Well Head Protection

in Idaho

. . . a plan to help your community protect its drinking water. . .

sponsored by

Idaho Department of Health and Welfare
Division of Environmental Quality

in cooperation with

Idaho Water Resources Research Institute
University of Idaho

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Note: Selected technical terms noted by italics are included in the Glossary.

Section 1. Introduction

Ground water is one of Idaho's most valuable natural resources. Almost 95% of Idaho's drinking water is supplied by groundwater. Ground water is generally an excellent source of high quality drinking water, because of its accessibility and relative purity, and is essential for irrigation, mining, forestry, manufacturing and many other industries. The preservation of Idaho's ground water requires sound development, diligent conservation and conscientious protection from pollution.

The *Wellhead Protection Program* is designed to reduce the threat to the quality of ground water used for drinking water by identifying and protecting the vulnerable areas surrounding a well. A *wellhead protection area* (WHPA) is defined as the surface and subsurface area surrounding a well or wellfield that supplies a public water system, through which contamination could reach the well. WHPA boundaries are determined based on factors such as well pumping rates and ground water flow parameters for specific aquifer types.

Knowledge of water supply, hydrogeology and contaminant transport are essential to the wellhead protection effort. The purpose of this booklet is to provide basic information on the occurrence and movement of ground water, describe the processes which control contaminant movement in ground water, and outline methods to protect ground water drinking supplies through wellhead protection. A companion document entitled *Tools for Local Governments (EPA 440/6-89-002)* provides a thorough overview of wellhead protection strategies.

Section 2A. Ground Water

Introduction

An understanding of ground water occurrence and flow is important to protection ground water quality. This section will introduce basic principles of ground water hydrology, aquifer characteristics, such as porosity, permeability, and hydraulic conductivity, and ground water flow systems and water wells. In addition, major Idaho aquifer types and characteristics are presented. With this information, you will be better able to design and implement wellhead protection in your community.

Ground Water in the Hydrologic Cycle

Water cycles continuously through the atmosphere, on the earth's surface in rivers, lakes and oceans, and below the earth's surface in the form of ground water. This constant movement is known as the *hydrologic cycle* (Figure 2.1). Water begins the cycle as it evaporates from oceans--evaporation is greatest near the equator. Water vapor condenses when atmospheric conditions are suitable.

Water in the form of rain, snow or hail completes the cycle when it returns to the ocean via the land surface or by direct precipitation.

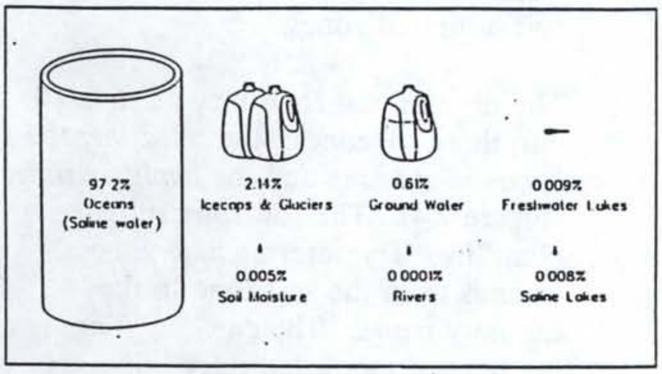

Figure 2.2. The world's total water supply.

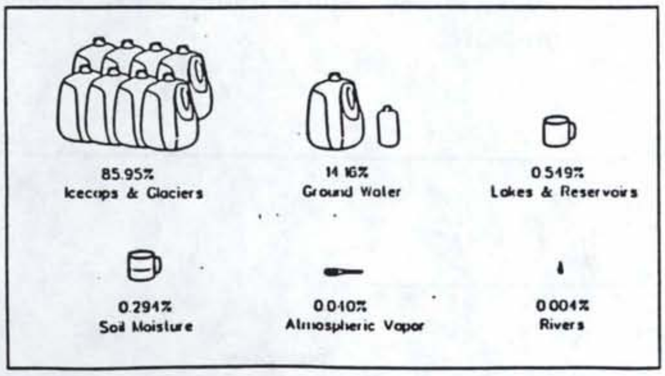

Figure 2.3. The world's fresh water supply.

ground water consumed, withdrawing an average of 4,800 million gallons per day (Table 2.1).

Table 2.1 Summary of Idaho's Water Withdrawals

Total fresh water withdrawals	22,300
Rank nationwide	2
Sources:	
Surface water	
Withdrawals (Mgal/day)	17,500
Percent of total state withdrawals	78%
Rank nationwide	2
Ground water	
Withdrawals (Mgal/day)	4,800
Percent of total state withdrawals	22%
Rank nationwide	4
Uses:	
Agricultural	
Withdrawals (Mgal/day)	21,600
Percent of total state withdrawals	97%
Rank nationwide	2
Industrial and Mining	
Withdrawals (Mgal/day)	340
Percent of total state withdrawals	2%
Rank nationwide	25
Domestic and Commercial	
Withdrawals (Mgal/day)	311
Percent of total state withdrawals	1%
Rank nationwide	34
Public Supply	
Withdrawals (Mgal/day)	212
Percent of total state withdrawals	1%
Rank nationwide	39

Water use in Idaho is dominated by agriculture, which accounts for 90.6% of the total ground water withdrawals and 98.8% of the surface water consumed.

We are second in the nation, behind California, in the volume of freshwater extracted for agricultural use. A large quantity of the ground water withdrawn for agriculture (75.6%) is returned to the ground water system, through infiltration.

Industries such food processing in southern Idaho, pulp and paper processing in Northern Idaho, and mining consume approximately 1.5% of

The boundary between the saturated and unsaturated zones is called the *water table*. The shape of the water table often resembles the shape of land surface. Hydraulic pressure at the water table is equal to atmospheric pressure. Below the water table, in the saturated zone, hydraulic pressure increases with increasing depth, due to the weight of the water.

Ground Water Aquifers

An *aquifer* is best defined as a saturated rock unit or sedimentary unit capable of transmitting significant quantities of water to wells. Water almost never occurs in underground rivers or streams. Rather, aquifers resemble rocks and soils we see at the surface, but the pore spaces are filled with water.

The ability of an aquifer to store and transmit water is a function of its *porosity* and *permeability*. Porosity is a measure of the void space in rocks or sediments. But for water to move through rock, the pores must be connected. *Effective porosity* is the measure of interconnected pores. High porosity values mean that more space is available for ground water. Porosity values for common rock types are given below:

Unconsolidated deposits	
Gravel	25 - 40
Sand	25 - 50
Silt	35 - 50
Clay	40 - 70
Rocks	
Fractured basalt	5 - 50
Karst limestone	5 - 50
Sandstone	5 - 30
Limestone, dolomite	0 - 20
Shale	0 - 10
Crystalline rock	
Fractured	1 - 10
Dense	0 - 5

Porosity of sediments is determined by the shape, orientation, and sorting of sedimentary particles. Well-sorted sediment is more porous than poorly-sorted sediment because smaller particles fill the void spaces between larger ones (Figure 2.5). Irregularly shaped grains tend to have greater porosity than spherical sediment grains. The orientation or packing of irregularly-shaped grains also affects porosity of sediments.

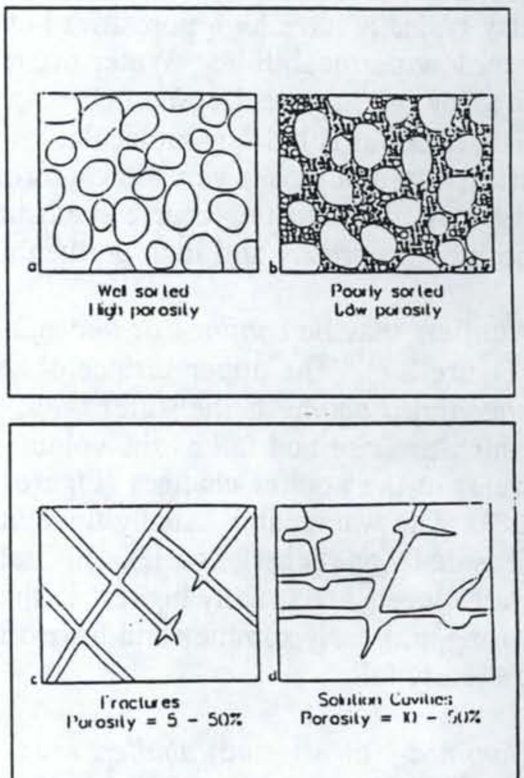

Figure 2.5. Porosity of unconsolidated sediments (a and b) and rocks (c and d.)

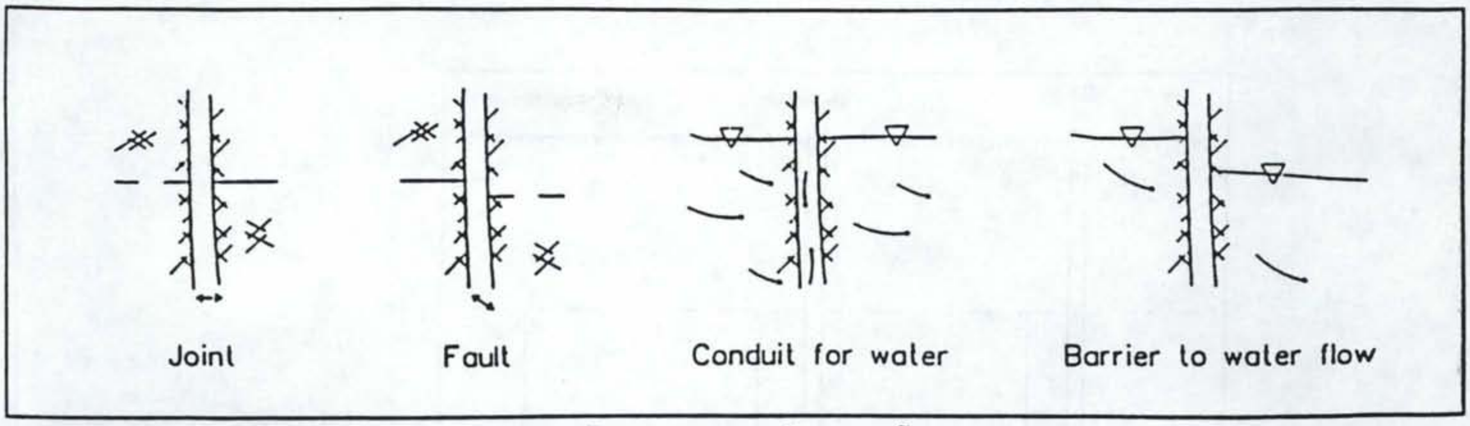

Figure 2.6. Joints and faults and their effect on ground water flow.

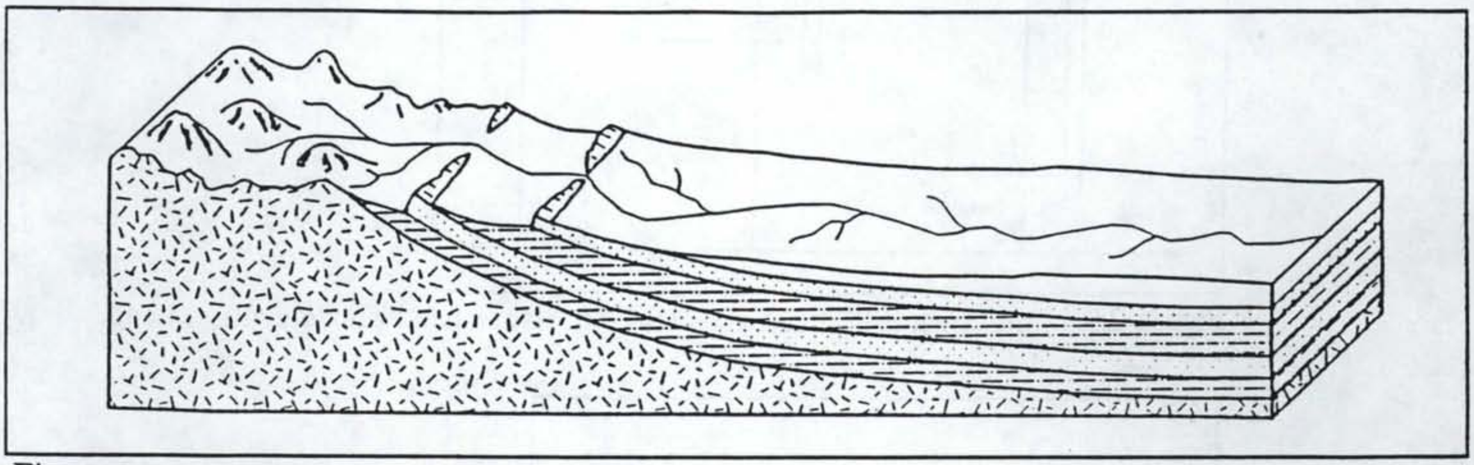

Figure 2.7. Confined and unconfined aquifers.

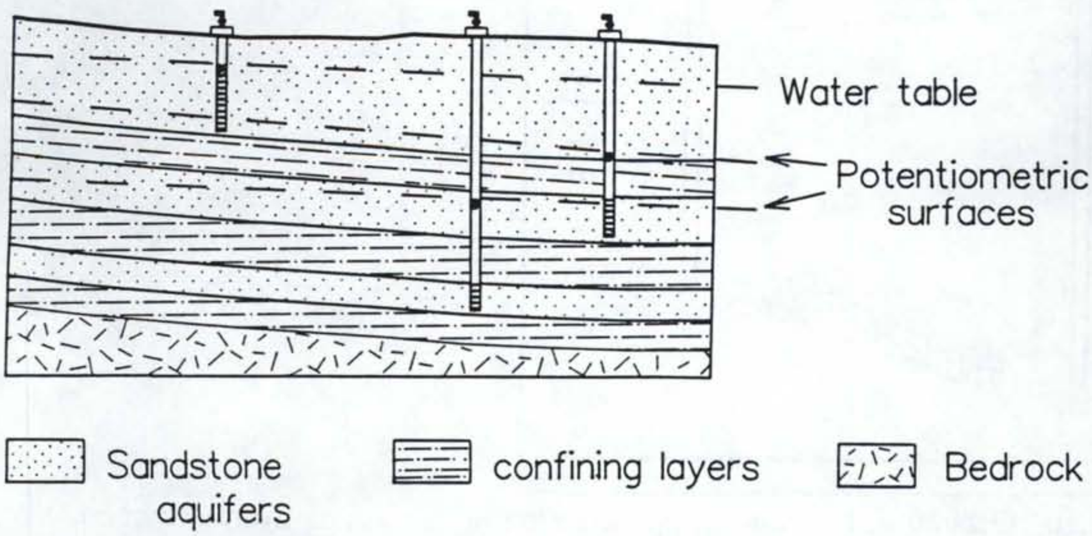

Figure 2.8. Water table and potentiometric surface in unconfined and confined aquifers.

describes the factors which control the flow of groundwater:

$$Q = K I A.$$

In Darcy's equation, Q is the discharge--the amount of water flowing through the aquifer. I is the hydraulic gradient and A is the cross sectional area of the aquifer.

K, the *hydraulic conductivity*, is a measure of the ease with which water will flow through a saturated rock or soil. The hydraulic conductivity of different geologic materials varies widely (Figure 2.11). Hydraulic conductivities are highest for materials with high effective porosity, such as sand and gravel, and lowest for silts and clays.

Transmissivity, another commonly used aquifer parameter, is the rate at which water is transmitted through a unit width of an aquifer or confining bed under a unit hydraulic gradient. In other words, transmissivity is the hydraulic conductivity of the aquifer multiplied by the aquifer thickness.

Hydrogeologists also speak of the *storativity* of aquifers. Storativity is the volume of water that an aquifer will release from storage per unit surface area per unit change in head. The storativity of an unconfined aquifer is its *specific yield*, the ratio of the amount of water the aquifer will yield by gravity or by pumping to the total volume of aquifer materials. The specific yield of clay and silt is generally only 2-15% of the total rock volume, whereas that of gravel and coarse sand is often 25-35% of the total rock volume.

Ground Water Movement

The movement of water through a region is called a ground water *flow system*. It is important to understand the system of ground water movement in the aquifer of concern. The flow will be different for different aquifers, but all flow systems have some common characteristics.

Water moves in the direction of decreasing slope of the water table or the potentiometric surface. Water enters the flow system in areas of recharge (highlands) and moves through the aquifer to areas of ground water discharge (valleys or lowlands).

In recharge areas, ground water flows downward, away from the water table. Ridges in the water table are ground water divides, which often coincide with surface water divides. Ground water flows in opposing directions from the divide. In discharge areas ground water flows upward, toward the water table. The water table is usually at or near the ground surface in discharge areas. Here, ground water may escape as a spring, seep, or surface stream, or may evaporate.

The movement of most ground water is exceedingly slow (Figure 2.12). Shallow ground water may move at rates of less than a foot per day to several feet per day, depending on permeability and hydraulic gradient. Deep ground water moves extremely slowly--sometimes as little as a few feet per century.

Local and Regional Flow Systems

Ground water flow follows topography. If the topography is very hilly, subsystems of ground water flow may develop within the major system (Figure 2.13). Ground water in an upper aquifer may flow along local flow paths, away from hills and into small surface streams. Deeper ground water is less affected by surface topography, and flows along regional flow paths. Where local relief is negligible, only regional flow systems may develop.

Water Wells

The primary function of a water well is to provide a conduit from the aquifer to the ground surface. Water wells may be dug or drilled and can be used for water supply, for aquifer tests, for measuring water levels, and for monitoring water quality.

Water wells must be designed to produce acceptable quality water and protect it from contamination (Figure 2.14). All wells constructed in the state of Idaho since 1968 have been subject to well construction standards to guard against waste and contamination of ground water resources. Steel or PVC plastic well *casing*, gravel packs, and grouting are used to isolate the pumping interval and prevent movement between different aquifers in the same area. Abandoned wells should be sealed to prevent the well from being a vertical channel for contamination.

When a well is pumped the water level in the well begins to decline. The difference between the water level in a well before pumping and the water level in the well during pumping is called *drawdown* (Figure 2.15). The water table declines around the well as drawdown occurs in an unconfined aquifer. Confined aquifers experience a drawdown in artesian pressure (loss of head) as a result of pumping, but the aquifer is not normally dewatered.

As drawdown occurs, the head in the well falls below the level in the surrounding aquifer, and water begins to flow into the well from all directions (Figure 2.16). The flow of water into a well causes a lowering of the water table in all directions, which is called a *cone of depression*. The outer limit of the cone of depression is the *radius of influence*. The *zone of contribution* is the area of the aquifer which supplies water to the well. The sizes of the cone of depression and zone of contribution depend on the hydrologic characteristics of the aquifer and the pumping rate of the well.

The drawdown is directly proportional to the pumping rate and the length of time that pumping has been in progress. Pumping a well at a high rate typically causes a steep cone of depression. A lower pumping rate results in a shallower cone of depression. Each aquifer has a maximum sustainable pumping rate, beyond which the aquifer cannot supply sufficient water to the pump.

Two or more wells pumping from the same aquifer are called a *well field* (Figure 2.17). Where pumping wells are relatively close together, pumping of one will cause drawdown in the others.

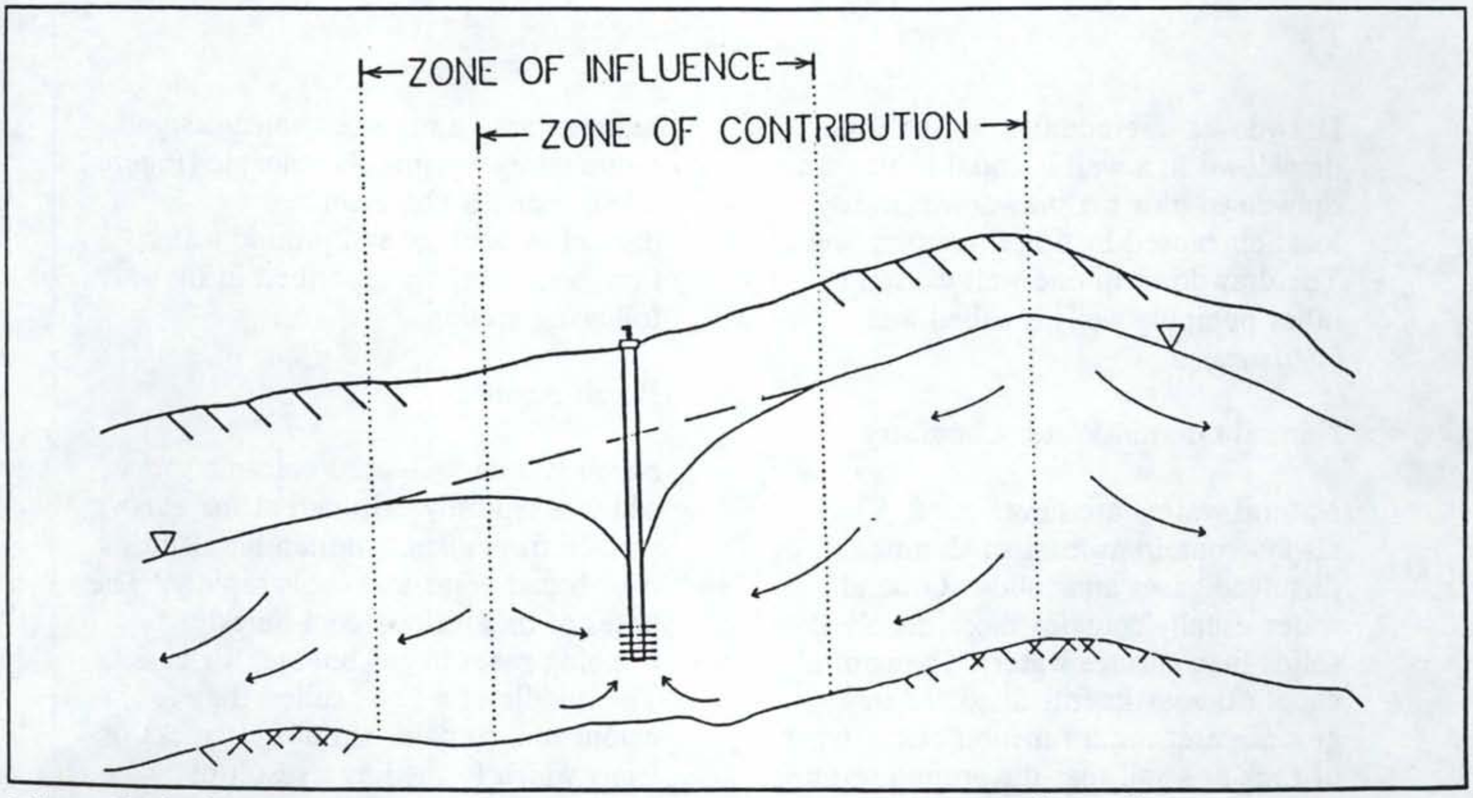

Figure 2.16. Zone of influence and zone of contribution around a pumping well.

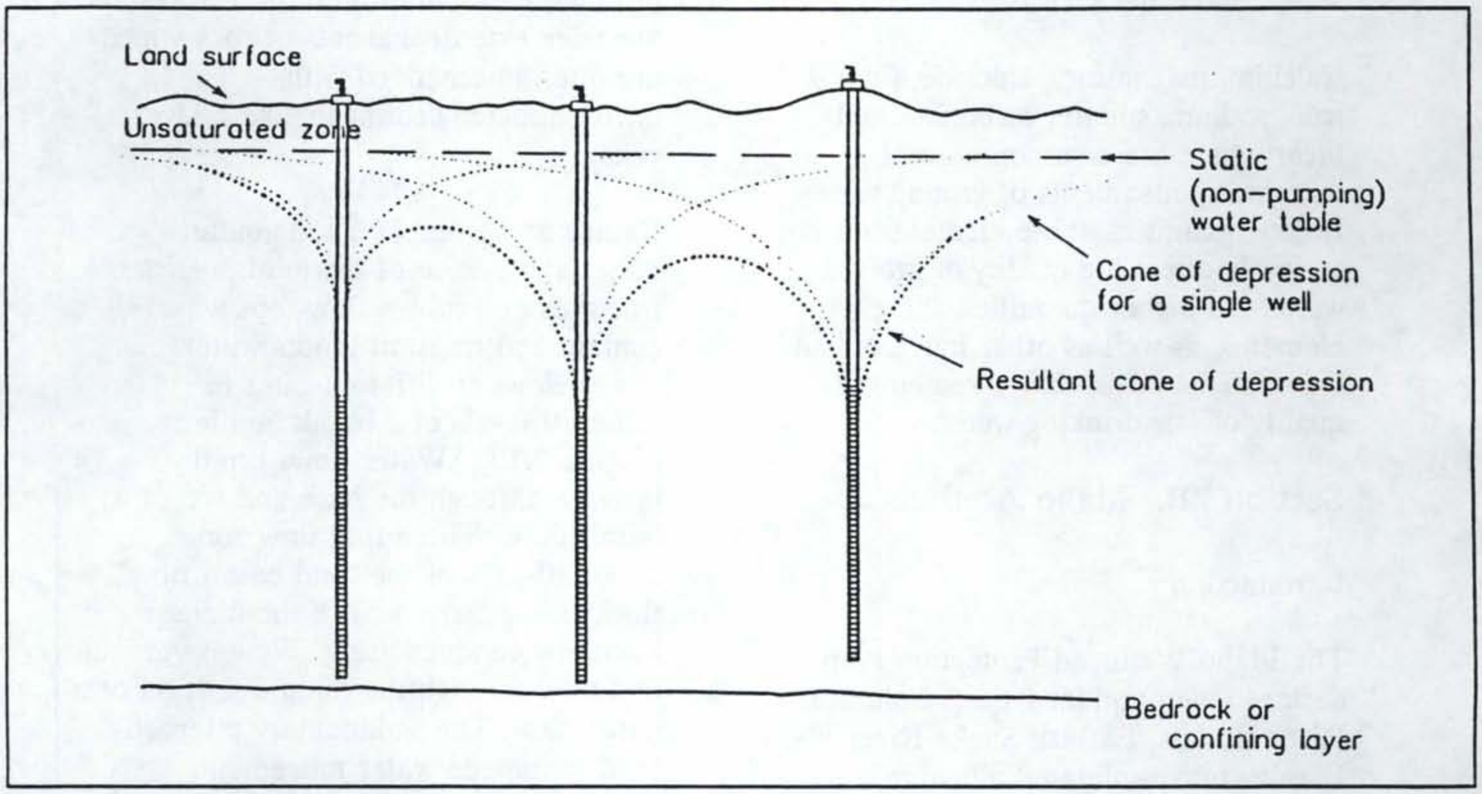

Figure 2.17. Well field interference.

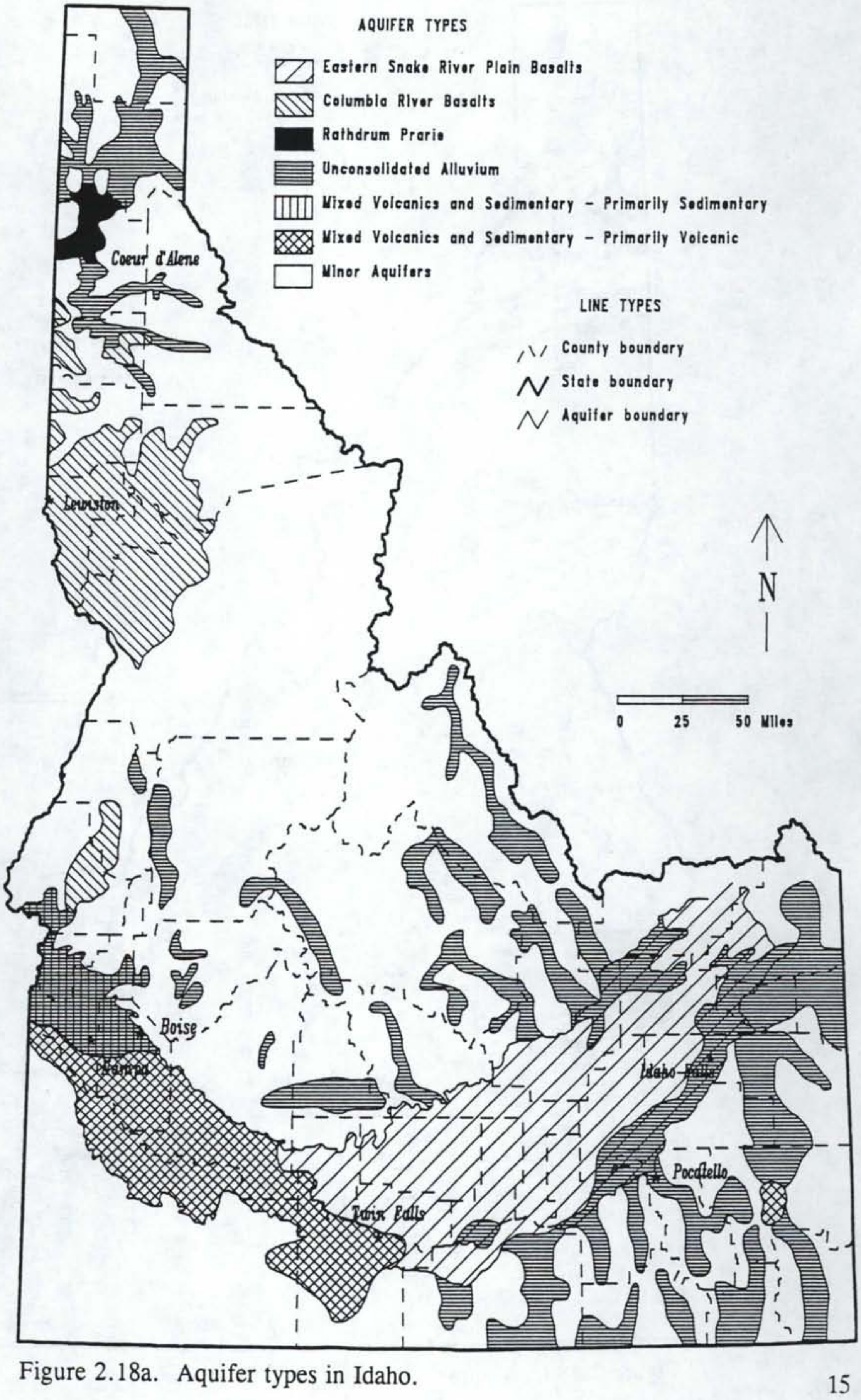

Figure 2.18a. Aquifer types in Idaho.

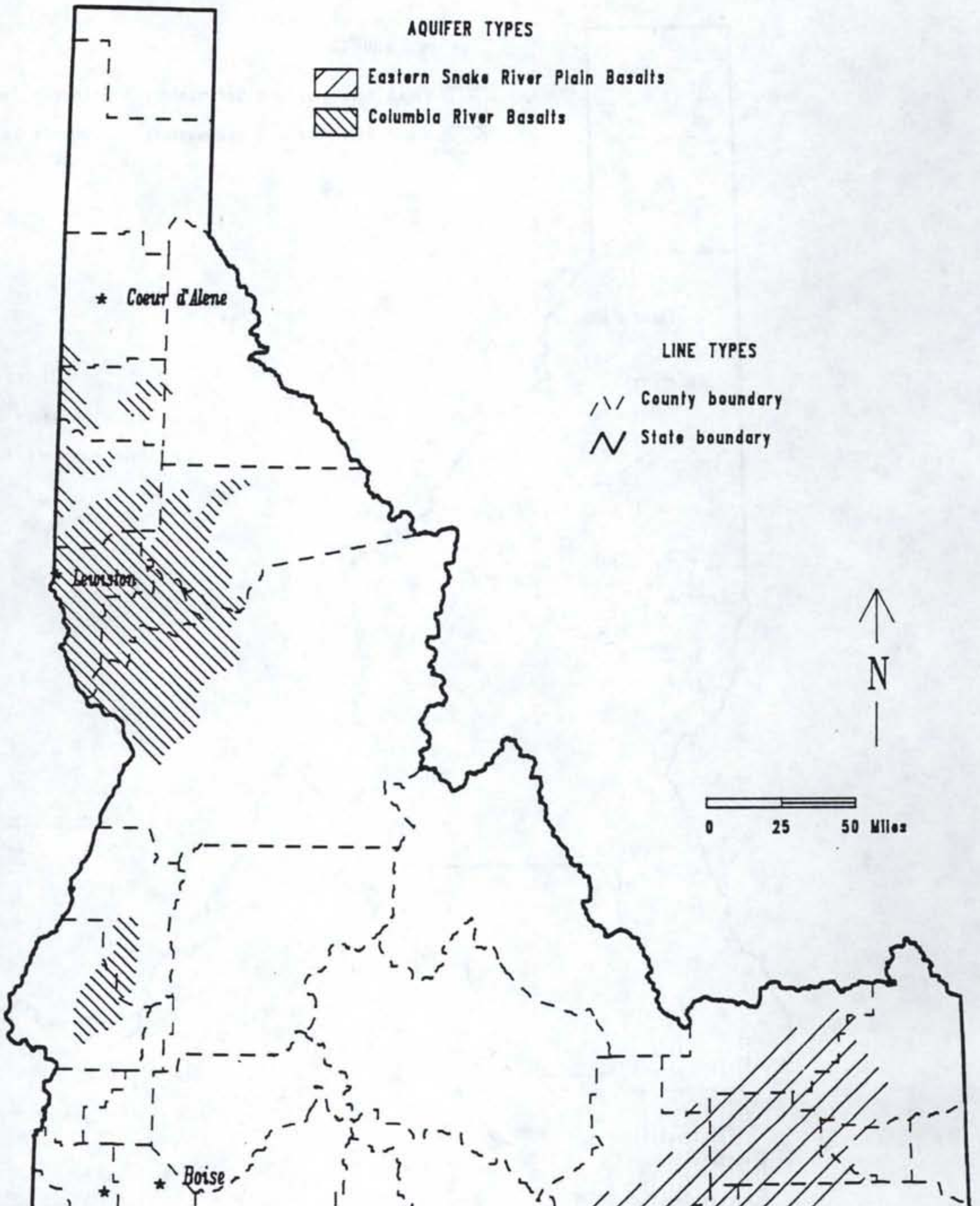

Figure 2.18c. Aquifer types in Idaho.

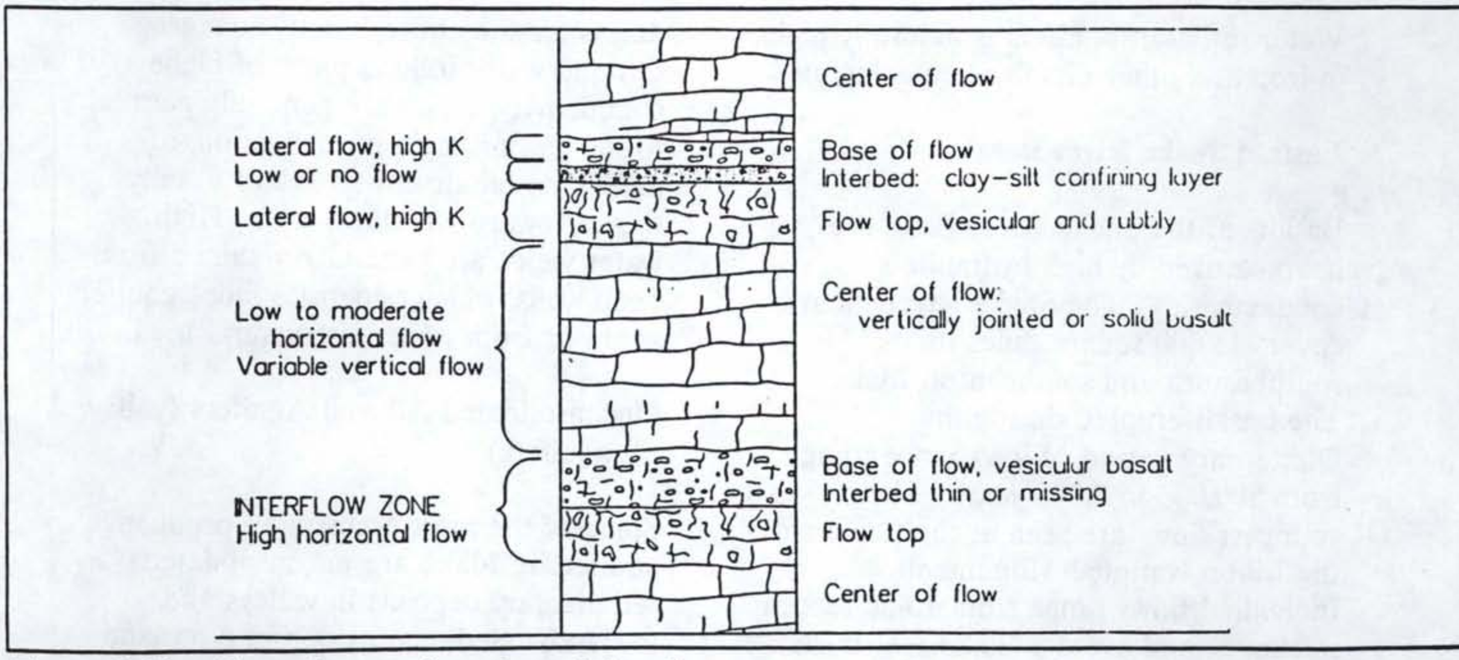

Figure 2.19. Ground water flow through basalt.

Rathdrum Prairie Aquifer

The Rathdrum Prairie aquifer is an unconfined alluvial aquifer which supplies groundwater to over 350,000 people in Coeur d'Alene, Hayden Lake and Post Falls, Idaho and Spokane County, Washington.

The aquifer consists of fine to coarse sands and gravels which were deposited during the last glacial stage. The sandy glacial outwash is believed to overlie the fine-grained sediments of the Latah Formation and is topped by coarser materials deposited by the Missoula/Spokane Flood. An ice dam which had impounded the waters of Glacial Lake Missoula gave way, and water cascaded across northern Idaho and the Columbia River plateau. Cobbles, gravels, and sands covered the sandy valley fill of the Rathdrum Prairie.

The well-sorted, coarse deposits have extremely high hydraulic conductvities. The aquifer is generally unconfined from land surface to the water table over its entire expanse, allowing free infiltration. The US Environmental Protection Agency designated the Rathdrum Prairie aquifer as a sole source aquifer, subject to special protection requirements.

Mixed Volcanic and Sedimentary Rock - Primarily Volcanic Rock

These aquifers include the Bruneau, Banbury and Glenns Ferry Formations. The Bruneau and Banbury Formations are characterized by thick basalt flows, commonly interbedded with thin, fine grained sedimentary layers. Total basalt thickness exceeds 1000 feet in some localities.

The Glenns Ferry Formation is characterized by poorly consolidated detrital material and minor flows of basalt. Silt, clay, and sand beds are common. Total thickness is about 2000 feet.

Mixed Volcanic and Sedimentary Rocks - Primarily Sedimentary Rocks

These aquifers include the Idaho Group rocks, commonly found in the deeper wells of the Boise Valley. The Idaho Group rocks are characterized by unconsolidated to poorly consolidated clay, silt, sand, volcanic ash, diatomite, fresh water limestone and conglomerate. Basalt interbeds occur in some areas. The Idaho Group sediments are overlain by unconsolidated silts, sands and gravels (typically called Terrace Gravel deposits). Thicknesses may reach 5000 feet near the Idaho-Oregon State line.

Section 3. Ground Water Contamination

Introduction

Water is one of Idaho's most important resources. Water, and the lack of water, has and continues to play a critical role in the development of our agriculture, our industry, and our communities. Water, throughout Idaho's history, has been a lifeline for sustenance and commerce.

In the past many water investigations, especially ground water investigations, have focused on the development of environment from these facilities are referred to *point-source* releases. Pipeline ruptures or the transport of toxic substances may lead to accidental releases into the environment. And *nonpoint-source* ground water contamination may result from the application of agricultural chemicals and urban runoff.

Contaminant Transport Processes

The following section examines the processes that lead to the migration of contaminants from at or near the ground surface to potable ground water supplies. The study of contaminant fate and migration often poses complex problems, due to highly variable contaminant properties and wide differences in subsurface geology. For instance, different contaminants may be in *gaseous, solid,* or *liquid* phases; liquid contaminants may be lighter than water, heavier than water, or *immiscible* with water. Contaminants moving in an unconsolidated alluvial aquifer, e.g. the Spokane-Rathdrum Prairie aquifer, will travel much differently than the same contaminant in a basalt aquifer, such as the Snake River Plain aquifer or the Pullman-Moscow aquifer. This section provides a very basic review of some of the processes influencing a contaminant's fate.

Factors Influencing Contaminant Fate

Contaminant migration in the subsurface is controlled by the contaminant's physical and chemical properties as well as by aquifer characteristics. Many processes (natural and man-made) control contaminant fate before and after entering the subsurface.

Dilution may occur both above and below ground, for example, spilled solvents may be mixed with water, soap, or even other wastes. A small amount of waste is thus converted to a larger volume of waste, which may complicate treatment. Mixed wastes may complicate treatment by requiring two or more different treatment processes; analysis for mixed wastes may be more difficult, certainly more expensive. Contaminants may migrate, move, or dilute with percolating rainwater, or with leachate in landfills, or may dilute with ground water. Dilution in the subsurface leads to a spreading of the contaminant. Due to relatively low ground water velocities it can be many years, if ever, before contaminants reach background levels.

Density affects influence contaminant movement. Some contaminants that are less dense than water, such as gasoline, can float on aquifers, leading to a contaminant concentration in one zone. Conversely, denser contaminants may sink to the lower reaches of an aquifer, and not be detected by a well that only penetrates the upper part.

Porous soils and rocks can physically *filter* out some contaminant particles suspended in ground water, which reduces the contaminant concentration in the remaining, moving ground water. Filtration, for this reason, is a common water treatment method.

Radioactive decay reduces a radioactive constituent's concentration at predictable rates. Tritium, a byproduct from nuclear testing in the 1950's, is being used to

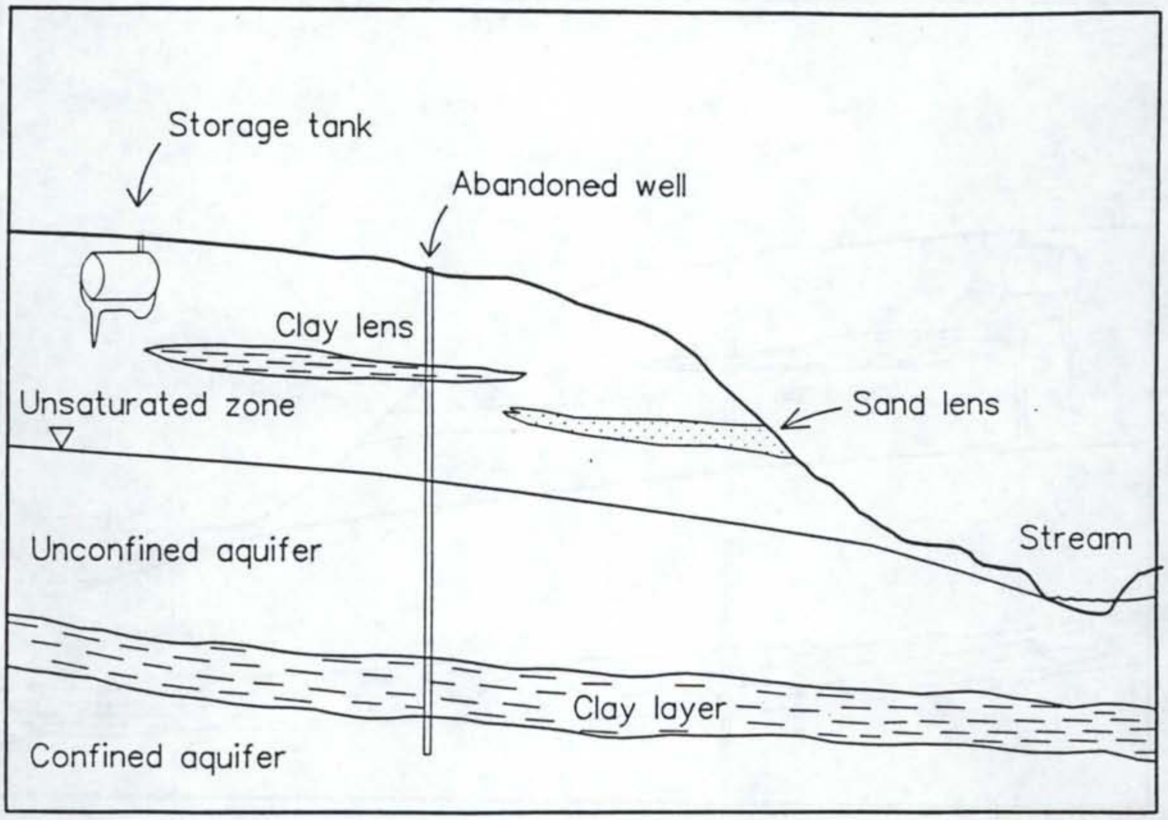

Figure 3.1a. General ground water contamination sequence.

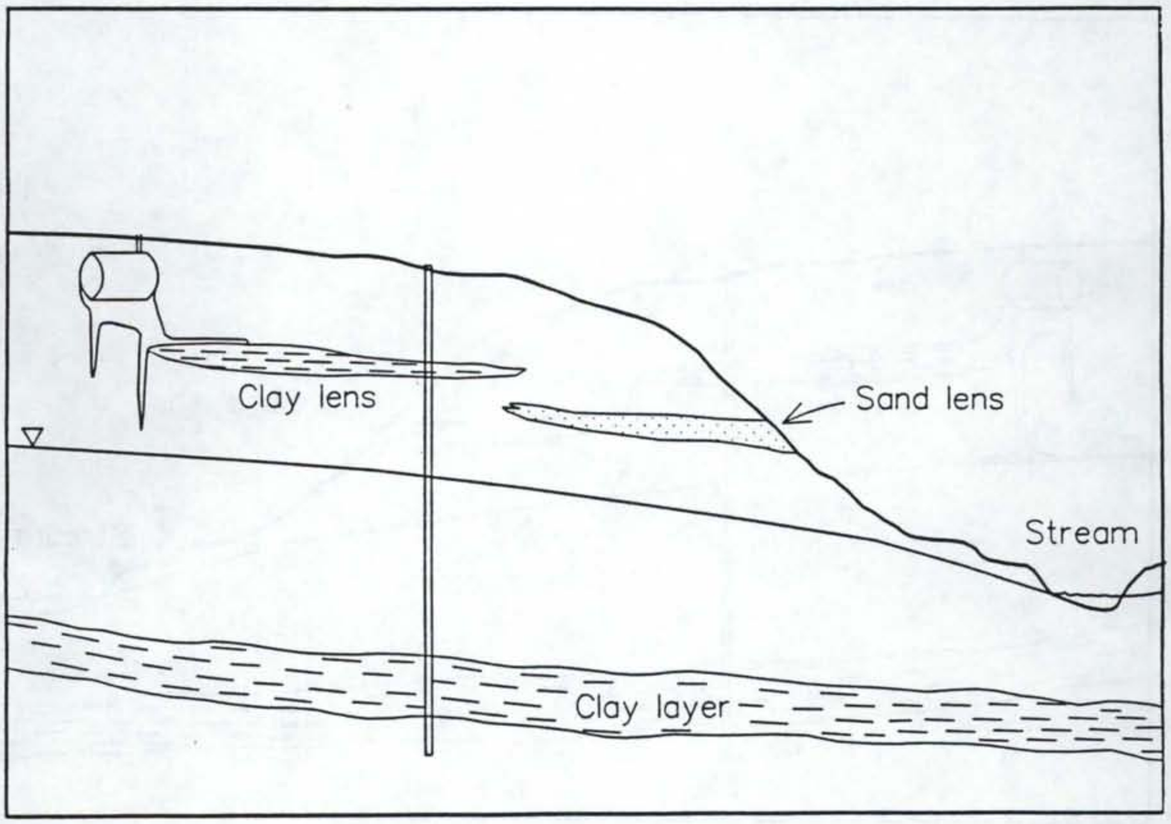

Figure 3.1b. General ground water contamination sequence.

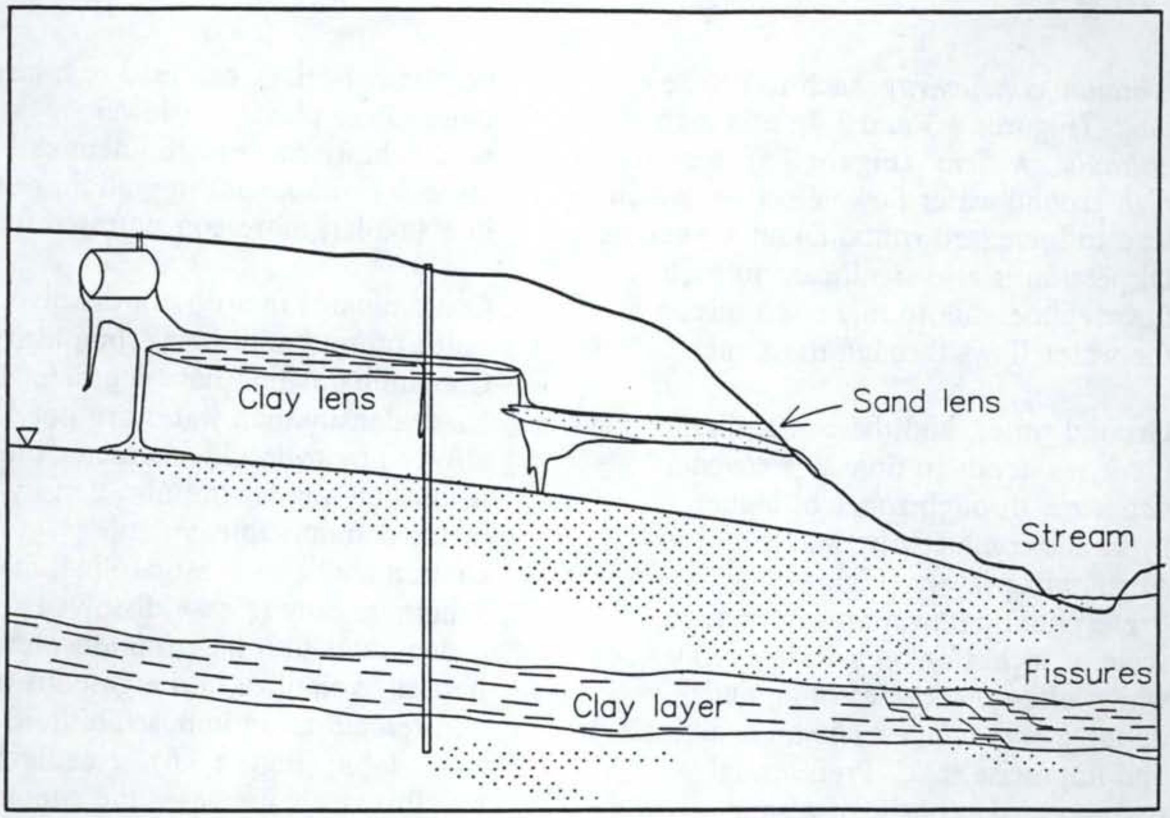

Figure 3.1e. General ground water contamination sequence.

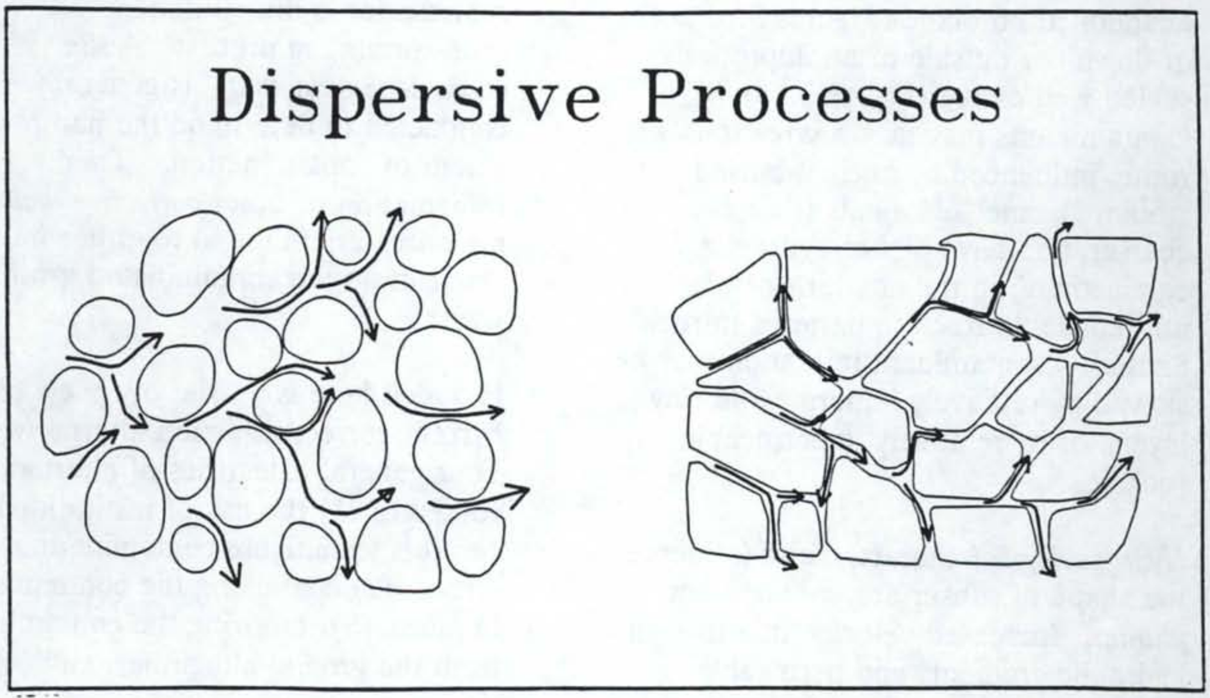

Figure 3.2. General ground water contamination sequence.

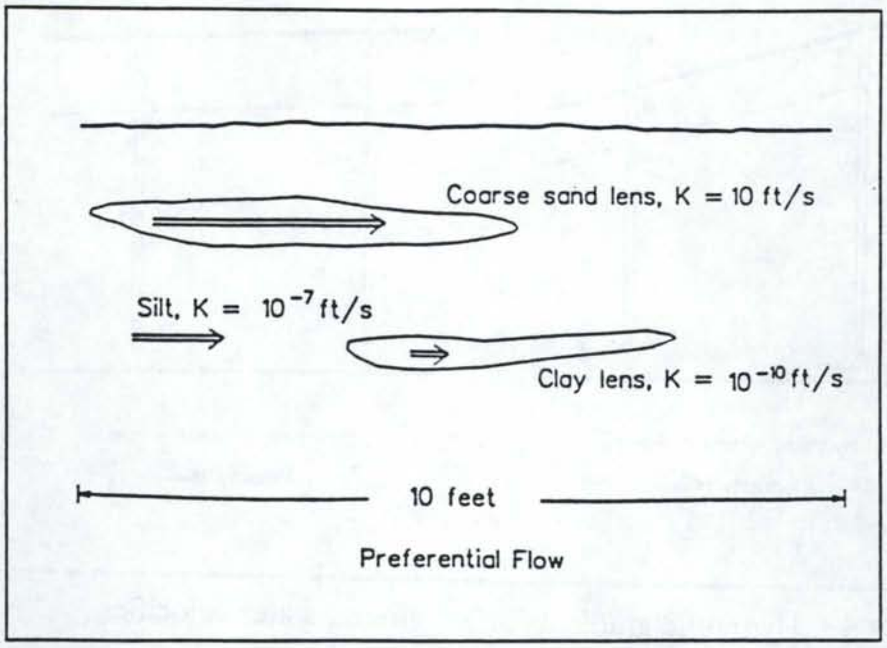

Figure 3.3. Preferential flow in zones of increased hydraulic conductivity.

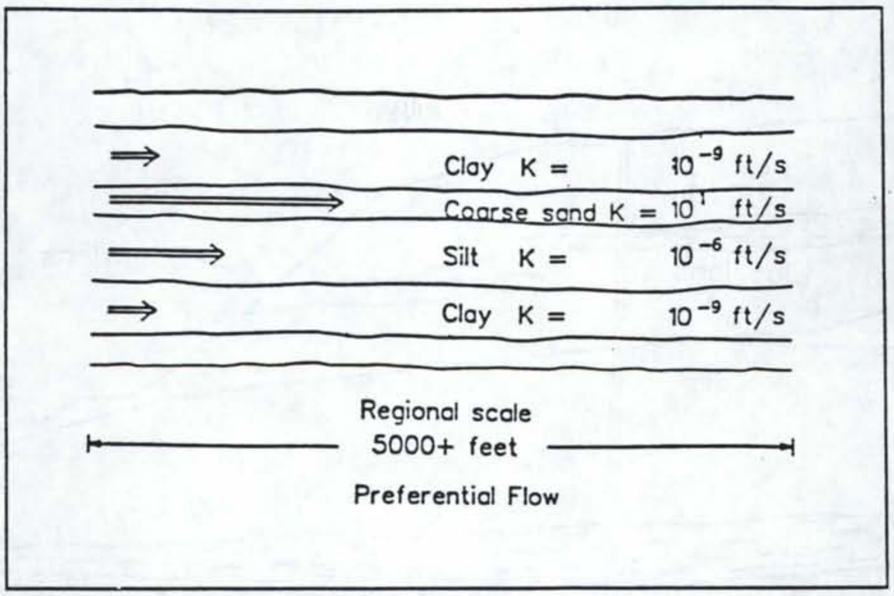

Figure 3.4. Preferential flow in zones of increased hydraulic conductivity.

treating the contamination *in situ*. The individual cleanup strategies used depends on the type of contaminant, the site hydrogeology, and regulatory constraints; cleanup strategies may be combined as necessary.

Institutional measures may consist of limiting or terminating the use of an aquifer and finding replacement water sources, developing alternative water supplies, or purchasing alternative water supplies, such as bottled water. Other measures include simply monitoring ground water in a "wait and see" mode, issuing health advisories to potential water users, or making a decision to accept an increased risk -- the "no action" alternative.

Contaminant containment is an effort to prevent further subsurface spreading of a contaminant. This strategy may be applied to contaminants that are not far below the ground surface and have not traveled far in a horizontal distance. Examples of methods used to contain a contaminant include the installation of trenches around, or downgradient of, a contaminated area, or to inject a slurry or grout into a series of closely-spaced wells around the contaminant to create a relatively impermeable subsurface barrier to flow.

It is frequently desirable to remove as much of a contaminant as possible. If the contaminant is relatively close to the ground surface the contaminated area may be excavated, and the contaminated soil be treated or disposed of in a hazardous waste landfill. If the contamination has reached ground water it may be necessary to remove the contaminated water by installing a series of pumping wells, which create a local water table depression and induce ground water flow toward the wells. Contaminated water may be treated by exposure to *activated charcoal* or aerating the water to induce volatilization. It may be very difficult to remove all of a contaminant by pumping, since some of the contaminant may remain *adsorbed* onto soil particles or have dispersed into aquifer pores not easily flushed by pumping.

In situ bioremediation may be applied in some cases as a primary remediation strategy, or to restore lower contaminant concentrations left behind by pumping methods. Some contaminants represent an energy source for bacteria, and biological degradation leads to the production of simple compounds like water and carbon dioxide from toxic organic contaminants. Most commonly used are techniques that enhance the growth of existing microbial populations through the addition of nutrients and oxygen. Increasingly, methods are being developed to introduce microbes for contaminants not degraded by natural populations. Research in this field is also focusing on the development of genetically-engineered microbes that are able to degrade specific contaminants. These methods, while promising, are currently at an early stage of development. Remediation is difficult, expensive, and time-consuming. The best alternative is to prevent the need for remediation by implementing wellhead protection.

leak occur, and tank closure requirements. In addition, the storage tank operator must provide evidence of financial assurance to cover the costs of potential remediation.

3. RCRA provides regulations that specify enhanced construction standards for municipal solid waste facilities. These requirements include a single impermeable liner under the waste pile, a leachate collection system, and a ground water monitoring system. Again, the regulations also cover closure and post-closure operations.

THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), otherwise known as "Superfund", was originally enacted in response to Love Canal. CERCLA was a legislative effort to clean up some of the nation's worst environmental threats to ground water. The Superfund act established a National Priority List of the nation's worst ground water contamination problems, based on a Hazard Ranking System. The Superfund Amendments and Reauthorization Act (SARA) in 1986 extended and expanded the superfund legislation.

CERCLA contains site investigation and cleanup regulations similar to those contained under RCRA, except that RCRA focuses on active, regulated facilities whereas CERCLA applies to inactive or uncontrolled sites. CERCLA authorized the EPA to investigate, obtain documents and information, inspect sites, and subpoena documents and witnesses. CERCLA authorized the EPA to spend public funds to conduct investigations and to design and implement remediation efforts. Furthermore, EPA was granted enforcement authority to require private parties to conduct cleanups, or to recover funds spent by the EPA for cleanup efforts. Superfund cleanups must attain federal standards or more stringent state standards, if such apply. Superfund regulations may also apply to sites not specifically on the National Priority List; for instance, approximately 30,000 sites are registered on the CERCLA Information System (CERCLIS).

CERCLA established liability for the costs of remediating Superfund sites. Under CERCLA the current facility owner or operator, previous owners or operators (at the time of disposal), those who arranged disposal, those who transported to a facility they selected, and the waste generators may be held liable for cleanup costs. Cleanup costs may include the costs of the site investigation, cleanup, government administration, legal efforts, health assessments, damages, and interest.

Section 4. Wellhead Protection

Introduction

This section provides a brief description of wellhead protection programs, methods for delineating wellhead protection areas, managing wellhead protection areas, contingency planning and public participation.

general aquifer characteristics; the refined approach is based on a moredetailed analysis of subsurface characteristics and aggregate pumping requirements. A community that wishes to implement wellhead protection can choose either approach.

Basic wellhead protection areas have been calculated for five major hydrogeologic settings in Idaho and have been calculated using the peak pumping rates from 50 gallons per minute to 7,000 gallons per minute. The five hydrogeologic settings are:

- Eastern Snake River Plain Basalts
- Colombia River Basalts
- Unconsolidated Alluvium
- Mixed Volcanic / Sedimentary Rocks- Primarily Sedimentary Rocks
- Mixed Volcanic / Sedimentary Rocks- Primarily Volcanic Rocks

The basic wellhead protection area is subdivided into three zones:

Zone IA: Minimum 50 feet radius around wells, 100 feet for springs

Zone IB: Two (2) year time of travel; calculated fixed radius

Zone II: Five (5) year time of travel; calculated fixed radius

The radii for the five major hydrogeologic settings in Idaho are shown in Table 4.1a - 4.1b.

Refined wellhead protection areas are also subdivided into zones:

Zone IA: Minimum 50 feet radius around wells, 100 feet for springs

Zone IB: Two (2) year time of travel; use site specific data and analytical semi-analytical, or numerical modeling

Zone II: Five (5) year time of travel; use site specific data and analytical, semi-analytical, or numerical modeling

Zone III: Known recharge areas and flow boundaries; use site specific data and hydrogeologic mapping

The water purveyor, in cooperation with the local government, will have the responsibility to develop refined wellhead protection areas, if the refined approach is chosen.

There are two exceptions to the general delineation guidelines; wellhead protection delineation on the Rathdrum Prairie Aquifer and a refined exception delineation.

Wellhead protection areas on the Rathdrum Prairie Aquifer, which is located in Kootenai County, Idaho, are to be delineated as follows:

Zone I: Minimum 50 feet radius around wells, 100 feet for springs, 300 feet for wetted recharge areas

Zone II: Aquifer boundary as established by EPA, 1978

Zone III: Critical aquifer recharge areas

The North Idaho Regional Office - Division of Environmental Quality, Panhandle Health District, Kootenai

Table 4.1b. Basic delineation, calculated radii.

MIXED VOLCANICS/SEDIMENTARY ROCKS – PRIMARILY SEDIMENTARY ROCKS										
PUMP RATE	50 GPM	100 GPM	500 GPM	1000 GPM	2000 GPM	3000 GPM	4000 GPM	5000 GPM	6000 GPM	7000 GPM
2 YEAR TOT	200'	200'	400'	600'	900'	1000'	1300'	1600'	1800'	2000'
5 YEAR TOT	300'	400'	700'	1000'	1300'	1700'	1900'	2200'	2500'	2700'

MIXED VOLCANICS/SEDIMENTARY ROCKS – PRIMARILY VOLCANIC ROCKS										
PUMP RATE	50 GPM	100 GPM	500 GPM	1000 GPM	2000 GPM	3000 GPM	4000 GPM	5000 GPM	6000 GPM	7000 GPM
2 YEAR TOT	3200'	3300'	3400'	3600'	3900'	4200'	4500'	4800'	5000'	5400'
5 YEAR TOT	8200'	8200'	8400'	8600'	9000'	9300'	9700'	10000'	10000'	11000'

GPM = Gallons per minute TOT = Time of Travel

Table 4.2a. Sources of ground water contamination.

CATEGORY I *Sources designed to discharge substances*	
Source	**Examples/Related Business**
Subsurface percolation	Cesspools Septic tanks Storm water drain fields
Injection Wells	Class I-III injection wells (Not authorized by state rules) Class IV injection wells (Prohibited by federal and state law) Class V injection wells: Deep injection wells (> 18′ deep) - Ag return water disposal - Urban runoff disposal - Heat pump return wells - Mining waste disposal - Artificial recharge wells Class V : Shallow injection wells (<18′ deep) - Urban runoff disposal
Land Application	Municipal/industrial wastewater Municipal/industrial sludge/septage
Non-Waste	Artificial recharge Enhanced/steam recovery Geothermal discharge Ground water heat pump discharge

Table 4.2b. Sources of ground water contamination.

CATEGORY II *Sources designed to store, treat, and/or dispose of substances; discharge through unplanned release*	
Source	**Examples/Related Business**
Landfills	Industrial hazardous waste Industrial non-hazardous waste Municipal sanitary
Open dumps	Abandoned dumps Illegal dumps
Residential disposal	Trash burning residue Waste oil disposal
Surface Impoundments	Food processing Industrial processing Sewage lagoons
Waste tailings	Acid mine drainage Mine tailings
Waste piles	Asphalt and construction debris Agricultural wastes Animal wastes Community compost piles Food processing wastes Wood wastes
Materials stockpiles	Animal feed piles Battery storage Coal storage Fertilizer piles Junkyards Road salt storage Scrapyards
Graveyards	Human burial (embalming chemical contamination)
Animal burial	Animal burial

Table 4.2e. Sources of ground water contamination.

CATEGORY II (Continued) *Sources designed to store, treat, and/or dispose of substances; discharge through unplanned release*	
Source	**Examples/Related Business**
Above ground storage tanks	Chemical storage Fertilizer storage Fuel storage - home/business Lubricant storage Pesticide storage Solvent storage Tank farms Transportation maintenance shops Waste/used material storage
Underground storage tanks	Chemical storage Fertilizer storage Fuel storage - home/business Lubricant storage Pesticide storage Solvent storage Transportation maintenance shops Waste/used material storage

continue supplying water to its customers, who is responsible for determining the problem, where are the funds to deal with the situation, etc. A difficult situation can be made much easier if there has been some planning. Since most of these responsibilities already lie with the water purveyor, the development of contingency plans for wellhead protection should be with the water purveyor.

Wellhead Protection for New Wells

Wellhead protection also applies to potential and new wells. New wells need to be sited in appropriate locations that limit the chance that it could become contaminated from existing sources. For example, suppose there were two well locations, one in a downgradient direction from an established heavy industrial zone and the other away from any industry and located in a sewered residential zone. Which well location would probably be the least likely to become contaminated, all other factors being equal.

Another consideration to protect new wells from becoming contaminated is well construction. Well construction should include an adequate surface seal and limit the interconnection of aquifers. Many wells are believed to have become contaminated due to inadequate well construction.

The last consideration is to incorporate new wells into the local wellhead protection program. The delineation of new wellhead protection areas should be consistent with those of existing wells and the management of the wellhead protection areas should be at least as stringent as for existing wellhead protection areas. The water purveyor and local government will need to work cooperatively to plan, site, and protect potential well locations.

Public Participation and Education

This component is the cornerstone of any wellhead protection program. Emphasis has been placed on public participation and education because there can only be support for the program if the public understands basic ground water and drinking water concepts and is a part of the decision to develop and implement wellhead protection plans. Once this decision is made, the state Wellhead Protection Plan can provide guidance on how to prevent drinking water from becoming contaminated.

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GLOSSARY

Adsorption: Adherence of gas molecules, ions, or molecules in solution to the surface of solids.

Advection: The process by which solutes are transported by the motion of flowing ground water.

Alluvium: Sediments laid down by physical processes in river channels, floodplains and fans at the foot of mountain slopes.

Anion: Ion that has a negative electrical charge; nitrate and chloride, for example.

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

Aquiclude: A saturated rock unit with very low hydraulic conductivity which impedes ground water flow.

Artesian: Water which occurs at greater than atmospheric pressure.

Artesian aquifer: See confined aquifer.

Artesian well: A well tapping a confined aquifer in which the static water level is above the top of the aquifer.

Basalt: A fine-grained, dark-colored volcanic rock, composed mainly of magnesium and iron-rich minerals.

Basement rocks: Igneous or metamorphic rocks which underlie stratified sedimentary rocks.

Bedrock: Consolidated (solid) rock which underlies soil or other unconsolidated material.

Biodegradation: Transformation of an organic compound into new compounds through biological activity. For example, toxic organic molecules may be degraded into smaller, less toxic (or sometimes more toxic) molecules by microbes in soil.

Bore hole: An uncased drilled hole.

Dikes:	Sheets of igneous rock, typically vertical or steeply inclined, which cut across older, preexisting rocks and represent ancient channelways of upward rising magma. Molten basalt flowed upward through dikes, then outward across the Snake River Plain and Columbia Plateau.
Dip:	The angle of inclination of a rock unit, measured in degrees from an horizontal plane.
Discharge area:	The area in which ground water moves upward, toward the water table and may escape as a spring, seep, or surface stream, or may evaporate.
Dispersion:	The process by which a solute in ground water is mixed with uncontaminated ground water, becomes more widespread and is reduced in concentration.
Domestic withdrawals:	Water used for normal household purposes drinking, bathing, washing clothes, food preparation, and watering lawns and gardens.
Drawdown:	The difference between the water level in a well before pumping and the water level in the well during pumping.
Dry well:	A well which does not extend into the saturated zone.
Elevated:	Concentration of a contaminant in ground water that is significantly above the natural background level but below the concentration level considered harmful to human health.
Eutrophication:	The reduction of dissolved oxygen in lakes, often as a result of nutrient loading and increased algal populations. Eutrophication leads to the deterioration of the aesthetic and life-supporting qualities of a lake.
Free product:	A condition of petroleum contamination of ground water where petroleum product is floating on the surface of the water table or is perched on a rock layer that prevents its infiltration downward.
Fresh water:	Water that contains less than 1,000 mg/L of dissolved solids. Water which contains less than 500 mg/L dissolved solids is better suited for drinking.

In situ bioremediation: The use of soil microbes to clean contaminated ground water within the aquifer.

Ion: A positively or negatively charged atom or group of atoms.

Ion exchange: The reversible chemical replacement of an ion bonded at the liquid-solid interface by an ion in solution.

Joints: Fractures in rock, in which movement has been perpendicular to the fracture plane. Joints form in basalt as it cools and in granite and sedimentary rocks, due to stresses.

Landfarm: A facility where sewage wastes are spread on the ground for washing and drying.

Lithology: The physical character of rocks.

Local flow: Small scale systems of ground water flow within the larger regional flow system.

Loess: A widespread, fine-grained blanket of wind deposited silt, clay and fine sand.

Maximum Contaminant Levels (MCL): Health standards established by the state and federal government (Environmental Protection Agency, 1990).

Metamorphic rock: Any rock formed by the alteration of preexisting rocks, as a result of heat, pressure and/or chemically active fluids deep within the earth.

Metasediment: A sedimentary rock which shows signs of having undergone metamorphism.

Monitoring well: A well used to measure ground water levels and to obtain water samples for chemical analysis.

Nonpoint source: Supply of contamination to ground water or surface water from a broad or diffuse area. Automobile emissions, storm water runoff, etc. are common nonpoint source pollutants of water.

Organic chemical: A compound, natural or manmade, which contains carbon.

Quaternary: The second period of the Cenozoic era. It began two to three millions years ago and extends to the present, encompassing the Pleistocene and Holocene epochs.

Radionuclide: A species of atom that emits alpha particles, beta particles or gamma rays for a measurable length of time.

Recharge: The addition of water to the ground water system by natural or artificial processes.

Recharge area: An area over which recharge (commonly precipitation) occurs.

Regional flow: The large scale direction, rate and preferential pathways of a ground water flow system.

Remediation: The process of cleaning a contaminated area, to restore or improve the quality of ground water.

Runoff: The portion of precipitation that remains on the surface of the earth in lakes, streams or overland flow.

Saline water: Water which is unsuitable for human consumption or for irrigation because of high amounts dissolved solids.

Saturated zone: The area underground in which all voids in the rock or sediment are filled with water.

Sediments: Assemblages of individual rock grains deposited by wind, water, ice or gravity.

Sedimentary rocks: Rocks formed by the accumulation, compaction and lithification of sediment.

Sole source aquifer: An aquifer designated by the EPA as the "sole" water supply source in an area. The aquifer must be the principal source of water and supply 50% or more of the drinking water for the area. The Rathdrum Prairie aquifer was designated as a sole source aquifer by the EPA in 1978.

Soil: Unconsolidated natural materials, near the earth's surface, which support plant life and are typically organic-rich.

Well casing: A solid piece of pipe, typically PVC plastic or steel, used to keep a well open in unconsolidated sediments or unstable rock.

Well field: Two or more wells pumping from the same aquifer.

Well interference: The cumulative effect of pumping two or more wells whose drawdown cones intercept. The total well interference at a given location is the sum of the drawdowns due to each individual well.

Zone of contribution: The area surrounding a well from which water is drawn into the well during pumping.

Zone of influence: The area surrounding a well in which drawdown of the aquifer occurs during pumping. The outer limits of the cone of depression define the zone of influence.

Unit of measurement of dissolved constituents in water:
mg/L--milligrams of solute per liter of solution.
μg/L--micrograms of solute per liter of solution.
ppm--parts per million (mass of solute per 1,000,000 mass units of solution.)
ppb--parts per billion (mass of solute per 1,000,000,000 mass units of solution.)

Appendix

ORDINANCE NO.______________

An Ordinance relating to the construction, alteration, operation and maintenance of individual subsurface sewage disposal systems and commercial and light industrial subsurface sewage disposal systems and amending the Comprehensive Land Management Code of the Township of Sparta by adopting N.J.A.C. 7:9A Standards for Individual Subsurface Sewage Disposal Systems adopted July 28, 1989 and adding thereto the following Section entitled "Standards for Individual, Commercial, and Light Industrial Subsurface Sewage Disposal Systems and Groundwater Protection":

RECITALS:

WHEREAS, the New Jersey Department of Environmental Protection ("DEP") has amended its regulations regarding the standards for individual subsurface sewage disposal systems, N.J.A.C. 7:9A-1.1 et seq.; and

WHEREAS, the purpose of the DEP's amended regulations is to:

(i) prevent pollution of the waters of the State as a result of improper location, design, construction, installation, alteration, operation or maintenance of individual subsurface sewage disposal systems;

(ii) provide standards for the proper location, design, construction, installation, alteration, operation and maintenance of individual subsurface sewage disposal systems;

(iii) protect the public health and safety;

(iv) protect potable water supplies; and

(v) safeguard fish and aquatic life and ecological values; and

WHEREAS, the Township Council of Sparta has authority to regulate the design, construction, alteration, operation and maintenance of individual subsurface sewage disposal systems pursuant Sections 2-1 and 2-3 of the Faulkner Act, N.J.S.A. 40:69A-26 and 28; the Realty Improvement Sewerage and Facilities Act, N.J.S.A. 58:11-23 to -42; and N.J.S.A. 26:3-31 and -45 to -47, and has the authority to manage land use under Chapter XVIII of The Comprehensive Land Management Code of the Township of Sparta; and

WHEREAS, the Township Council of Sparta Township has determined that additional, more stringent standards than those promulgated by DEP for certain commercial and light industrial subsurface sewage disposal systems are necessary to protect the public health and the environment within the Township of Sparta;

WHEREAS, the Township Council of Sparta supports the

Section 3. SCOPE

This Ordinance prescribes procedures for the operation and maintenance of subsurface sewage disposal systems serving commercial, and light industrial facilities in the ED Zone.

This Ordinance also prescribes development standards and requirements for the protection of Sparta Township's water supply by managing not only subsurface sewage disposal systems, but also those activities, along with the chemicals, substances, and materials used in the performance of those activities, that have been found to be detrimental to the local groundwater system.

Section 4. DEFINITIONS

(a) All definitions given in Subchapter 2 of the DEP Standards for Construction of Individual Subsurface Sewage Disposal Systems, N.J.A.C. 7:9A-1.1 et seq., and any amendments thereto, ("DEP Regulations") are hereby incorporated into this Ordinance, with the following additions:

(b) "Certificate of Compliance" means a certification issued by the Health Officer stating that the septic system is in compliance with this ordinance for the prescribed period.

(c) "Completed Alteration/Pumpout Report" means a report submitted to the Health Officer by an Owner/Operator indicating that the required pumpout or alteration of the individual subsurface sewage disposal system has been completed in accordance with the Notice of Pumping, Alteration, or Repair.

(d) "Completed Inspection Certificate" means a certificate submitted to the Health Officer by an Owner/Operator indicating that the required inspection of the septic tank has been completed in accordance with the Notice of Pumping, Alteration, and Repair.

(e) "Educational Program" means an educational program prepared and administered by the Health Officer regarding the fundamentals of individual subsurface sewage disposal systems and the proper procedures for the operation and maintenance of such systems.

(f) "Environmentally Hazardous" means those chemicals, substances, or materials that are defined as hazardous in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Section 101(14) of CERCLA also defines as hazardous:

1) any hazardous substances designated pursuant to Section 311(b)(2)(A) of the federal Clean Water Act;

2) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of CERCLA;

3) any hazardous waste regulated under the federal Resource Conservation and Recovery Act;

(p) "Survey and Inventory of Commercial/Industrial Facilities" means a report which follows the format prescribed by the Health Officer pursuant to Section 7 of this ordinance, and is certified by a Professional Engineer and submitted by the facility owner to the Health Officer, which discloses operational procedures and processes pertinent to the purposes of this ordinance.

Section 5. GENERAL REQUIREMENTS FOR THE CONSTRUCTION, INSTALLATION, ALTERATION AND OPERATION OF INDIVIDUAL SUBSURFACE SEWAGE DISPOSAL SYSTEMS

No business, corporation, establishment, organization, or entity shall construct, install, alter, or operate an individual subsurface sewage disposal system unless such construction, installation, alteration, or operation is in accordance with the DEP Regulations, this Ordinance, and any regulations promulgated hereunder by the Health Officer.

Section 6. PERMITTED USE IN THE ECONOMIC DEVELOPMENT ZONE OVER THE GERMANY FLATS AQUIFER

The following uses are permitted within the Economic Development Zone overlying the Germany Flats Aquifer provided that all permits, compliances, and approvals required by local, state, and federal law shall have been obtained:

(a) All uses currently permitted under Chapter XVIII of the Comprehensive Land Management Code of the Township of Sparta are permitted in the Economic Development Zone overlying the Germany Flats Aquifer subject to the provisions of this Ordinance.

(b) Notwithstanding any other requirement herein, a nonconforming use within the ED zone may be continued and maintained so long as this use remains otherwise lawful. No such use shall be enlarged, altered, extended, or operated in any way as to increase the threat of groundwater contamination or otherwise contravenes with the purpose and intent of this Ordinance.

(c) If a nonconforming use has ceased for a consecutive period of one (1) year, such a nonconforming use may not be resumed except in conformity with the requirements of operation within the ED zone.

Section 7. RESTRICTIONS AND REQUIREMENTS FOR OPERATION WITHIN THE ECONOMIC DEVELOPMENT ZONE

I) Prohibited Uses and Activities

The following activities shall be prohibited in the ED zone overlying the Germany Flats Aquifer, unless these activities have commenced before the effective date of this Ordinance and are otherwise lawful and are in conformance with all local, state, and preparation, dishwashing, laundry facilities, manufacturing processes, etc.;

d) Declaration of the types and amounts of chemicals, substances, and materials, hazardous and potentially hazardous, used and consumed in the operation of the facility itself, or used in the manufacturing process performed at this location;

e) The method of storage and transport of any hazardous and potentially hazardous chemicals, substances, or materials used and/or consumed in the manufacturing process or in the operation of the facility itself;

f) A description of how chemicals, substances, and materials are used in the operation of the facility itself, and/or how they are used in the manufacturing process performed at this location;

g) A description of the transport and disposal methods for used hazardous chemicals, substances, and materials and other liquid and solid wastes. Copies of manifest reports or any existing Best Management Practice Plans or other plans or methodology generated as part of existing State or Federal regulatory programs must be submitted as part of the survey.

(2) The Health Officer may waive certain survey submittal requirements based on prior knowledge of the property and operation of the facility.

(3) The Health Officer reserves the right to initially and periodically perform a visual site inspection and a "walk through" inventory of activities at the site of the commercial or industrial use.

(4) Any change in the use of chemicals, substances, and hazardous and potentially hazardous materials, manufacturing or related processes, or type of business or ownership, or any expansion of existing operations or facilities, will necessitate a new or amended survey, also certified by a licensed Professional Engineer.

(5) If information provided in the Survey and Inventory as described above warrants, in the sole and absolute discretion of the Sparta Township Health Officer, the implementation of discharge monitoring requirements so as to achieve the stated purposes of this ordinance, said facility located or wishing to locate in the ED zone shall be required to submit an analysis of its wastewater effluent each year of the first three years of the licensing period. Each facility shall submit discharge sampling analysis results of wastewater effluent collected and tested to the Health

polluting agents;

c) re-evaluation of the Survey and Inventory of Commercial/Industrial facilities;

d) modification of the manufacturing process that has been deemed the cause of the contamination;

e) resampling as deemed necessary by the Health Department.

(7) If warranted, in the sole and absolute discretion of the Health Officer, each owner of a facility located or seeking to locate in the ED zone shall, at its' own expense, shall install one or more groundwater monitoring wells as determined by and in a manner approved by the Health Officer. Every owner shall, at its' own expense, sample groundwater in each monitoring well semiannually, or at a frequency determined by the Health Officer, and obtain independent analytical results of the presence and concentrations of those chemicals, substances, or materials found in each monitoring well. The analytical results shall be obtained through the use of standard methods by a State certified lab. The results shall be submitted to the Health Officer within thirty (30) days after the test is performed.

Nothing in this requirement shall be construed to limit or to alter the authority of the Health Officer to conduct independent analyses if the test results obtained from the facility or test methods used by the facility or their authorized agents are inaccurate or are suspected of being inaccurate.

(8) If it has been determined that any hazardous chemicals, substances, or materials are present in unacceptable amounts or concentrations or that any potentially hazardous chemicals, substances, or materials are present in such quantities as to compromise the quality and integrity of the local groundwater system, and it has also been found that the local groundwater has been contaminated, it shall be the responsibility of the owner of that facility to report such an occurrence to the appropriate State Department of Environmental Protection Agency (NJDEP) for their response. At a minimum, the owner of the facility shall formulate and implement a groundwater clean-up strategy for the affected areas of the groundwater system. A document outlining this strategy must be submitted to the Health Officer no later than fifteen (15) days after groundwater contamination has been confirmed. This document must contain the following information:

a) A list of types, quantities, and concentrations of contaminants present in each monitoring well;

b) Method of clean-up;

c) Method of future contamination prevention. If case, a new and amended survey must be certified by a Professional Engineer and submitted by the licensee to the Health Officer;

(2) has submitted all results of the wastewater and effluent tests performed along with all information specified above;

(3) has submitted all results of groundwater monitoring analysis, if applicable, along with all information specified above;

(4) has submitted clean-up strategy and all information specified above, if applicable;

(5) has submitted to the Health Officer evidence that the necessary maintenance has been performed on its subsurface sewage disposal system as prescribed in N.J.A.C. 7:9A-12.3;

(6) has submitted applicable written documentation as to the transport and ultimate destination of any wastewater or other items identified in the Survey as being treated off site,

(7) has had their individual subsurface sewage disposal system inspected pursuant to Section 8 below;

(8) has paid any and all fees due and owing to the Health Officer under this Ordinance; and

(9) has received the educational program materials.

Section 9. INSPECTIONS

(a) Inspections for all new systems shall take place every 3 years after installation according to Chapter 199, unless the system was not pumped out at the time the system was last inspected. In this case, inspection will be required yearly until the system is pumped out.

(b) Inspections shall take place when any system installed after January 1, 1990 is altered.

(c) The Health Officer shall ensure that inspection of an individual subsurface sewage disposal system shall take place prior to the expiration of the Operator's License. The Health Officer shall notify the licensee prior to the expiration of the Operator's License. Failure to receive renewal notification does not preclude or waive license requirements.

(d) Inspection forms that are in accordance with Chapter 199 or are more stringent than Chapter 199 as approved by the Township shall be used in the inspection of individual subsurface hereby declared a nuisance.

Section 12. ENFORCEMENT AND PENALTIES

(a) The Health Officer shall enforce the provisions of this Ordinance pursuant to (section of the Sanitary/Zoning Code regarding general enforcement procedures).

(b) Any person who violates any provision of this Ordinance, any rules or regulations of the Health Department promulgated hereunder, or any term or condition of any permit or license issued by the Health Officer shall be liable for a civil penalty in the amount of ___________ maximum $500, N.J.S.A. 26:3-70).

(c) Any person who fails to comply with any notice or order issued by the Health Officer pursuant to this Ordinance shall be liable for a civil penalty in the amount ___________________(same maximum).

(d) Each violation for each separate day and each violation of any provision of this Ordinance, any rule or regulation of the Health Department, any term or condition of any permit or license, or any notice or order issued by the Health Officer shall constitute a separate and distinct violation under this Section 10.

(e) The Health Officer shall enforce and collect all civil penalties assessed under this Ordinance in accordance with N.J.S.A. 26:3-72 to -78.

(f) Nothing in this Section 10 shall be construed as limiting the remedies of the Township to the assessment and collection of civil penalties. In addition to the assessment and collection of civil penalties, the Township may proceed under any other remedy available at law or in equity for any violation of this Ordinance, any rule or regulation of the Township promulgated hereunder, or any term or condition of any permit or license issued by the Health Officer, or for any failure to comply with any notice or order issued by the Health Officer under this Ordinance.

Section 13. APPEALS

(a) If a certificate of compliance is denied by the Health Officer, the applicant may request a hearing before the Township. The Township shall hold a hearing within 15 days of such request in accordance with N.J.S.A. 58:11-31. Upon such hearing, the Health Officer shall affirm, alter or rescind its previous determination and take action accordingly within 15 days after the date of such hearing.

(b) Procedures for appeals from any other actions of the Health Officer pursuant to this Ordinance shall be taken in accordance with Section____ of the Sanitary/Zoning Code of Sparta Township.

Chapter XX

WELL HEAD PROTECTION DISTRICT
of
CITY of TOWNER, ND ORDINANCES

as adopted by City Commissioners ~~1992~~
2-03-1992

PURPOSE AND INTENT

The Towner City Commission recognizes (1) that residents of the City of Towner rely exclusively on ground water for a safe drinking water supply and (2) that certain land uses in McHenry County can contaminate ground water particularly in shallow/surficial aquifers.

The purpose of the Wellhead Protection District is to protect public health and safety by minimizing contamination of the shallow/surficial aquifers of McHenry County. It is the intent to accomplish this, as much as possible, by public education and securing public cooperation.

Appropriate land use regulations will be imposed, however, which are in addition to these imposed in the underlying zoning districts or in other county regulations. It is not the intent to grandfather in existing land uses which pose a serious threat to public health through potential contamination of public water supply wellheads areas.

Section 20.0101 DEFINITIONS

1) AQUIFER. A geological formation, group of formations or part of a formation capable of storing and yielding ground water to wells and springs.

2) BEST MANAGEMENT PRACTICES. Measures, either managerial or structural, that are determined to be the most effective, practical means of preventing or reducing pollution inputs from nonpoint sources to water bodies.

3) BUFFER ZONE. An area outside and adjacent to Zone A that has been delineated to account for possible changes in the boundaries of Zone A due to effects of irrigation pumping.

4) CHEMIGATION. The process of applying agricultural chemicals (fertilizer or pesticides) using an irrigation system by injecting the chemicals into the water.

5) CONTAMINATION. The process of making impure, unclean,

of hazardous materials and cause the release of their contents. Examples: battery acid and phospheric acid.

12) MANURE STORAGE AREA. An area for the containment of animal manure in excess of 8,000 pounds or 1,000 gallons.

13) LEAKS AND SPILLS. Any unplanned or improper discharge of a potential contaminent including any discharge of a hazardous material.

14) PASTURE. A field that provides continuous forage to animals without depletion of forage matter.

15) PRIMARY CONTAINMENT FACILITY. A tank, pit, container, pipe or vessel of first containment of a liquid or chemical.

16) SECONDARY CONTAINMENT FACILITY. A second tank, catchment pit, pipe, or vessel that limits and contains liquid or chemical leaking or leaching from a primary containment area; monitoring and recovery are required.

17) SHALLOW/SURFICIAL AQUIFER. An aquifer in which the permeable media (sand and gravel) starts at the land surface or immediately below the soil profile.

18) TEN YEAR TIME OF TRAVEL DISTANCE. The distance that ground water will travel in ten years. This distance is a function of the permeability and slope of the aquifer.

19) ZONE OF CONTRIBUTION. The entire area around a well or wellfield that is recharging or contributing water to the well or wellfield.

<u>Section 20.0201 ZONES</u>

1) ZONE A - AQUIFER CRITICAL IMPACT ZONES. Zone A, the wellhead protection area, is the zone of contribution mapped around all public water supply wells or wellfields and includes land upgradient to the ten year time of travel boundary plus contributing drainage areas.

(a) Permitted uses provided they meet appropriate performance standards outlined for aquifer protection overlay zones:

1. Agriculture
2. Horticulture
3. Park, greenways or publicly owned recreational areas
4. Necessary public utilities/facilities designed so as to prevent contamination of ground water.

(b) Special exceptions:

(c) Prohibited uses:

1. Fall application of nitrogen fertilizer except spreading of manure.
2. Weedsprays that do not conform to county standards.

(d) Performance standards:
The following standards shall apply to land uses in Zones A and B of the Aquifer Protection Overlay Districts:

1. New or replacement septic tanks and associated drain fields for containment of human or animal wastes must conform with regulations established by the North Dakota State Department of Health.
2. Any facility involving the collection, handling, manufacture, use, storage, transfer or disposal of any solid or liquid material or wastes, except for spreading of manure, in excess of 1000 pounds and/or 100 gallons which has the potential to contaminate ground water must have a secondary containment system which are easily inspected and and whose purpose is to intercept any leak or discharge from the primary containment vessel or structure. Underground tanks or buried pipes carrying such materials must have double walls and inspectable sumps. Pipes installed to carry diluted chemicals for chemigation are exempted and storage of liquid fertilizer for chemigation is allowed as long as a secondary containment system is used. Secondary containment for tanks used for chemigation must be in place by July 1, 1990.
3. Open liquid waste ponds containing materials referred to in (2) above will not be permitted without a secondary containment system except for community wastewater lagoons. Agricultural waste storage ponds are permitted under certain conditions as approved by the City Commission.
4. Storage of petroleum products in quantities exceeding fifty-five (55) gallons at one locality in one tank or series of tanks must be in elevated tanks; such tanks must have a secondary containment system noted in (2) above where it is deemed necessary by the City Commission.
5. Discharge of industrial process water on site is prohibited without City Commission approval.
6. Owners/operators of active or abandoned feedlots shall handle and dispose of manure in accordance with regulations set by the City Commission.
7. Auto service, repair, or painting facilities and junk or salvage yards in Zone B shall meet all

quantity at any one time.

The City Inspector shall be informed within 24 hours of all leaks and spills of materials that might potentially contaminate the water.

9. Since it is known that improperly abandoned wells can become a direct conduit for contamination of ground water by surface water, all abandoned wells should be plugged.

Section 20.0301 SCOPE

The provisions of this article shall apply to all wells or other openings greater than fifteen (15) feet in depth. Furthermore, the owner of any proposed well shall be required to apply and receive from the City Commission a permit to construct such a well or opening, the application for which shall supply all the information required under Section 20.0501, and for such permit the Council shall charge and receive the fee hereinafter provided for.

Section 20.0401 PERMIT

1) A permit shall be granted when the City Inspector has examined the application and determined that the proposed use, activity, or development meets the performance standards.

2) In securing a use permit, the owner/developer must make future improvements which may become necessary to prevent contamination of shallow/surficial aquifers and the owner/developer must allow City personnel to inspect any improvements to verify they meet the performance standards.

3) Whenever any person has obtained a permit and thereafter desires alteration of the authorized use, such persons shall apply for a new permit. The owner may appeal a City Inspector's decision to modify or deny a requested permit.

4) It shall be unlawful for any person to drill or otherwise construct, repair, correct, abandon or plug a well, or to engage upon such work, within the limits of the area, or to employ anyone else to engage in such work, without first applying for and securing a permit from the City Commission or a duly authorized agent thereof. Such permit may be granted with the approval of the City Commission to any person who files with such Commission the application hereinafter provided for and pays the fee hereinafter required, and complies with all other provisions of this article applicable to him.

of the violation, the city in good faith determines that the violator is unwilling to participate in informal reconciliation and take the corrective actions prescribed, the city shall notify the violator by mail of the termination of the informal reconciliation.

(e) The city make take the corrective action prescribed above following thirty (30) days after notifying violator by mail of the notice of termination of the informal reconciliation, and bill the violator for the reasonable cost of such action.

2) Criminal Enforcement:

(a) In lieu of proceeding under Section 20.0701, a person who is alleged to have violated Sections (c) and (d) may be prosecuted for the commission of a crime. Violation of Section (c) and (d) is a misdemeanor and may be punished by imprisonment of not more than ninety (90) days or imposition of a fine of not more than $700.00 or both.

SECTION 20.0801 SAVING CLAUSE

1) Should any section or provision of this ordinance be declared invalid, such decision shall not affect the validity of the ordinance as a whole or any other part thereof.

First Reading 2-03-1992

Second Reading 3-02-1992

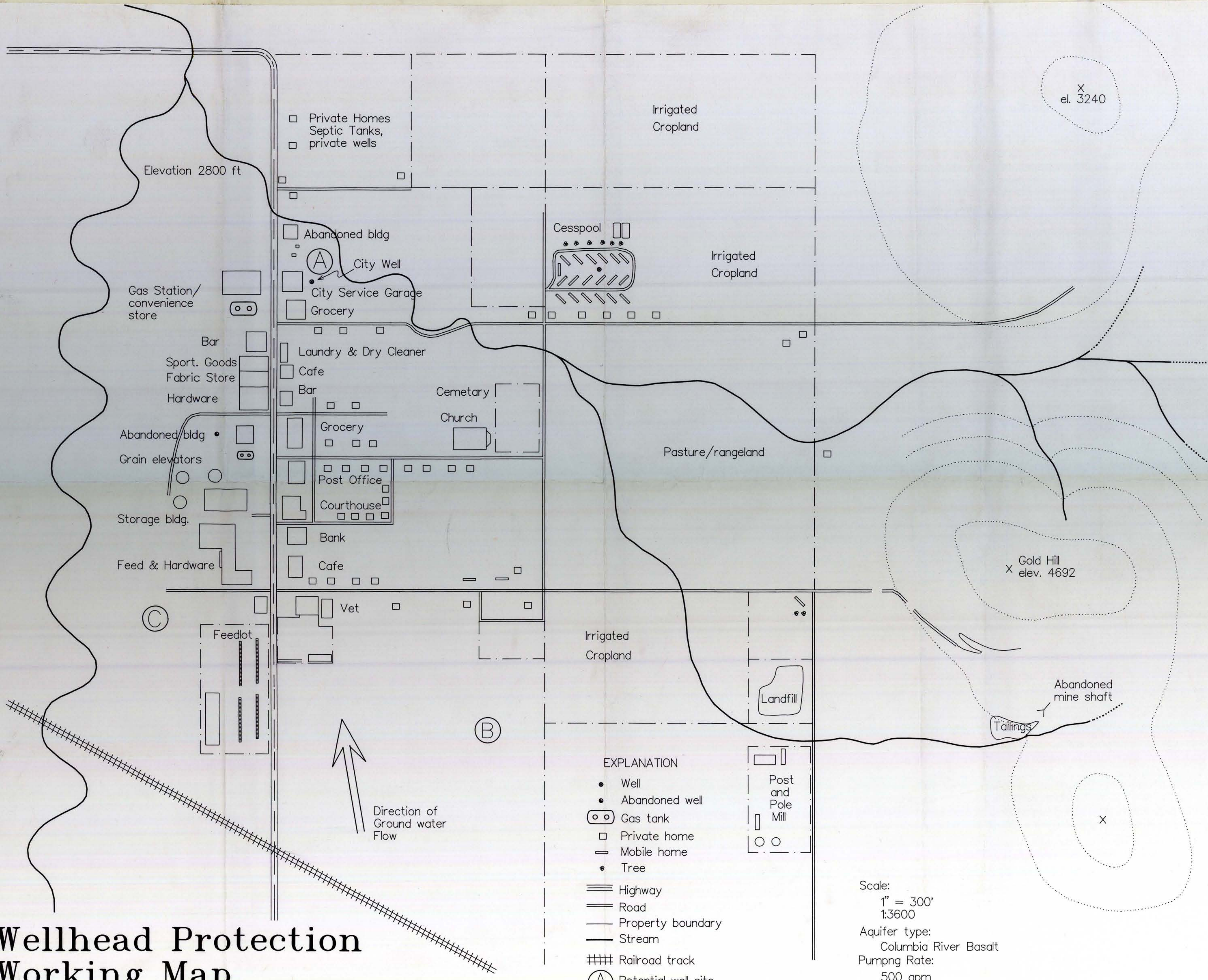
Passage 3-16-1992

Approved 3-16-1992

Clarine Pottenger, Auditor

Steve Zimmerman, President
City Commission

Wellhead Protection Working Map



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