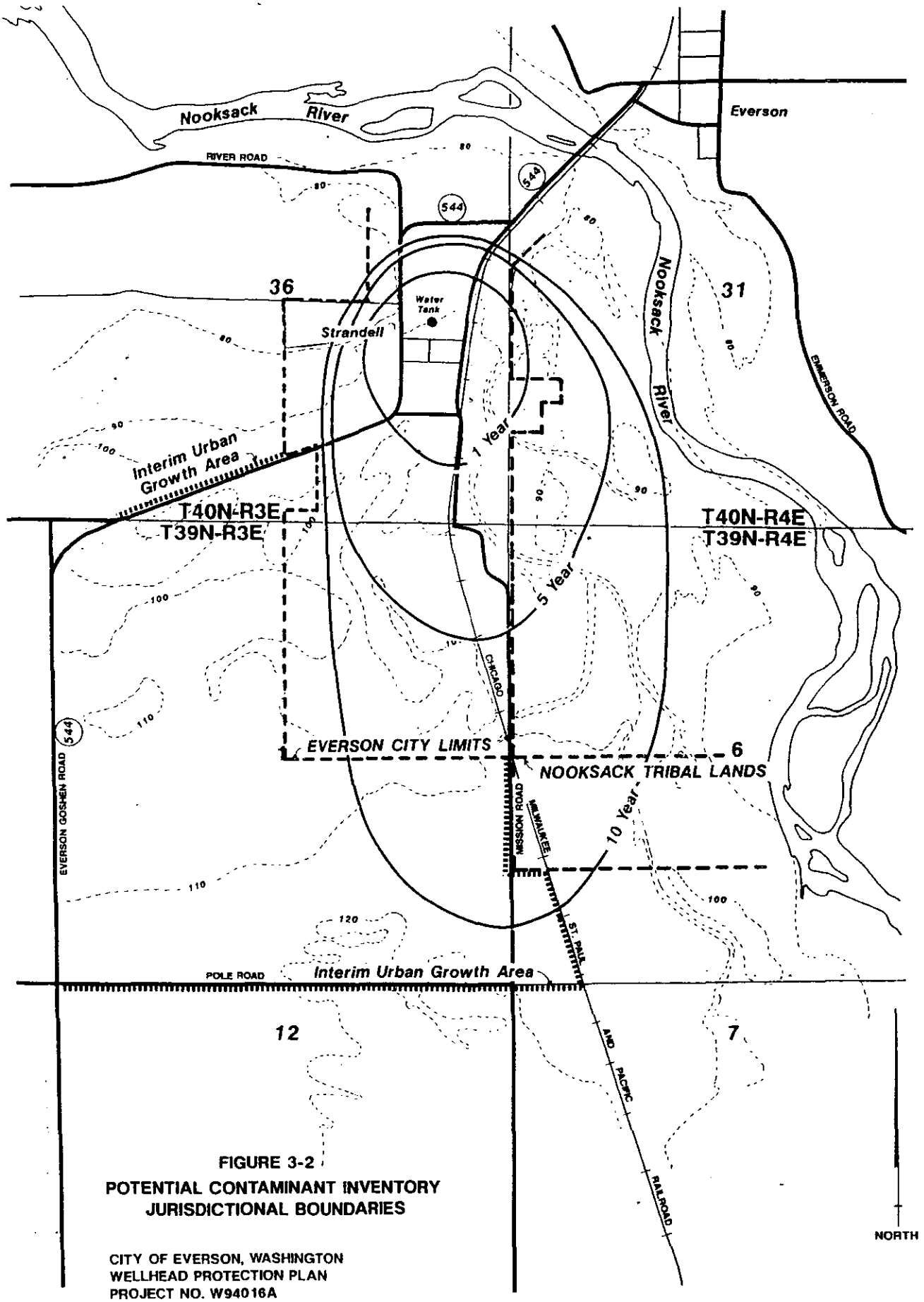

FIGURE 3-2
POTENTIAL CONTAMINANT INVENTORY
JURISDICTIONAL BOUNDARIES

CITY OF EVERSON, WASHINGTON
WELLHEAD PROTECTION PLAN
PROJECT NO. W94016A
AUGUST 1994

Water Resources Consulting

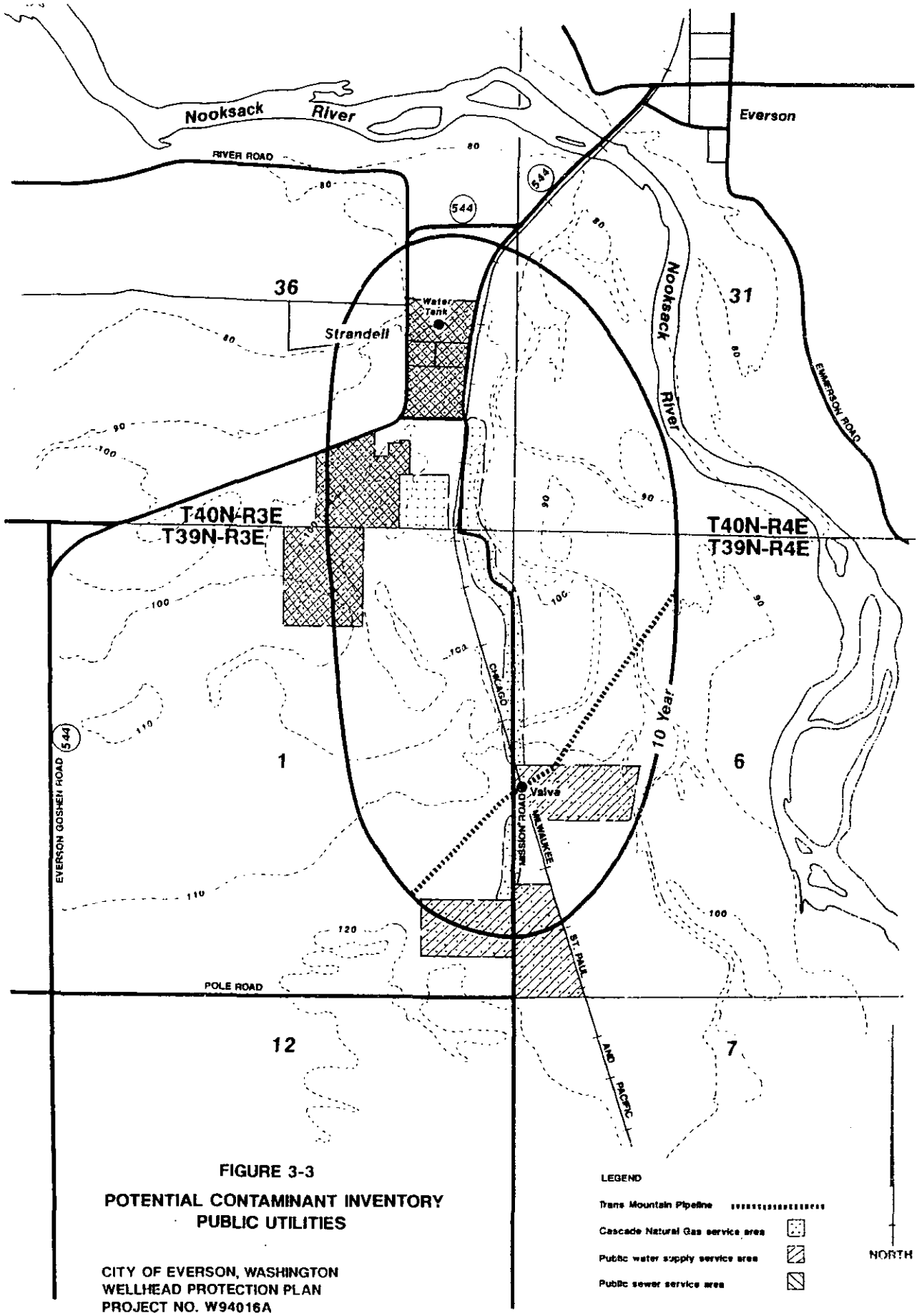

FIGURE 3-3

POTENTIAL CONTAMINANT INVENTORY
PUBLIC UTILITIES

CITY OF EVERSON, WASHINGTON
WELLHEAD PROTECTION PLAN
PROJECT NO. W94016A
AUGUST 1994

Water Resources Consulting

APPENDIX A

HYDROGEOLOGIC DATA AND MODELING

APPENDIX A

HYDROGEOLOGIC DATA AND MODELING

GROUND WATER MODELING

Ground water flow in the Sumas outwash aquifer was simulated by using a numerical model, MODFLOW, developed by the United States Geological Survey (McDonald, M.G. and Harbaugh, A.W., 1988). The primary purpose of the model developed for this study was to delineate the 1, 5, and 10 TOT zones under existing and potential future pumping rates. Currently the City of Everson pumps up to 400 gpm. Future needs are projected to approach 800 gpm. The 25 year TOT zone was delineated for the 800 gpm pumping rate to assist in determining the ZOC.

Input into the numerical model was based on existing information determined during pump tests and other hydrogeologic investigations. Primary information sources included a report on the Strandell Wellfield (Converse, 1993) and other documents (Landau, 1993 and GeoEngineers, 1994). Conservative assumptions were incorporated into the modeling as necessary to reflect potential variations in ground water conditions.

MODFLOW FEATURES

Mathematical modeling simulates ground water flow indirectly by using numerical approximations for flow equations designed to represent the physical properties and processes of aquifer systems, boundary conditions, and head distribution (Anderson, M.P. and Woessner, W.W., 1992). MODFLOW is a modular, three dimensional, block centered finite-difference computer program.

The finite-difference method solves a set of differential-flow equations to find the distribution of "heads" (ground water elevations or "potentiometric surface") over the aquifer flow system. This is accomplished by placing a network of grid cells over the flow system and calculating the heads at each cell node by trial and error. Additionally, at the end of a simulation, the program calculates the water budget for the entire model showing inflow and outflow rates specified for the different sources and sinks. Sources include recharge areas and rivers, and sinks may include wells or other discharge points such as return flow to the Nooksack River.

The computer program is divided into "packages". A package is that part of the program that represents a particular hydrologic or mathematical feature. The Block Centered Flow package calculates terms in the finite-difference equation that represent flow between cells. "Stress" packages calculate terms that represent flow into or out of the aquifer. The stresses include the River, Evapotranspiration, Drain, Recharge, Well, and General Head Boundary packages. The Solver package solves the system of finite-difference equations. The Basic package performs those tasks which belong to the model as a whole, such as specification of boundaries and initial conditions. The printing code for model results is given in the Output Control package. Ground water flow paths were obtained from FLOWPATH.

MODFLOW INPUT PARAMETERS

The numerical model developed for the City of Everson's WHPA delineation study was based on a single layer unconfined aquifer system. The model grid contained 50 rows and 42 columns creating 2100 cells. The cell dimensions were 400 feet by 400 feet. The model extended 8000 feet north, west and east of the Strandell Wellfield and 11,600 feet south. The bottom of the model was -60 feet and represents the depth to the Bellingham drift as determined by nearby wells.

Model boundaries included "constant head" and "no-flow" cells designed to simulate the hydrogeologic setting. "No-flow" cells were placed along the southwestern margins of the model and along the western half of the northern model boundary. The "no-flow" cells represented areas with relatively low permeability sediments such as till, clay or bedrock as mapped by Easterbrook (1976). The remaining model boundaries were assumed to represent constant head cells simulating inflow from or outflow to areas outside the cell margins.

Recharge was distributed to the model layer as a specified flux. Recharge rates varied depending on the time of year with the majority occurring from October through June. The average recharge used in the model varied between 18 to 25 inches. Several simulations indicated that the model was calibrated to a recharge value of 20 inches per year.

The hydraulic properties of the Sumas outwash aquifer in the Everson WHPA were based on pump tests of wells at the Strandell Wellfield (Converse, 1993). The hydraulic conductivity averaged about 130 ft/d and the specific yield was 0.20 reflecting the unconfined nature of the aquifer.

The Nooksack River was represented by the MODFLOW river package. This package identifies the location of the river, river bottom elevation, stage of the river, and river conductance. The location and river bottom elevation was determined from U.S.G.S. topographic maps and the river stage was set to 3/4 bankfull during winter months and 1/4 bankfull during summer months. No flooding was modeled.

River conductance is a function of the connection of the river water to the underlying aquifer systems and is directly related to river bottom sediment conductivity and thickness. These values can change from point to point on the river as well as temporal changes due to erosion versus deposition. No direct measurements of river conductance were available for this evaluation, therefore, the river conductance used in the model was based on calibration and sensitivity analysis.

CALIBRATION AND SENSITIVITY

The computer model was calibrated by performing a series of two primary simulations representing transient flow conditions. The object of the model calibration was to achieve an acceptable match between computer generated output data and known water levels. Water levels were calibrated for both summer and winter conditions. The model was also calibrated to water levels reported during pump testing (Converse, 1993).

The direction of ground water flow varies from almost due north during the winter months to north by northwest during the late summer. The first calibration scenario was designed to account for these changes in ground water flow directions and to match known static water levels in nearby wells. The calibration involved varying the recharge and hydraulic properties and changing river conductance until there was good agreement between computer output and known conditions.

The second calibration scenario was also run under transient conditions and focused on matching pump test results with actual pump test data. The calibrations were performed to obtain good agreement between predicted and actual drawdown values in wells affected by the pump test.

All calibration involved trial and error methodology. During calibration runs, minor adjustments to values of hydraulic conductivity, storage coefficients, and recharge rates were made until there was good agreement between simulated and measured potentiometric surfaces. The calibration scenarios were performed on an interactive basis, therefore following modifications to one of the scenarios, the other calibration scenario was re-run to verify that simulated and actual conditions remained in good agreement.

Sensitivity analyses were also performed to determine effects of varying one input parameter while keeping the others constant. The purpose of the sensitivity analysis was to determine which parameter(s) and situation(s) significantly influence water levels and results.

The sensitivity analyses indicate that water levels would be affected most significantly by changes in hydraulic conductivity or aquifer thickness. To account for potential variations in aquifer parameters, the TOT zone delineation was based on a conservative mapping methodology described in the section titled Simulation and Model Results.

Potential influences from the Nooksack River were also evaluated. Only minor variations were observed in modeled water levels when river conductance was changed by an order of magnitude. This indicates that in this case, the ground water model is not as sensitive to river conductance as it is to changes in recharge or hydraulic properties.

SIMULATION AND MODEL RESULTS

Following completion of the calibration and sensitivity analysis, the model was combined with "MODPATH" and "MODPLOT" programs. These programs allow the user to assess ground water flow paths in response to an outside stress, in this case pumping from two wells in the Strandell Wellfield. This was accomplished by placing computer generated "tracers" around the well screens and observing the flow paths taken by each tracer over time.

This analysis provided the basis for developing the 1, 5, 10 and 25 year TOT zones shown on Figure 2-3. The flow path analysis accounted for variations in summer and winter water levels. A conservative mapping methodology was used to account for potential variations in aquifer parameters. The 1, 5 and 10 year TOT zones illustrated on Figure 2-3 were based on areas determined from 1-1/2, 7 and 15 year TOT zones, respectively. This conservative approach is considered appropriate to account for aquifer variability.

APPENDIX B

WELLHEAD PROTECTION AREA INVENTORY DATA

APPENDIX B

WELLHEAD PROTECTION AREA INVENTORY DATA

Notes on use of Inventory

The following Appendix is a paper print-out of the master inventory of potential ground water contaminant sources in the 10 year time of travel zone for the City of Everson water supply wells. The inventory is available in a computer spreadsheet file which was furnished to the City of Everson with this report. This file has additional detail that is not displayed on the paper copy. The computer version will allow updating of the inventory as resources and interest become available.

The inventory of potential ground water contamination sources is not complete as it was turned over to the City of Everson. Some information was not available at all, and some property owners chose not to share information about potential sources on their property. The inventory methods depended entirely on voluntary information, so there are some inevitable gaps.

The accuracy of the inventory is as detailed as possible given available time and resources. The Wellhead Protection Advisory Committee believes it to be a sound basis for development of priorities and management options for protecting the City of Everson water supply.

Entries in the database included in this Appendix are necessarily brief. Additional information is included in the "comments" column in the computer version of the inventory.

Everson Wellhead Protection Program
Appendix Table
Inventory of Potential Contaminants -- Summary
Revised: 02-Nov-94

Land Use	
1 = Residential	155
2 = Commercial	0
3 = Agriculture	18
4 = Industrial	9

Total # Parcels 182

Water Sources	
1 = Domestic in use	13
2 = Irrigation in use	137
3 = Abandoned	18
4 = Municipal water	105
5 = Other	0

Total Wells 168
Total Municipal 105

Domestic Waste	
1 = Septic tank present	61
2 = 2 Septic tanks present	1
3 = Municipal sewer	82

Total Septic Tanks 63
Total Municipal 82

Dumps	
1 = Present	0

Landfills	
1 = Present	0

Agricultural Land Uses	
By Category	
1 = Dairy	7
2 = Poultry	0
3 = Swine	0
4 = Crop	17
5 = Other	0

Total Agricultural Uses 24

Agricultural Practice	
0 = None	1
1 = Fertilizers	13
2 = Herbicides	3
3 = Insecticides	2
4 = Nematicides	2

Total Agricultural practices 21

Hazardous MaterialsTransport	
1 = Present	0

Fuel Storage	
1 = Underground diesel	0
2 = Underground gasoline	2
3 = Other	0
4 = above ground diesel	0
5 = above ground gasoline	0

Total Tanks 2

Chemical Storage	
1 = Present	2

Gravel Mining	
1 = Present	0

Wellhead Protection Program
City of Everson, Washington
Inventory of Potential Ground Water Contaminant

Revised 02-Nov-94

LAND USE	WATER SUPPLY	WASTE DISPOSAL
1 = Residential	0 = None	0 = None
2 = Commercial	1 = Domestic well in	1 = Septic Ta
3 = Agriculture	2 = Irrigation well in u	2 = 2 Septic
4 = Industrial	3 = Abandoned well	3 = Municipal
	4 = Municipal Water	4 = Other
	5 = Other	

Row No.	Township North	Range East	Section	Tax parcel X	Tax parcel Y	Land Use Primary	Land Use Secondar	Source, Main	Source Add'l	Domestic Waste
1	39	3	1			1				1
2	39	3	1			1				1
3	39	3	1			1				1
4	39	3	1	346	069	3				
5	39	3	1	334	146	4				
6	39	3	1	340	350	4				
7	39	3	1	406	026					
8	39	3	1	406	113	1				1
9	39	3	1	415	074					
10	39	3	1	424	113	1				1
11	39	3	1	427	028					
12	39	3	1	440	026					
13	39	3	1	445	086					
14	39	3	1	445	113	1				1
15	39	3	1	446	061					
16	39	3	1	447	324	4		4		1
17	39	3	1	458	036					
18	39	3	1	462	431	1		4		1
19	39	3	1	464	164	1				1
20	39	3	1	464	233	4				1
21	39	3	1	471	116					
22	39	3	1	475	055					
23	39	3	1	475	069					
24	39	3	1	475	087					
25	39	3	1	482	019					
26	39	3	1	482	040					
27	39	3	1	482	479	1				1
28	39	3	1	491	116	1		3		1
29	39	3	1	495	087	3		4	2	
30	39	3	1	500	062					
31	39	3	1	515	087	1		1		1
32	39	3	1	515	109	1				1
33	39	3	1	515	124	1				1
34	39	3	1	515	155	1				1
35	39	3	1	515	455	1				1
36	39	3	1	516	491	1				1
37	39	3	1	517	405	1		4	3	1
38	39	3	1	517	435	1				1
39	39	3	1	517	450	1				1
40	39	3	1	522	014					
41	39	3	1	522	038					
42	39	3	1	549	478	1				1
43	39	3	1	550	405	1		4		1
44	39	4	6			1		4		1
45	39	4	6	464	233	4				
46	39	4	6	015	029			4		1
47	39	4	6	015	100					
48	39	4	6	016	055					
49	39	4	6	021	119	1		1	3	1
50	39	4	6	030	499	3		1		1
51	39	4	6	036	061	1		4		1
52	39	4	6	037	028					
53	39	4	6	039	009	1		4		1
54	39	4	6	040	090	1	2 (hair sal	4		1
55	39	4	6	050	080	1		4		1
56	39	4	6	052	057	3		4		1
57	39	4	6	061	035	1		4		1
58	39	4	6	070	011	1		4		
59	39	4	6	128	435	3				
60	39	4	6	141	294	3				
61	39	4	6	224	061	3				
62	40	3	36			1				1
63	40	3	36	150	012	1		1		
64	40	3	36	189	022	1		1		
65	40	3	36	207	168	1	2	1	2	
66	40	3	36	215	512	1		1		
67	40	3	36	217	485	1		1		
68	40	3	36	218	016	1		1		
69	40	3	36	218	038	1		1		

	AGRICULTURE 0 = None 1 = Dairy 2 = Poultry 3 = Swine 4 = Crop 5 = Other				Agriculture Practice: 0 = None 1 = Fertilizers 2 = Herbicides 3 = Insecticides 4 = Nematicides		HAZARDOUS MATERIALS 0 = None 0 = None 1 = Underground diesel 1 = Present 2 = Underground gasoline 3 = Other 4 = above ground diesel 5 = above ground gasoline			
Row No.	Ag Type Predomin	Ag Type Subordin	Type of Crop	No. of Cattle	Practice Primary p	Practice Secondar	Haz. Mater. Transport	Fuel Storage	Secondar Fuel	Storage, Chemical
1										
2										
3										
4	4	1	grass							
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16								1	2	1
17										
18										
19										
20										
21										
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28										
29	4		1.5 acres		1	2		*NOTE- s		
30										
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36										
37										
38										
39										
40										
41										
42										
43										
44	0							0		
45										
46										
47										
48										
49								0		
50	4		grass		1					
51			Home gar					0		0
52										
53	0							0		0
54	0									
55								0		0
56	4		Christmas					0		0
57	0							0		0
58	0							0		0
59	1	4	grass	630	1					
60	4		grass		1					
61	1	4	grass, cor	400	1	2		1		
62										
63										
64										
65								4	2	
66										
67										
68										
69										

Wellhead Protection Program
City of Everson, Washington
Inventory of Potential Ground Water Contaminant

Revised 02-Nov-94

LAND USE	WATER SUPPLY	WASTE DISPOSAL
1 = Residential	0 = None	0 = None
2 = Commercial	1 = Domestic well in	1 = Septic Ta
3 = Agriculture	2 = Irrigation well in u	2 = 2 Septic
4 = Industrial	3 = Abandoned well	3 = Municipal
	4 = Municipal Water	4 = Other
	5 = Other	

Row No.	Township North	Range East	Section	Tax parcel X	Tax parcel Y	Land Use Primary	Land Use Secondar	Source, Main	Source Add'l	Domestic Waste
70	40	3	36	246	509	1		1		
71	40	3	36	255	398	3	1			
72	40	3	36	313	057	1		3		
73	40	3	36	334	308	3				
74	40	3	36	336	043	1		1		
75	40	3	36	340	180	3				
76	40	3	36	350	016	1		4		3
77	40	3	36	350	035	1		4		3
78	40	3	36	350	045	1		4		3
79	40	3	36	350	059	1		4		3
80	40	3	36	351	080	1		4		3
81	40	3	36	353	068	1		4		3
82	40	3	36	355	005	1		4		3
83	40	3	36	363	005	1		4		3
84	40	3	36	363	050	1		4		3
85	40	3	36	365	026	1		4		3
86	40	3	36	368	017	1		4		3
87	40	3	36	368	075	1		4		3
88	40	3	36	368	085	1		4		3
89	40	3	36	369	065	1		4		3
90	40	3	36	378	010	1		4		3
91	40	3	36	378	020	1		4		3
92	40	3	36	378	030	1		4		3
93	40	3	36	378	040	1		4		3
94	40	3	36	378	050	1		4		3
95	40	3	36	378	060	1		4		3
96	40	3	36	378	070	1		4		3
97	40	3	36	378	080	1		4		3
98	40	3	36	378	088	1		4		3
99	40	3	36	384	395	1		4		3
100	40	3	36	388	010	1		4		3
101	40	3	36	388	060	1		4		3
102	40	3	36	394	375	1		4		3
103	40	3	36	394	385	1		4		3
104	40	3	36	394	395	1		4		3
105	40	3	36	398	010	1		4		3
106	40	3	36	398	024	1		4		3
107	40	3	36	398	034	1		4		3
108	40	3	36	398	044	1		4		3
109	40	3	36	408	014	1		4		3
110	40	3	36	408	024	1		4		3
111	40	3	36	408	034	1		4		3
112	40	3	36	408	044	1		4		3
113	40	3	36	408	060	1		4		3
114	40	3	36	410	083	1		4		3
115	40	3	36	415	093	1		4		3
116	40	3	36	416	108	1		4		3
117	40	3	36	418	006	1		4		3
118	40	3	36	421	083	1		4		3
119	40	3	36	425	158	1		3		
120	40	3	36	425	170	1		3		
121	40	3	36	425	190	1		3		
122	40	3	36	425	200	1		3		
123	40	3	36	425	226	1		3		
124	40	3	36	426	214	1		3		
125	40	3	36	427	064	1		4		3
126	40	3	36	427	089	1		4		3
127	40	3	36	427	180	1		3		
128	40	3	36	428	016	1		4		3
129	40	3	36	428	026	1		4		3
130	40	3	36	428	034	1		4		3
131	40	3	36	428	044	1		4		3
132	40	3	36	428	054	1		4		3
133	40	3	36	429	112	1		4		3
134	40	3	36	433	089	1		4		3
135	40	3	36	434	066	1		4		3
136	40	3	36	442	074	1		4		3
137	40	3	36	442	084	1		4		3
138	40	3	36	442	183	1		4	3	3

	AGRICULTURE 0 = None 1 = Dairy 2 = Poultry 3 = Swine 4 = Crop 5 = Other				Agriculture Practice: 0 = None 1 = Fertilizers 2 = Herbicides 3 = Insecticides 4 = Nematicides		HAZARDOUS MATERIALS 0 = None 0 = None 1 = Present 1 = Underground diesel 2 = Underground gasoline 3 = Other 4 = above ground diesel 5 = above ground gasoline			
Row No.	Ag Type Predomin	Ag Type Subordin	Type of Crop	No. of Cattle	Practice Primary p	Practice Secondar	Haz. Mater. Transport	Fuel Storage	Secondar Fuel	Storage, Chemical
70										
71	4	1	peas	8	1					
72										
73	4		grass		1	3				
74										
75	1	4	corn, gras	300	1	2				
76										
77										
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Wellhead Protection Program
City of Everson, Washington
Inventory of Potential Ground Water Contaminant

Revised 02-Nov-94

LAND USE	WATER SUPPLY	WASTE DISPOSAL
1 = Residential	0 = None	0 = None
2 = Commercial	1 = Domestic well in	1 = Septic Ta
3 = Agriculture	2 = Irrigation well in u	2 = 2 Septic
4 = Industrial	3 = Abandoned well	3 = Municipal
	4 = Municipal Water	4 = Other
	5 = Other	

Row No.	Township North	Range East	Section	Tax parcel X	Tax parcel Y	Land Use Primary	Land Use Secondar	Source, Main	Source Add'l	Domestic Waste
139	40	3	36	443	138	1		4	3	3
140	40	3	36	444	177	1		3		
141	40	3	36	445	115	1		4		3
142	40	3	36	447	167	1		4		3
143	40	3	36	451	006	1				1
144	40	3	36	451	011	1				1
145	40	3	36	451	021	1				1
146	40	3	36	451	036	1				1
147	40	3	36	451	051	1				1
148	40	3	36	452	183	1		4		3
149	40	3	36	460	156	1		4		3
150	40	3	36	460	182	1		4		3
151	40	3	36	461	109	1		4		3
152	40	3	36	461	122	1		4		3
153	40	3	36	462	283	3				
154	40	3	36	472	186	1		4		3
155	40	3	36	475	175	1		4		3
156	40	3	36	475	138	1		4		3
157	40	3	36	477	186	1		4		3
158	40	3	36	478	174	1		4		3
159	40	3	36	480	510	1				1
160	40	3	36	481	007	1				1
161	40	3	36	481	016	1				1
162	40	3	36	481	026	1				1
163	40	3	36	481	036	1				1
164	40	3	36	481	051	1				1
165	40	3	36	481	523	1				1
166	40	3	36	482	163	1		4		3
167	40	3	36	483	174	1		4		3
168	40	3	36	485	140	1		4		3
169	40	3	36	485	142	1		4		3
170	40	3	36	485	155	1		4		3
171	40	3	36	486	186	1		4		3
172	40	3	36	490	174	1		4		3
173	40	3	36	493	143	1		4		3
174	40	3	36	495	184	1		4		3
175	40	3	36	496	156	1		4		3
176	40	3	36	504	173	1		4		3
177	40	3	36	504	184	1		4		3
178	40	3	36	515	017	1		4		1
179	40	3	36	515	008	1				1
180	40	3	36	516	480	1				1
181	40	3	36	518	041	1		4		1
182	40	3	36	518	048	1				1
183	40	3	36	518	056	1				1
184	40	3	36	518	514	1				1
185	40	3	36	519	305	1		4		2
186	40	3	36	522	064	1		4		1
187	40	3	36	522	071	1				1
188	40	3	36	522	080	1				1
189	40	3	36	539	115	3	light agric			
190	40	3	36	541	147	1	1- zoned li	1	3	1
191	40	3	36	545	194	4		4		0
192	40	3	36	548	018	3	3 (light ag	4	2	1
193	40	3	36	548	048	3				
194	40	3	36	548	240	1	1- zoned li	4		3
195	40	3	36	549	081	3	light agric	4		1
196	40	4	31	009	142	1		4	3	1
197	40	4	31	034	138	3		4		1
198	40	4	31	129	094	3				
199	40	4	31	147	025	3				
200	Linear Feat			No tax x	no tax y					
201	Multi-sect.					4		0		0
202	Multi-sect.					4		0		
203	Multi-sect.					4		0		

	AGRICULTURE 0 = None 1 = Dairy 2 = Poultry 3 = Swine 4 = Crop 5 = Other				Agriculture Practice: 0 = None 1 = Fertilizers 2 = Herbicides 3 = Insecticides 4 = Nematicides		HAZARDOUS MATERIALS 0 = None 0 = None 1 = Present 1 = Underground diesel 2 = Underground gasoline 3 = Other 4 = above ground diesel 5 = above ground gasoline			
Row No.	Ag Type Predomin	Ag Type Subordin	Type of Crop	No. of Cattle	Practice Primary p	Practice Secondar	Haz. Mater. Transport	Fuel Storage	Secondar Fuel	Storage, Chemical
139										
140										
141										
142										
143										
144										
145										
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147										
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177										
178	0							0		0
179										
180										
181	0							0		0
182										
183										
184										
185	0							5		0
186	0							0		0
187										
188								0		0
189	1			6						
190	0							0		0
191								0		1
192	4		grass		1			0		
193	4		grass		1					
194	0							0		0
195	4		3 acres on		0					0
196	0							0		0
197	1	4	hay (5 acr	20 - 30 co	1			0		0
198	4		grass		1					
199	4		grass		1					
200										
201	0						1	0		0
202							1			
203							0			

APPENDIX C

WELLHEAD PROTECTION TERMS AND ACRONYMS

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WELLHEAD PROTECTION TERMS AND ACRONYMS

Alluvium - Clay, silt, sand, gravel and cobbles deposited by rivers and streams.

Aquifer - Rock or sediment which is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs.

Bedrock - Relatively unweathered rock below soil and glacial drift materials.

Best Management Practices (BMPs) - Practices and operating procedures which aid in the prevention or reduction of the pollution load. They are designed to facilitate voluntary compliance through education.

Confining Layer - A body of material of low hydraulic conductivity that is stratigraphically adjacent to one or more aquifers. It may lie above or below the aquifer.

Contamination - The addition to water of contaminants, preventing the use or reducing the usability of the water. Sometimes considered synonymous with pollution.

Critical Recharge Area - An area characterized by geologic conditions that do not effectively remove pollutants and where large quantities of water replenish the aquifer. Also an area designated under the Whatcom County Critical Area Ordinance.

Drift - Sediment in transport or deposited in close proximity to a glacier.

Drift Plain - Elevated surface underlain predominantly by glacial drift.

Floodplain - A wide flat plain composed of river sediments.

Fluvial - Pertaining to rivers and streams.

Glacial Outwash Deposits - See outwash.

Ground Water - The water contained in interconnected pores located below the water table in an unconfined aquifer or located in a confined aquifer.

Ground Water, Confined - The water contained in a confined aquifer. Pore-water pressure is greater than atmospheric at the top of the confined aquifer.

Ground Water Flow - The movement of water through openings in sediment and rock; occurs in the zone of saturation.

Ground Water, Unconfined - The water in an aquifer where there is a water table.

Group A Public Water System - A water system in Washington State which meets the federal definition of a public water system. This is a water system with fifteen or more connections, or which serves an average of twenty-five or more persons per day for sixty or more days within a calendar year. WAC 246-290-020.

Hydrogeology - The study of the interrelationships of geologic materials and processes with water, especially ground water.

Infiltration - The flow of water downward from the land surface into and through the upper soil layers.

Nonpoint Source - A source discharging pollutants into the environment that is not a single, discrete point.

Onsite Sewage Disposal System - A system designed for the safe and effective treatment and disposal of domestic waste water to a septic tank and drainfield system in onsite soils.

Outwash - Stratified drift deposited by meltwater streams.

Outwash Plain - Plain beyond the margin of a glacier composed of outwash.

Permeability - The property of a porous medium to transmit fluids under an hydraulic gradient.

Pleistocene - The earlier of the two epochs comprising the Quaternary Period. The Pleistocene in Whatcom County is considered to have ended 12,000 to 15,000 years before present.

Point Source - Any discernible, confined, or discrete conveyance from which pollutants are or may be discharged, including (but not limited to) pipes, ditches, channels, tunnels, conduits, wells, containers, rolling stock, concentrated animal feeding operations, or vessels.

Porosity - Void space as a percentage of total sediment volume.

Potentiometric Map - A contour map of the potentiometric surface of a particular hydrogeologic unit.

Potentiometric Surface - A surface that represents the level to which water will rise in tightly cased wells. If the head varies significantly with depth in the aquifer, then there may be more than one potentiometric surface. The water table is a particular potentiometric surface for an unconfined aquifer.

Public Water System - Defined in Washington State as any system, excluding systems serving only one single-family residence, providing piped water for human consumption.

Quaternary - The latest (and current) period in geologic time ranging from 2 to 3 million years ago to the present.

Recharge - The processes involved in the absorption and addition of water to the zone of saturation or water table.

Recharge Area - Area in which water reaches the zone of saturation by surface infiltration.

Runoff - The fraction of precipitation flowing to surface streams.

Septic System - Refer to "Onsite sewage disposal system."

Static Water Elevation - Water elevation relative to sea level representing the "standing" or stabilized water level unaffected by ground water withdrawal.

Time of Travel (TOT) - The time period used to define the area through which ground water will move and recharge a pumping well. For wellhead protection purposes, TOT is expressed in years.

Undifferentiated Deposits - Sediments from undetermined age or formation.

Watershed - The area contained within a drainage divide above a specified point.

Water Table - The surface in an unconfined aquifer at which the pore water pressure is atmospheric.

Wellfield - An area containing two or more wells with overlapping zones of contribution that supply a public water supply system.

Wellhead - The physical structure, facility, or device at the land surface from or through which ground water flows or is pumped from water-bearing formations.

Wellhead Protection Area (WHPA) - The surface and subsurface area surrounding a water well or wellfield, supplying a public water system through which contaminants are likely to move toward and reach such well or wellfield.

Zone of Contribution - The area surrounding a pumping well that encompasses all areas or features that supply ground water recharge to the well.

Zone of Saturation - That part of the earth's crust beneath the regional water table in which all voids, large and small, are filled with water under pressure greater than atmospheric.

APPENDIX D

REFERENCES

APPENDIX D

REFERENCES

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