DRINKING WATER PROTECTION PLAN

City of Florence
Florence, Oregon

DECEMBER 2003

Prepared

by

Oregon Department of Human Services
Health Services
Drinking Water Program

Oregon Department of Environmental Quality
Water Quality Division
Drinking Water Protection Program

Brown and Caldwell Consultants
AND
City of Florence Drinking Water Protection Committee

Completed with funding assistance from Oregon Department of Land Conservation and Development Technical Assistance Grant

oregon department of human services

DEQ
State of Oregon
Department of Environmental Quality

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DEFINITION OF TERMS

DEQ/ODEQ	**Oregon Department of Environmental Quality**
ODHS	**Oregon Department of Human Services**
DWPA	**Drinking Water Protection Area**
EPA	**U.S. Environmental Protection Agency**
GIS	**Geographic Information System**
IOCs	**Inorganic Compounds**
IP	**Infiltration Potential**
ODA	**Oregon Department of Agriculture**
PCSs	**Potential Contaminant Sources**
RCRA	**EPA Resource Conservation Recovery Act**
SOCs	**Synthetic Organic Compounds**
TOT	**Time of Travel**
TP	**Traverse Potential**
VOCs	**Volatile Organic Compounds**
WHPA	**Wellhead Protection Area**

City of Florence
Drinking Water Protection Plan

Executive Summary

The Safe Drinking Water Act of 1974 provided the statutory basis for designation of sole source aquifers by the Environmental Protection Agency (EPA). A sole source aquifer is an aquifer which is the sole or principle drinking water source for the area (50 percent or more) and which, if contaminated, would create significant hazard to public health. The City of Florence's drinking water source, the North Florence Dunal Aquifer, has been designated as a sole source aquifer. The City in order to protect its drinking water source, a goal made even more important due to the sole source designation of its aquifer, has worked to successfully complete this Drinking Water Protection Plan.

The Source Water Assessment Program, mandated by the 1996 Amendments to the Safe Drinking Water Act, requires that states provide the information needed by public water systems to develop drinking water protection plans if they choose. The source water assessment includes the identification of the area most critical to maintaining safe drinking water, i.e., the Drinking Water Protection Area (DWPA), an inventory of potential sources of contamination within the DWPA, and an assessment of the relative threat that these potential sources pose to the water system. The wellhead protection plan for the City of Florence (City) includes the source water assessment, management strategies for potential contaminants, contingency plan, and an analysis of a potential new well field to assist in planning for future water supply.

The DWPA for the City is identified as the ground surface overlying the critical portion of the aquifer that supplies groundwater to the City's wells. This aquifer has been identified as fine- to medium-grained sand and is of the Florence Dunal Aquifer. According to well logs, groundwater occurs at depths ranging from 13 to 70 feet below the surface. The aquifer is considered to be shallow and unconfined.

The aquifer is considered highly sensitive because of its shallow unconfined nature, the highly permeable geologic material separating the aquifer from the surface, and the high infiltration potential that exists. The presence of highly permeable soils within the DWPA, the high number of other wells in close proximity to the well field and the age of City wells numbers 1 and 2 also contribute to the overall sensitivity of the drinking water supply.

Potential Contaminant Source Inventory

An inventory of potential contaminant sources (PCSs) was performed with the assistance of representatives from the City within the DWPA. The primary intent of this inventory was to identify and locate significant potential sources of contaminants of concern. The inventory was conducted by reviewing applicable state and federal regulatory databases and land use maps, interviewing persons knowledgeable of the area, and conducting a windshield survey by driving through the DWPA to field locate and verify as many of the PCS activities as possible. It is important to remember the sites and areas identified are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.

The City's DWPA contains 7 operating wells with an additional 5 wells that were drilled during the summer of 2003 and will be placed into operation in the spring of 2004. The delineated DWPA for all 12 wells is primarily dominated by residential and municipal land use. Four PCS's were identified in the 2-year time-of-travel zone of the DWPA. They include a golf course, high density housing, a drinking water treatment plant, and City sewer lines. Three PCSs (an RV park, stormwater outfalls, and a lake), were identified within the 5-year and 10-year time-of-travel zones. Area-wide potential sources such as the golf course, high density housing, and City sewer lines extend from the 2-year time-of-travel zone into the 5-year and 10-year time-of-travel zones. All of the potential sources pose a relatively high to moderate risk to the drinking water supply with the exception of the RV park, stormwater outfalls, and the lake, which pose a lower risk. One PCS, a transportation corridor, was identified outside the delineated DWPA; however, this source poses a relatively moderate degree of potential contamination risk and is therefore included in this inventory.

The size of the DWPA is designed to approximate the next 10 to 15 years of groundwater supply for the City of Florence Public Water System, depending on the type of delineation method. The DWPA for the City of Florence is shown in Figure 1b (Appendix B). Additional 5-year, 2-year, and 1-year "time-of-travel" zones are identified inside the DWPA. The 2-year time-of-travel zone shown on the map is specifically used as a conservative estimate of the survival time of some viruses in groundwater. Based on assessment results, the aquifer is considered to be highly sensitive to contamination. Given that viral contaminant sources have been identified inside the 2-year time-of-travel zone for the DWPA, e.g., sewer lines and residential housing, the drinking water supply is considered to be susceptible to viral contamination.

The costs associated with contaminated drinking water are high. Developing an approach to protect that resource will reduce the risks of a contamination event occurring. This report, summarizes the local geology and well construction issues as they pertain to the quality of the City's drinking water source. The DWPA is the most critical area to protect and preserve water quality, therefore, potential sources of contamination within that area were identified. Management strategies have been developed for each land use type identified as a potential risk. A contingency plan has also been developed to respond to incidents that impact the City's ability to provide water supply during an emergency. Finally, information is provided to assist planning efforts associated with development of a future well field.

1. Introduction

1.1 Source Water Assessment Project

Traditionally, water systems have relied on proper water system management, water quality monitoring and, if necessary, water treatment to ensure that the water they provide meets drinking water standards. In spite of the best of these efforts, contamination of drinking water still occurs. The costs, both tangible and intangible, to a water system contending with a contaminated water supply are significant. At a minimum, there is the cost of increased monitoring that will be required to make certain that the water does not pose a significant health risk. At contaminant concentrations exceeding drinking water standards, the system may be burdened with the cost of installing and maintaining additional treatment processes, the loss of the drinking water source, and most assuredly, a concerned and often frightened public.

Beginning with the 1986 Amendments to the Safe Drinking Water Act, an additional "barrier to contamination" was recognized at the federal level. A shift from the "reactive" approach of water treatment to a "proactive" approach of prevention began to occur. Although water treatment may be necessary in some cases, it is much more cost effective to prevent the contamination from happening in the first place. The Oregon Department of Environmental Quality (DEQ) and the Oregon Department of Human Services (ODHS) Drinking Water Program recently compared the estimated cost of prevention (less than $15 per resident) to the actual cost of investigation and treatment (more than $1,500 per resident) in a small Oregon community (population 330) impacted by a volatile organic contaminant that exceeded the drinking water standard.

Oregon has a Drinking Water Protection Program in place for groundwater systems, i.e., wells and springs. In order to protect a drinking water resource, a water system must know where the drinking water comes from, what potential sources of pollution exist, and what level of threat each presents to the system's drinking water. Until recently, the costs associated with acquiring this information were the responsibility of the water system, a financial burden that even the most proactive water systems found difficult to meet. The 1996 Amendments to the Safe Drinking Water Act lifted that burden from water systems by requiring that the states conduct Source Water Assessments for federally recognized public water systems that fall under state regulative authority. The purpose of the Assessment is to provide the water systems with the information that they need to develop a strategy to protect their source of drinking water if they choose.

As mandated by the 1996 Amendments, a Source Water Assessment consists of the following:

1. The identification of the area that directly overlies that part of the aquifer supplying drinking water to the well or spring,
2. An inventory of potential sources of contamination within that area, and
3. The evaluation of the susceptibility of the water system to contamination from those sources.

Funding for assessments was provided to the states through the Act as part of the state's Drinking Water Revolving Loan Fund.

The DEQ and ODHS worked with a citizen's advisory committee and with the ODHS Drinking Water Advisory Committee to design a program that would meet the needs of Oregon's public water systems. The U.S. Environmental Protection Agency (EPA) has certified that Oregon's plan meets the requirements of the Safe Drinking Water Act. Within the program, ODHS has the responsibility of working with groundwater systems and the DEQ works with surface water systems and conducts all potential contaminant inventories.

This report contains general descriptions of the various elements of the Source Water Assessment Program, as well as specific information identifying the DWPA for the City's water system and an inventory of the potential threats to drinking water quality. Although developing a Drinking Water Protection Plan is voluntary in Oregon, it is hoped that the information provided in the Source Water Assessment Report will be used as a basis for reducing the risk of contamination to the water supply. Risk reduction can be accomplished by correcting intake construction and/or set back deficiencies that contribute to water system susceptibility and by implementing Best Management Practices for identified PCSs. The bulk of the risk reduction recommendations center on developing a "state certified" Drinking Water Protection Plan, and providing information to those residences, agricultural operations and businesses, etc., that live or operate within the identified protection area.

1.2 Groundwater Basics

In order to protect a groundwater source of drinking water, it is important to understand how the groundwater system works, e.g., where groundwater comes from, how it occurs in the subsurface, how it moves, and how it can become contaminated. Included in Appendix G of this report is a Fact Sheet about groundwater that can be used to help increase the awareness of others regarding groundwater and its susceptibility to contamination.

When a well is drilled, the drilling equipment first passes through the vadose zone until it encounters the water table. Within the vadose zone, the open pore spaces between soil and sediment particles and/or the open fractures within the bedrock material are only partially filled with water. Most of the open pore/fracture space is filled with air, therefore, little if any water can be obtained from this zone. The water table marks the top of the saturated zone, where the open pore/fracture spaces are, for the most part, completely saturated (full) with groundwater. It should be understood that within the saturated zone, groundwater does not occur as underground rivers, lakes, or veins. An aquifer is any geologic material located below the water table (and is therefore water saturated) that can yield an adequate water supply to a well. Geologic materials that tend to yield large quantities of water to wells include sand and gravel deposits, porous lava flows, and fractured bedrock.

Groundwater is part of the hydrologic cycle which controls the distribution of water on the earth's surface. Groundwater is therefore linked to other water sources, notably surface water such as streams, rivers, and lakes. Groundwater originates as precipitation at the earth's surface which sinks through the soil and percolates down to the water-table. Because groundwater originates at the surface it's vulnerable to contamination. As recharging groundwater moves downward through the soil it comes in contact not only with the geologic materials present, but also with any contaminants contained within the soil. Therefore, recharging groundwater can carry contaminants downward to the aquifer. Likewise liquid chemicals, if present in large enough quantities, can enter the aquifer by following the same path as recharging groundwater.

The direction and speed with which groundwater moves are controlled by the slope of the water-table and aquifer permeability. The slope of the water table often mimics, in a subdued sense, the earth's surface with groundwater moving from high areas to low areas. Aquifer permeability is a measure of how easy it is for groundwater to move through the geologic material that makes up the aquifer. Geologic materials with greater permeability allow groundwater to move with less restriction. In general, groundwater movement is measured in terms of a few inches to a few feet per day. A pumping well can significantly influence the speed and direction of groundwater movement by drawing the water table down in its vicinity, creating a depression in the water table. As the well continues to pump, the depression in the water table spreads out through the aquifer and leads to the formation of a "capture zone." Groundwater inside the capture zone is eventually pumped to the earth's surface by the well.

When wells are used as a water source, the DWPA is set by delineating those portions of the capture zone around the well(s) where, on average, it will take 15 or 10 years (depending on the delineation technique used) for water moving through the aquifer to arrive at the well. Five-, 2-, and 1-year capture zones are also identified around the well(s) to enhance the overall usefulness of the DWPA.

2. City of Florence Water System Information

2.1 Location of the Drinking Water Source

Location of the City's existing drinking water source (7 existing wells) is shown in the following table. Horizontal datum for the coordinates are per North American Datum of 1983/1991 (NAD 83) and based on Lane County control monuments L861 (1535) and L872 (1546) from data printed May 4, 1995.

Source	Northing	Easting
Well 1 - Source AA	867118.79	3976166.86
Well 2 - Source AB	866504.87	3976350.85
Well 3 - Source AC	866362.31	3976800.75
Well 4 - Source AD	866847.92	3976886.74
Well 5 - Source AE	868502.23	3976556.90
Well 6 - Source AF	867978.31	3976536.35
Well 7 - Source AG	867480.53	3976520.30

In addition to the City's existing 7 wells, 5 additional wells were under construction in 2003. These new wells generally located to the north-east of the existing wells are at the following locations:

Source	Northing	Easting
Well 8	867,308.98	3,976,943.41
Well 9	868,243.67	3,976,983.47
Well 10	868,786.75	3,976,961.36
Well 11	869,351.13	3,977,034.47
Well 12	869,888.15	3,977,056.50

2.2 Source Construction

The City of Florence consists of seven wells installed between 1964 and 1994 and five additional wells under construction in 2003. Each of the wells is constructed in a manner consistent with Standards for Construction as outlined in Oregon Administrative Rules (OAR's). Each of the wells has a concrete pad and locked enclosures to protect the wellheads from surface water contamination and public trespassing, respectfully. Each of the wells is located on City owned property. The following paragraphs provide additional explanation of the specific construction details for each of the seven existing wells. Appendix D includes a summary table of the seven existing wells along with OWRD construction logs.

No official well report for well 1 could be located. No information regarding the depth of the aquifer, static water level, or the placement of a casing seal is known. A 1964 document prepared by Carter's Drilling and Pump service indicates that the well is 105 feet deep and is screened from 62 to 97 feet. The well includes a concrete pad as required by ODWR.

Well 2 was constructed in March 1976. A 16-inch hole was drilled to 20 feet with a 12-inch hole continuing to 125 feet. Twelve-inch casing was placed from 2 feet above the surface to a depth of 56.5 feet. Ten-inch screens were placed in the well to allow water access and at the same time hold the hole open. Although not specified, it is assumed that the screens extend to 120 feet where "blue clay" was encountered. The driller reported finding water at a depth of 12 feet and that the static water level after drilling was also 12 feet. Bentonite, an expanding clay, was placed between the casing and the outer wall of the hole from the surface to a depth of 20 feet to serve as a casing seal. The casing seal provides protection from surface or near-surface water moving laterally to the casing and gaining access to the well bore. Given that the aquifer is unconfined, this casing seal is considered to be adequate. The well includes a concrete pad as required by ODWR

Well 3 was constructed in July 1991. A 12-inch hole was drilled to 156 feet. Twelve-inch casing was placed from 2 feet above the surface to a depth of 120 feet. Ten-inch liners were placed in the well to hold the hole open from 115 to 121.5 and from 151.5 to 156. Twelve-inch diameter screens were placed from 121.5 to 151.5 feet to allow water access to the well. "Blue clay" was encountered in the well at 151 feet. The driller reported finding water at a depth of 49.67 feet and that the static water level after drilling was also 49.67 feet. Because the aquifer consists of dunal sand, the Water Resources Department has granted an exception to construction standards that require a casing seal. Given that the aquifer is sand, a casing seal will not hinder the downward movement of water and therefore would serve no real purpose. The well includes a concrete pad as required by ODWR

Well 4 was constructed between July 1994 and January 1995. A 16-inch hole was drilled to 15 feet with a 12-inch hole continuing to 182 feet. Twelve-inch casing was placed from 1.5 feet above the surface to a depth of 119 feet. Ten-inch liners were placed in the well to hold the hole open from 115 to 126 and from 166 to 182 feet. Twelve-inch-diameter screens were placed from 126 to 166 feet to allow water access to the well. The driller reported finding water at a depth of 70 feet and that the static water level after drilling was also 70 feet. Bentonite, an expanding clay, was placed between the casing and the outer wall of the hole from the surface to a depth of 15 feet to serve as a casing seal. Because the aquifer consists of dunal sand, the Water Resources Department has granted an exception to construction standards that require a casing seal be placed to a depth of 18 feet. The well includes a concrete pad as required by ODWR

Well 5 was constructed between August 1994 and January 1995. A 16-inch hole was drilled to 15 feet with a 12-inch hole continuing to 143 feet. Twelve-inch casing was placed from 1.5 feet above the surface to a depth of 78 feet. Ten-inch liners were placed in the well to hold the hole open from 76 to 78 and from 166 to 182 feet. Twelve-inch diameter screens were placed from 78 to 118 feet to allow water access to the well. The driller reported finding water at a depth of ~13 feet and that the static water level after drilling was also ~13 feet. Bentonite, an expanding clay, was placed between the casing and the outer wall of the hole from the surface to a depth of

15 feet to serve as a casing seal. Because the aquifer consists of dunal sand, the Water Resources Department has granted an exception to construction standards that require a casing seal be placed to a depth of 18 feet. The well includes a concrete pad as required by ODWR

Well 6 was constructed between August 1994 and January 1995. A 16-inch hole was drilled to 15 feet with a 12-inch hole continuing to 140 feet. Twelve-inch casing was placed from 1.5 feet above the surface to a depth of 78 feet. Ten-inch liners were placed in the well to hold the hole open from 76 to 79 and from 119 to 140 feet. Twelve-inch-diameter screens were placed from 79 to 119 feet to allow water access to the well. The driller reported finding water at a depth of ~14 feet and that the static water level after drilling was also ~14 feet. Bentonite, an expanding clay, was placed between the casing and the outer wall of the hole from the surface to a depth of 15 feet to serve as a casing seal. Because the aquifer consists of dunal sand, the Water Resources Department has granted an exception to construction standards that require a casing seal be placed to a depth of 18 feet. The well includes a concrete pad as required by ODWR

Well 7 was constructed between August 1994 and January 1995. A 16-inch hole was drilled to 15 feet with a 12-inch hole continuing to 143 feet. Twelve-inch casing was placed from 1.5 feet above the surface to a depth of 78.5 feet. Ten-inch liners were placed in the well to hold the hole open from 77.4 to 82.6 and from 122.9 to 143 feet. Twelve-inch-diameter screens were placed from 82.6 to 122.9 feet to allow water access to the well. The driller reported finding water at a depth of 19.1 feet and that the static water level after drilling was also 19.1 feet. Bentonite, an expanding clay, was placed between the casing and the outer wall of the hole from the surface to a depth of 15 feet to serve as a casing seal. Because the aquifer consists of dunal sand, the Water Resources Department has granted an exception to construction standards that require a casing seal be placed to a depth of 18 feet. The well includes a concrete pad as required by ODWR.

Copies of the well reports for these wells are included in Appendix D.

2.3 Nature and Characteristics of the Aquifer

The aquifer supplying the drinking water to the City of Florence Well Field consists of sand of the Florence Dunal Aquifer.

As described in the well construction discussion above, the depth to first water encountered in the wells and the static water level after well completion is the same in the aquifer. This implies that the groundwater is under atmospheric pressure only and is thus unconfined, i.e., there are no materials of low permeability separating the aquifer, or water table, from the surface. Based on the well reports, the aquifer appears to range in thickness from ~100 to ~130 feet thick, although this will vary with season, being thicker in the spring after the winter precipitation recharge when water table rises. The mean sea-level (MSL) elevation of the well screens varies from -11 feet MSL (Well 2) to -43 feet MSL (Well 3).

3. Delineation of the Drinking Water Protection Area

3.1 Methodology

The delineation of the DWPA is the fundamental aspect of the source water assessment for the City. When information regarding the DWPA location is provided to the community, it enables development of management strategies that will have the most impact with regard to preserving long-term drinking water quality. For groundwater systems, the DWPA identifies the area on the surface which directly overlies the portion of aquifer that supplies enough groundwater to the well, well field, or spring to meet long-term water demand (i.e., 10 to 15 years). Once delineated, the DWPA outline is placed on a map and provides the City with the knowledge of the geographic area providing water to the wells. This is the area where contamination poses the greatest threat to the drinking water supply.

The delineation exercise requires the use of site-specific information so that the identified DWPA adequately reflects the hydraulic characteristics of the aquifer and the operation of the water system. Both analytical and numerical methods are available for delineation of DWPAs. The numerical method was used for delineation of the City's DWPA and parameters used in the delineation model are included in Appendix E.

Numerical Methods are sophisticated models that allow for the incorporation of complex boundaries such as streams and formation contacts, are checked with local water levels, and incorporate spacial variations in aquifer properties.

Hydrogeologic Mapping Methods are also used with the numerical delineation method and involve identifying the hydrogeologic boundaries of the aquifer. Hydrogeologic boundaries include constant head boundaries (i.e., streams and/or reservoirs) and no-flow boundaries which occur when an aquifer comes in direct contact with a relatively impermeable material.

3.2 Results

As stated above, a numerical method was used to delineate the DWPAs for the City's wells. The resulting DWPAs are shown in Appendix B, Figure 1b. This delineation assumes that wells 8 through 12 have been added to the field and the wells are pumping at levels anticipated for 2006. In addition, the City is exploring the development of a second well field near Highway 101 northwest of the current field. Figure 1c offers the DWPAs for one possible configuration of these wells. This data reflects use as is projected for the year 2020 and is offered for planning use purposes only. The City expects that the well field location may differ from the information as shown and will work with ODHS to develop more accurate representation of the well locations as the information becomes available.

Specific information regarding the parameters used in the delineation process including; the delineation method, estimated pump rate of each well, and aquifer characteristics can be found in Appendices E and H.

4. Sensitivity Analysis

After the DWPA has been identified, aquifer susceptibility to PCSs inside the DWPA can be evaluated. Aquifer susceptibility is dependent on two factors, the natural environment's characteristics that permit migration of a contaminant into the aquifer (i.e., aquifer sensitivity) and the presence, distribution, and nature of the PCSs within the DWPA. The intent of the sensitivity analysis is to identify those areas within the DWPA where the aquifer is most sensitive to contamination regardless of whether or not contamination is present. However, even if the aquifer is sensitive, it should be understood that the public water system's drinking water source cannot be susceptible to contamination unless PCSs are present within the DWPA. The analysis is based on data collected or generated during the DWPA delineation process and is designed to meet the needs of other existing or developing programs such as Monitoring Waivers and the Groundwater Rule.

4.1 Sensitivity Analysis Methodology

Aquifer sensitivity refers to those factors characteristic of the aquifer and overlying materials, in addition to those that are imposed upon the aquifer, such as well construction, that increase the potential for both surface and subsurface contaminants to gain access to the aquifer. The aquifer sensitivity analysis depends on a number of factors that can collectively or individually allow the aquifer to become contaminated. Factors considered during the sensitivity analysis are described below and are summarized in Appendix F, Sensitivity Summary. Aquifer characteristic factors pertaining to sensitivity are categorized as highly or moderately sensitive. Aquifer characteristic factors related to the aquifer tend to be a direct result of natural conditions and in most cases can not be modified.

4.1.1 Depth to First Water-bearing Zone Below Casing Seal

The depth to the first water-bearing zone below the casing seal is important in controlling the aquifer's sensitivity because it relates to the time of travel (TOT) from the surface to groundwater. The greater the distance and estimated travel time, the greater the potential for the contaminant to be degraded to insignificant levels. Although not specifically evaluated on the sensitivity summary form in Appendix F, the depth to the first water-bearing zone below the casing seal is used in the traverse potential (TP) and infiltration potential (IP) calculations described later.

4.1.2 Aquifer Characteristics and Hydraulic Nature

Aquifer characteristics refer to the geologic material (lithology) that groundwater is moving through and how the lithology controls groundwater movement. Aquifer characteristics that contribute to sensitivity include materials that provide large open pore spaces and/or short pathways for contaminants to travel through the aquifer. Therefore, aquifer materials such as gravels, boulders, and fractured bedrock contribute to overall aquifer sensitivity. These types of materials do not provide for natural filtration of contaminants as water can move with relative ease through the larger diameter pore spaces and/or fractures. The presence of fractured bedrock at the surface inside the DWPA is also an indication that contaminants could move quickly from the surface into the local aquifer system.

For the purpose of the source water assessment, the hydraulic nature of the water inside the aquifer is described as either unconfined, confined, semi-confined, and/or fractured confined. Unconfined aquifers are often shallow and are not separated from the surface by a protective low-permeability layer. Confined aquifers are often deeper and are overlain by a protective low-permeability layer. As a result, unconfined aquifers have minimal protection from downward percolating contaminants and are considered sensitive to PCSs. However, the overall protective nature of the overlying low-permeability (confining) layer for a confined aquifer may be limited if it is thinner than 15 feet. Under such conditions the aquifer may be considered semi-confined, raising concern that the confining layer may be absent or ineffective within large portions of the DWPA. Likewise, concern is raised if a well or spring is drawing water from a fractured aquifer exhibiting confined characteristics which lies within 50 feet of the surface. At shallow depths, the potential for fractures to intercept the surface or near surface increases. Any fracture reaching the shallow subsurface can provide a pathway for contaminated shallow groundwater to enter the aquifer, effectively raising aquifer sensitivity.

4.1.3 Overburden Thickness and Characteristics

The material resting between the surface and the aquifer can have a significant impact on the aquifer sensitivity analysis. Overburden thickness can be related to the time of travel from the surface to the aquifer. The greater the distance and time, the greater the potential for contaminants to be degraded to insignificant levels. In addition, laterally persistent materials of low permeability, such as silt, clay, and unfractured bedrock, will restrict the downward movement of contaminants. Therefore, the presence of a thick (greater than 15 feet) confining unit resting on top of the aquifer offers the greatest amount of natural protection to a drinking water supply. Confining units consisting of plastic clay and/or unfractured bedrock are much more protective than those consisting of silt.

4.1.4 Soil Types

Although soils usually compose a very small portion of the overburden above the aquifer, they are the first natural barrier between the surface and the water table. Therefore, the amount of time it takes for water to pass through the soil zone can be used as a factor in determining overall aquifer sensitivity. Even over short distances, the permeability and thickness of different soil types can be highly variable as some soils are thinner and/or have a higher permeability than others. Therefore, for the purposes of the source water assessment, we identify soils with high, moderate and low sensitivity based on the amount of time it takes for water to pass through a specific soil under saturated conditions. Highly sensitive soils are those soils for which it has been estimated to take less than 65 hours for water to pass through their profile under saturated conditions. This means that there is little opportunity for degradation of a contaminant, such as nitrate, within the soil zone. In addition, the travel time through the soil indicates the amount of response time available before an accidental spill becomes significantly more difficult to clean up.

Moderately sensitive soils are those for which it has been estimated to take between 65 and 256 hours (approximately 2.7 to 10.7 days) for water to pass through their profile and low sensitivity soils are those which it has been estimated to take more than 256 hours for water to pass through. Recognition of these soil types and their occurrence within the DWPA can indicate those parts of the protection area where contamination may pose a greater risk to the water system, therefore it is useful to compare the distribution of these soil types with respect to PCSs. The distribution and relative sensitivity of soils within the City's DWPA are shown on the Sensitivity Map (Appendix B, Figure 3) and the distribution of PCSs with respect to soils is shown on the Susceptibility Map (Appendix B, Figure 4).

4.1.5 Infiltration Potential

The Infiltration Potential (IP) is an estimate of the ability of water to infiltrate from the surface to the aquifer. It is based on (1) the depth to the aquifer, (2) an estimate of the weighted permeability of the material between the surface and the aquifer, a parameter referred to as the transverse potential (TP), and (3) the hydraulic surplus, or amount of water available from precipitation and/or irrigation at the surface that is able to infiltrate into the aquifer. Both IP and TP values are determined for each drinking water source and are used as factors for determining overall aquifer sensitivity near the wellhead (i.e., within the 100-foot sanitary setback or 2-year time-of-travel zone). The DWPA sensitivity and susceptibility maps (Appendix B, Figures 3 and 4) are based on TP and IP data.

Both IP and TP scoring varies from 1 to 10. A low TP value of 1 indicates that the materials above the aquifer are of very low permeability and/or are of great thickness. Conversely, a high TP value of 10 indicates materials above the aquifer have a very high permeability and/or are very thin. Therefore, TP values greater than 5 are an indication of areas where the potential for movement of water (and/or contaminants contained in the water) from the surface to the aquifer is greatest. These areas within the DWPA are highly sensitive to contamination.

IP values are determined using TP values and an estimate of the available water at the surface for aquifer recharge. The estimate of available water at the surface assumes that rainfall, evaporation, plant uptake, and runoff remain constant throughout the DWPA. A low IP value of 1 indicates that it takes the available recharge water a long time to reach the aquifer. Conversely, a high IP value of 10 indicates that surface water is recharging the aquifer very quickly and therefore has the potential to transport large quantities of contaminants into the aquifer with little or no reduction in concentration. The DWPA is classified as having a high, moderate, or low sensitivity to contamination with respect to the calculated IP value as follows:

Sensitivity	Infiltration Potential
High	> 7
Moderate	4 to 7
Low	< 4

4.1.6 Source Construction

A groundwater based public water system's sensitivity to contamination is dependent not only on aquifer characteristics but also the integrity of the well(s) and/or spring boxes used to extract or collect water for distribution. If improperly constructed, these structures can also serve as conduits for contamination to move from the surface or near-surface environment into the well and/or spring. The sensitivity of the water system's intakes to potential contamination has been evaluated by reviewing construction deficiencies reported on recent sanitary surveys, the construction and depth of casing seal for the public water supply well(s), and age of the constructed intake.

When a well is drilled in soft or loose materials, a casing (steel or plastic pipe) is inserted to hold the hole open during and after drilling. The casing does not in itself provide adequate protection from contaminated shallow water gaining access to the well. Contaminated shallow groundwater can migrate to the casing and follow the casing directly down to the well intake. The real protection from potentially contaminated shallow water is the casing seal. This seal is put in place by drilling a hole that is at least 4 inches greater in diameter than the final casing. After the larger hole is drilled, the casing is installed and the annular space between the casing and the bore hole wall is filled with a sealant, either bentonite (an expanding clay), cement, or a combination of the two materials. The casing seal must, by law, be placed a minimum of 18 feet below the surface, however, it should be placed to a depth that is controlled by the local geology, e.g., for a confined aquifer the casing seal should extend a minimum of 5 feet into the confining layer. Having a well drilled by a licensed well constructor greatly reduces the risk that the well will be improperly constructed.

4.1.7 Other Wells

Other wells that fall in close proximity to the public water supply well and/or spring may provide a conduit for contaminants to reach the local aquifer if their construction is inadequate or has been compromised. The risk of encountering an improperly constructed or compromised well increases as the density of wells in the vicinity of the public water supply well increases. Even a properly constructed well has a given lifetime, after which the casing seal may begin to deteriorate and eventually fail, allowing shallow water to gain access to the aquifer. Therefore, overall risk becomes significantly greater when older wells are present, in part due to age and also due to the less stringent construction standards that were in effect prior to 1979.

ODHS evaluates aquifer sensitivity to contamination posed by other wells in the DWPA by totaling the number of well reports (these are reports filed by law for well construction activities by licensed well drillers and does not include wells that are installed per OWRD rules) on file at the OWRD that are within the same section containing the public water system's well(s) and/or spring(s) and develop a score based on the number of wells and their age. The equation for determining the Other Wells Score is as follows:

Other Well Score = (No. of wells 1979 or younger) + 4 x (No. of wells older than 1979)

The above expression assumes that wells drilled before 1979 are four times more likely to lead to water quality problems than those wells drilled after 1978. An Other Wells Score greater than 400 is assumed to represent a high density of wells and a moderate risk to local groundwater resources. In addition, a score that falls between 225 and 400 indicates a moderate density of wells, which is not an immediate cause for concern, unless a large number of wells are observed inside the DWPA or routine water quality monitoring suggests an ongoing degradation of source water quality.

Local well owners interested in protecting their private wells and in turn local groundwater resources from contamination can obtain useful information over the internet at www.wellowner.org or at http://wellwater.orst.edu. Also available are Home-A-Syst assessment packets, available through the OSU Extension Service. The Home-A-Syst program contact is:

Gail Glick Andrews
Oregon Home-A-Syst Coordinator
Bioresource Engineering
116 Gilmore Hall
Corvallis, OR 97331-3906
Phone: (541) 737-6294

Well logs were searched for the DWPA and a summary is included in Appendix L. The well log search included Section 10, 11, 14, 15, and 23 of Township 18 South, Range 12 West. Quarter sections within the section that were outside the DWPA are shaded out to indicate that the well search did not include these areas. In each quarter section where well logs exist, the well log identification number is provided. Well logs that had no quarter section designation where listed outside of the Section box. The well log identification number can be used to display well logs that are on file at OWRD (or from their webpage at www.wrd.state.or.us).

4.1.8 Monitoring History

Most groundwater contamination originates at the surface (accidental/deliberate spills, chemical applications, roadway/parking lot runoff, etc.) or in the shallow subsurface (underground storage tanks, septic systems, shallow injection wells, etc.); therefore, a review of water quality monitoring results for each water system can provide valuable information regarding aquifer sensitivity. Clearly, if a contaminant has been detected in the water source, a pathway from the surface to the aquifer must exist. As a means of protecting public health, public water systems in Oregon are required to routinely monitor drinking water quality for contaminants identified by the EPA as hazardous to human health. However, it is important to understand that the results from a given sample only provide information regarding water quality at the time that the sample was collected. Water quality within an aquifer can change with time for a number of reasons, including contamination and seasonal recharge. The fact that a water sample, or series of water samples, is free of contaminants is no guarantee that contamination of the aquifer cannot happen in the future. Therefore, if a water system is determined to have a moderate or low sensitivity with respect to monitoring history, it still may in fact be highly sensitive to contamination with respect to one or more other sensitivity analysis criteria.

ODHS review of water quality monitoring history included all Volatile Organic Compounds (VOCs), Synthetic Organic Compounds (SOCs), Inorganic Compounds (IOCs), nitrate, and coliform monitoring results available in the ODHS Drinking Water Program SDWIS on-line database. Required routine monitoring for nitrate and coliform occurs more frequently than that for VOCs, SOCs, and IOCs; therefore, both nitrate and coliform are particularly useful as indicators of contaminant pathways into the aquifer. Coliform bacteria are ubiquitous in the environment and their presence in source water (i.e., the aquifer) may indicate a microbial source nearby. Likewise nitrate provides similar information and is highly mobile compared to most contaminants and in some cases will act as a precursor to other contaminants entering the aquifer. Therefore, ODHS considers an aquifer yielding water that meets any of the following criteria to be highly sensitive to contamination:

- Any VOC or SOC detections,
- IOC detections greater than 50 percent of the EPA established maximum contaminant level,
- Source-related coliform detections, and/or
- Nitrate concentrations of 5 mg/L or greater.

4.2 Sensitivity Analysis Results

During the delineation phase of this assessment, the Florence Dunal Aquifer was identified as the aquifer from which the wells are drawing water. This aquifer is composed primarily of sand with minor interbeds of silt or clay. First water and static water levels are equivalent in this aquifer indicating that it is unconfined in nature.

The water table varies from less than 15 feet to more than 70 feet below the surface depending on the well. It is likely that the water table rises to even shallower depths in the spring after recharge of winter precipitation. TP and IP values for the wells are based entirely on the geologic description included on the well driller's report for the individual wells. On this basis, the calculated TP values for the DWPAs range from 8 to 9. Using an average precipitation rate of 65 inches (Hampton, 1963) and the high infiltration rates associated with sandy soils, an annual recharge rate to the aquifer in excess of 40 inches was estimated, which combined with the TP values, yields an IP of 10.

Seven different soil types occur within the recognized DWPAs, all of which have time-of-travel for water across them under saturated conditions of less than 65 hours: Dunal sand (<10 hours), Yaquina loamy fine sand (10 hours), Waldo find sand (2 hours), Netarts fine sand (12 hours), Yaquina urban land complex (10 hours) and Lint silty loam (45 hours).

Well report records indicate that there are approximately 120 other wells within the sections containing the City of Florence Wells. Of these, 100 were drilled before 1979. The remaining wells were drilled after 1979. This leads to an Other Well Score of 420, a score that exceeds the significant risk indicator threshold of 400. Thus, other wells in the area potentially represent a significant risk to the water system. In addition, it should be understood that the above numbers only represent wells on record at the Water Resources Department. Prior to 1960, well reports were not required to be filed. In addition, unauthorized wells are not uncommon in many areas. Therefore, the Other Well Score should be considered as a minimum assessment of risk.

ODHS Drinking Water Program records indicate that nitrate has not been detected at the entry point for the well field. Records also indicate that there have not been any positive detections for total coliform. Detections of VOCs, toluene (0.0023 mg/L on August 14, 2002) and chloromethane (methylchloride) (0.0034 to 0.0075 mg/L), have occurred. However, it was later determined that the toluene detections were false and a result of compounds contained in the tape used to secure sample caps. See appendix M. Chloromethane has only been detected in the finished water produced by the City's treatment plant not in the raw water from the well field. It is thought to be simply a product of the chlorination process at the treatment plant. Sodium has been detected up to concentrations of 37 mg/L.

The aquifer sensitivity for the system is summarized on the sensitivity summary sheet in Appendix F. If a criterion on the form is checked "No," it implies that the criterion does not contribute significantly to the aquifer's sensitivity. If neither box is checked for a criterion and/or "N/A" is written beside a criterion, it implies that there is either no information available for that specific criterion or that the criterion does not apply to the water system.

As indicated on Figure 4, Appendix B, there are both highly sensitive and moderately sensitive areas within the DWPA. The following criteria related to these areas have been identified which are believed to increase the aquifer's sensitivity to contamination from the surface.

4.2.1 Highly Sensitive Criteria

Based on assessment of the well reports, most recent site visit, and available monitoring history for the City of Florence, areas of the aquifer that the wells produce from are considered highly sensitive.

ODHS Drinking Water Program records indicate that detections of the organic chemicals toluene and methyl chloride have occurred, but records indicate that these samples were a result of laboratory contamination and therefore not representative of conditions in the aquifer. In addition, the aquifer is considered to be shallow and unconfined with the traverse potential and the infiltration potential exceeding the high sensitivity thresholds of 5 and 7, respectively.

4.2.2 Moderately Sensitive Criteria

Areas within the City of Florence's drinking water source also meet criteria for moderate sensitivity.

Based on our analysis within the DWPAs for the wells, the entire well field DWPA is covered with highly permeable soils. Highly permeable soils are those soils for which it has been estimated to take less than 65 hours for water to pass through their profile under saturated conditions. The distribution of relative soil permeability within the DWPA is shown in Appendix B, Figure 3. In the figure, soils that represent high sensitivity (10 to 45 hours) have been distinguished from those that represent extremely high sensitivity (2 to 10 hours). It is useful to compare the distribution of these highly permeable soils with respect to PCSs as shown in Appendix B, Figure 4.

5. Inventory of Potential Contaminant Sources

5.1 Methodology

The primary intent of an inventory is to identify and locate significant potential sources of any of the contaminants of concern within the DWPA. Significant sources of contamination can be defined as any facility or activity that stores, uses, or produces the contaminants of concern and has a sufficient likelihood of releasing such contaminants to the environment at levels that could contribute significantly to the concentration of these contaminants in the source waters of the public water supply. The inventory is a very valuable tool for the local community in that it:

- Provides information on the locations of PCSs, especially those that present the greatest risks to the water supply,
- Provides an effective means of educating the local public about potential problems, and
- Provides a reliable basis for developing a local management plan to reduce the risks to the water supply.

Inventories were focused primarily on the potential sources of contaminants regulated under the federal Safe Drinking Water Act. This includes contaminants with a maximum contaminant level, contaminants regulated under the Surface Water Treatment Rule, and the microorganism Cryptosporidium. The inventory was designed to identify several categories of potential sources of contaminants including micro-organisms (i.e., viruses, Giardia lamblia, Cryptosporidium, and bacteria); inorganic compounds, (i.e., nitrates and metals); and organic compounds (i.e., solvents, petroleum compounds, and pesticides). Contaminants can reach a water body (groundwater, rivers, lakes, etc.) from activities occurring on the land surface or below it. Contaminant releases to water bodies can also occur on an area-wide basis or from a single point source.

It is advantageous to identify as many potential risks as possible within the DWPA during the inventory. It is important to remember the sites and areas identified in this section are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly. Not all of these inventoried activities pose actual high risks to the City's water supply. The day-to-day operating practices and environmental (contamination) awareness varies considerably from one facility or land use activity to another.

When identifying potential risks to a public water supply, it is necessary to make "worst-case" assumptions. This is important because it is the potential risk that must be determined. The worst-case assumption that has to be made when considering potential risks to water bodies is that the facility or activity is not employing good management practices or pollution prevention. Also, assumptions are made about what sources are included in particular types of land use. For example, it is assumed that rural residences associated with farming operations have specific PCSs such as fuel storage, chemical storage and mixing areas, and machinery repair shops.

Past, current, and possible future potential sources of contaminants were identified through a variety of methods and resources. In completing this inventory, DEQ used readily available information including review of DEQ and other agencies' databases of currently listed sites, interviews with the public water system operator, and field observation as discussed below. In-depth analysis or research was not completed to assess each specific facility's compliance status with local, state and/or federal programs or laws. Further, the inventory process did not include an attempt to identify unique contamination risks at individual sites such as facilities (permitted or not) that do not safely store potentially hazardous materials.

The process for completing the inventory for the City of Florence's DWPA included several steps, which are summarized as follows:

- Relevant information as of February 2002 were collected from applicable state and federal regulatory databases including the following lists:
- DEQ Environmental Cleanup Site Information System which includes the EPA National Priorities List and the EPA Comprchensive Environmental Response, Compensation and Liability Information System list;
    - DEQ leaking underground storage tank list;
    - DEQ registered underground storage tank list;
    - DEQ Source Information System (for water discharge permit sites including National Pollutant Discharge Elimination System permits, Water Pollution Control Facility permits, stormwater discharge permits, and on-site sewage (septic) system permits);
- DEQ Active Solid Waste Disposal Permits list;
- DEQ Dry Cleaners list;

- DEQ Underground Injection Control list of facilities with registered underground injection control systems; and
- State Fire Marshall Hazardous Material Handlers site list (information on materials in a gas-form was not used since gaseous compounds rarely pose a threat to surface water or groundwater); and
- DEQ Hazardous Waste Management Information System list which includes EPA Resource Conservation Recovery Act (RCRA) generators or notifiers and EPA RCRA Treatment, Storage, and Disposal Facility Permits.
- Because of the way various state and federal databases are set up, the specific location of listed sites is not always given or accurate within the database. DEQ verified the presence and approximate location of PCSs within the DWPA by consulting with local community members and/or by driving through the area (windshield survey) as discussed below in subsequent inventory steps.

ODEQ officials interviewed City staff to identify potential sources that are not listed elsewhere in databases or on maps and to assist in locating potential sources listed in the state and federal databases.

A windshield survey was conducted by driving through the DWPA to field locate and verify as many as possible of the PCS activities. ODEQ looked for PCSs within four general categories of land use: residential/municipal, commercial/industrial, agricultural/forest, and other land uses (see Appendix C, Table 1).

Relative risk rankings of higher-, moderate-, or lower-risk were assigned to each PCS based on the Oregon Source Water Assessment Plan (1999). A summary of the types of PCSs and level of assigned risk is presented in Appendix C, Table 1 (Summary of Potential Contaminant Sources by Land Use). The comments section of Appendix C, Table 2 (Inventory Results-List of Potential Contaminant Sources) provides justification for any modifications to the risk rating that may have resulted from field observations that were different from what is typically expected for the specific facility. For example, a "random dumpsite" is typically considered a moderate risk to groundwater. However, if disposal of hazardous or toxic substances was observed during the field visit, the risk rating may be modified to "higher." Relative risk ratings are considered an effective way for the water supply officials and community to prioritize management efforts for the DWPA. When the local water supply officials and community "team" enhance the inventory for use in developing management options, further analysis may need to be conducted to more closely evaluate the actual level of risk.

A final summary of the inventoried sources and the GIS base map were prepared and included in this report.

Not all of the activities that are PCSs were inventoried in the entire DWPA. The inventory of sources of microorganisms such as bacteria, viruses and cryptosporidium focused primarily on areas within the 2-year time-of-travel because of limitations on survivability of the organism. Potential sources of microbes are highlighted on Appendix C, Table 1.

In addition to the PCS inventory conducted by ODEQ, a limited groundwater quality assessment investigation was conducted north of the DWPA along Munsel Lake Road and U.S. Highway 101 in the vicinity of an auto wrecking yard and gun club. The intent of the investigation was to perform a screening determination of groundwater quality downstream of these facilities. Although the facilities are outside the City's DWPA, they are close to the northern edge of the protection area and members of the City's Drinking Water Protection Committee had expressed concern that they might be a potential source of contamination. Appendix N contains a more thorough description of the assessment work including sampling locations, analysis performed and results.

5.2 Results

The results of the inventory were analyzed in terms of current, past, and future land uses; their time of travel relationship to the well site; and their associated risk rating. In general, land uses that are closest to the well and those with the highest risk rating pose the greatest threat to the City's drinking water supply. Inventory results are summarized in Appendix C, Tables 1 through 3 and are shown on Figure 2 (Appendix B).

5.2.1 Overview of Inventory Results within 2-Year Time-of-Travel for the Wells

The delineated 2-year time-of-travel zone is primarily dominated by residential and municipal land use. In summary, four PCSs were located within the 2-year time-of-travel zone for all the wells (Figure 2, Appendix B, and Table 2 Appendix C) and include a golf course, high density housing, the City of Florence Drinking Water Treatment Plant, and City sewer lines. The PCSs within the 2-year time-of-travel all pose a relatively higher to moderate risk to the drinking water supply. The City sewer lines have a high risk of transmitting micro-organisms to the groundwater. A description of the PCSs associated with each well is provided below.

- Well 1: High density housing and City sewer lines.
- Well 2: High density housing, City sewer lines, and the City of Florence Drinking Water Treatment Plant.
- Well 3: High density housing and City sewer lines.
- Well 8: Golf course.
- Well 9: Golf course.
- Well 10: Golf course.

5.2.2 Overview of Inventory Results within 5-Year and 10-Year Time-of-Travel for the Wells

The DWPA within the 5-year and 10-year time-of-travel zones is primarily occupied by residential and municipal land use. Three PCSs were identified in this area which are detailed on Table 2 in Appendix C and include an RV Park, stormwater outfalls, and Munsel Lake. The PCSs within the 5-year and 10-year time-of-travel all pose a relatively lower risk to the drinking water supply. Area-wide potential sources such as the golf course, high density housing and City sewer lines extend from the 2-year time-of-travel zone into the 10-year time-of-travel zone. These land uses occur throughout the DWPA and are shown on Figure 2 in the location nearest to the well. A description of the PCSs located in the 10-year time-of-travel associated with each well is provided below.

- Well 3: Golf course.
- Well 4: High density housing, City sewer lines, and Golf course.
- Well 5: High density housing and City sewer lines.
- Well 6: High density housing, City sewer lines, and stormwater outfalls.
- Well 7: High density housing, City sewer lines, and RV Park.
- Well 11: Munsel Lake.
- Well 12: Munsel Lake.

In addition, one PCS, Highway 101, was identified just outside the DWPA. Although this location is just outside the delineated area, the source poses a moderate degree of potential contamination risk, and is therefore included in this inventory.
This inventory of PCSs within the City of Florence's DWPA provides a quick look at the potential sources of contaminants that could, if improperly managed, adversely impact the City's drinking water source. Even very small quantities of certain contaminants can significantly impact water bodies.

5.2.3 Limited Groundwater Quality Assessment

Results of the limited groundwater quality assessment work performed immediately north of the DWPA (see Appendix N) indicated no existing pattern of groundwater contamination. Samples were tested for total petroleum hydrocarbons (TPHs), volatile organic compounds (VOCs) and polynuclear aromatic hydrocarbons (PAHs). Samples down gradient of the gun club were analyzed for dissolved lead.

Of the twelve samples collected, only one exceeded likely regulatory limits. Benz(a)anthracene, a PAH, was detected at a concentration of 0.23 micrograms per liter (µg/L) in the sample collected at the soil/groundwater interface from location P-4. This location was within the road right of way of Munsel Lake Road and near the utility easement for the overhead power lines running towards the north. Pyrene and Napthalene, also PAHs, were found in two samples but at concentrations many times lower than their respective likely regulatory limits.

Benz(a)anthracene is a low mobility compound that is found in petroleum products but may also originate from other sources such as the burning of plant and animal material. Potential sources of this compound are not limited to the wrecking yard but could include other historic/current upgradient activities, runoff from Munsel Lake Road, or even natural sources such as burned vegetation. Because Benz(a)anthracene is a low mobility compound, is outside the drinking water protection area, and was detected in only one sample, potential impact to the City's existing drinking water well field appears to be very low.

Napthalene and Pyrene like Benz(a)anthracene have very low mobility and may originate from a variety of sources. Because these compounds are far below their regulatory levels, have low mobility, and are outside the drinking water protection area, they also appear to pose little concern to the City's drinking water well field.

VOC's and TPH's were not reported at or above the laboratory method reporting limit for any of the samples.

Dissolved lead was also not reported at or above the laboratory reporting limit.

6. Susceptibility of the Drinking Water Source

Drinking water susceptibility can be defined as the potential for contamination within the DWPA to reach the well(s) and/or spring(s) being used by a Public Water System. The overall purpose of the susceptibility analysis is to identify the potential threats to drinking water quality and help prioritize community efforts for minimizing the contamination risk associated with those threats. Therefore, the susceptibility analysis is dependent on four factors: (1) identifying the location of the DWPA; (2) the sensitivity of the constructed intake (i.e., well); (3) the sensitivity of the aquifer to contamination; and (4) the occurrence and distribution of high- and moderate-risk PCSs within the DWPA. These four steps were accomplished during the delineation, sensitivity analysis, and PCS inventory phases of this assessment.

The susceptibility analysis is a management guidance tool that should be used to recognize and identify environmental conditions that are favorable for contamination of the drinking water supply. For example, if a contaminant is released to soils or groundwater in an area of high sensitivity, it is likely that contamination of the aquifer will occur if remedial action is not taken. However, the susceptibility analysis should not be used to predict when or if contamination will actually occur.

The susceptibility analysis is completed by overlaying the PCS inventory results onto a map of the highly and moderately sensitive aquifer areas inside the DWPA (Appendix B, Figure 4), which were identified using the traverse potential (TP) and infiltration potential (IP) (identified in Appendix B, Figure 3). These are areas within the DWPA where rapid infiltration of water from the surface is most likely to occur. PCS inventory results are analyzed in terms of current, past, and future land uses; their time of travel relationship or proximity to the well and/or spring location(s); and their associated risk rating (Appendix B, Figure 2). High- and moderate-risk contaminant sources have been defined as any facility or activity that stores, uses, or produces a contaminant of concern in large enough quantities that if released, could be detectable in the public water supply.

In general, land use activities which pose the greatest threat to the drinking water supply are those which are closest to the wells and have the highest associated risk rating. Therefore, the DEQ and ODHS Drinking Water Program strongly recommend that the community address all high- and moderate-risk PCSs that occur within their DWPA in order to reduce the risk of their drinking water supply becoming contaminated. How the PCSs are prioritized and the level of management strategies that are appropriate depend on the proximity of the PCS to the well and/or spring and whether the sensitivity of the aquifer at the PCS site is high, moderate, or low.

The City's drinking water source is considered to be susceptible to contamination, and it is recommended that the City identify those condition(s) that lead to the susceptibility and take steps to protect the resource (see Chapter 7).

6.1 Well Susceptibility

As described in the sensitivity analysis, the wells of the City of Florence's well field are not considered to contribute to the sensitivity of the drinking water source. Therefore, it is reasonable to assume that the wells themselves do not contribute to the overall water system susceptibility.

6.2 Aquifer Susceptibility

The aquifer is considered to be highly sensitive due to its shallow unconfined nature and its high transverse and infiltration potentials. The aquifer is also considered to be moderately sensitive due to the presence of highly permeable soils throughout the DWPA and the large number of private wells in the area.

6.2.1 Potential Contaminant Sources and Time-of-Travel Zones

In general, PCSs within the shorter time of travel zones pose greater risk than those in the longer time of travel zones. Also of concern is the location and distribution of these sources with respect to high and moderately sensitive areas. Overlaying the PCS location map and the sensitivity map for the Water System provides a tool to determine the susceptibility of the community's drinking water supply to contamination from each PCS (see Appendix B, Figure 4). The table below indicates the relationship between PCS risk, aquifer sensitivity, and estimated contaminant arrival time at the well, well field, and/or spring. The PCS location numbers on the inventory map are used in conjunction with the displayed aquifer sensitivity and relative risk rankings for each PCS (Table 2, Appendix C) to identify the susceptibility of the drinking water source to contamination from each PCS and to guide steps taken to reduce the risk accordingly.

The relative susceptibility of the City's water system with regard to the PCSs present in the DWPA has been quantified using the table below. Across the top of the table, each time of travel zone is subdivided to account for areas of high, moderate, and low sensitivity that may exist between each Time of Travel (TOT). PCS risk categories (high, moderate, and low) are listed down the left hand side of the table. The relative aquifer susceptibility to each PCS is demonstrated by the shading of each cell in the table. Cells that are shaded dark grey indicate a highly-susceptible condition, light grey shaded cells indicate a moderately-susceptible condition, and white cells indicate conditions of low susceptibility. The number in each cell indicates the number of PCSs that meet the conditions for that cell. Cells that do not contain a number indicate that there are no known PCSs that meet the conditions for the cell. PCSs that meet the specific criteria for a cell in the table can be identified by reviewing Table 2 in Appendix C. The number of PCSs are totaled across the bottom of the table.

City of Florence Emergency Well Susceptibility

	2-Yr TOT			2- to 5-Yr TOT			5- to 10-Yr TOT		
	High	Mod	Low	High	Mod	Low	High	Mod	Low
High Risk PCSs	2						1		
Moderate Risk PCSs	2						1		
Low Risk PCSs							3		
Total PCSs	4	0	0	0	0	0	5	0	0

TOT = time of travel

The distribution of high, moderate, and low sensitivity areas inside the DWPA can be determined using either soil sensitivity or the mapped distribution of Traverse Potential (TP) or Infiltration Potential (IP). In the case of the City of Florence Well Field, not only is the DWPA covered by highly permeable soils, both TP and IP scores (i.e.; a measure of natural aquifer sensitivity) based on the well logs are high, indicating that the geologic materials between the soil and the aquifer present no barrier to contaminant movement to the aquifer. Therefore, it is reasonable to assume that the natural aquifer sensitivity to contamination throughout the DWPA is high.

A total of 9 PCSs were identified inside the well field DWPA. As indicated in the above table, four PCSs occur inside the 2-year TOT, the remaining sources are located between the 5- and 10-year TOTs. Of the PCSs inside the 2-year TOT, two are of high risk and the remaining two are of moderate risk. Based on the analysis results shown in the relative susceptibility table, the City's well 2 and 9 are considered to be highly susceptible to the high risk potential contaminant source inside the 2-year TOT.

6.2.2 Susceptibility to Microbial Contaminant Sources

The EPA is authorized under the Safe Drinking Water Act to develop disinfection requirements for all public water systems. The EPA has already established such requirements for drinking water sources identified as surface water and groundwater under the direct influence of surface water through the Surface Water Treatment Rule. Currently the EPA is in the process of developing a National Primary Drinking Water Regulation that will address disinfection requirements for drinking water sources identified as groundwater. The purpose of the Groundwater Rule will be to protect the public from microbial (i.e., fecal) pathogens in groundwater and to prevent other waterborne disease outbreaks.

Under the pending Groundwater Rule, groundwater-based public water systems will have to disinfect their drinking water unless they can demonstrate that their source is not susceptible to fecal contamination. This demonstration will likely comprise four different elements: (1) enhanced sanitary surveys, (2) source water monitoring, (3) correction of source water intake defects, and (4) hydrogeologic assessments. The hydrogeologic assessment is based on determining the groundwater (aquifer) sensitivity with respect to microbial contamination. If a sensitive aquifer exists in conjunction with a source of fecal contamination, the drinking water source is considered to be susceptible to microbial contamination. In addition, it is also recognized that the source water intake construction may be significant in contributing to the susceptibility of a groundwater source to microbial contamination. Specifically, if the current construction or condition of the source water intake (well or spring box) allows for the migration of shallow waters into the aquifer and/or the distribution system, the drinking water source should be considered susceptible.

The susceptibility analysis was developed with the pending Groundwater Rule in mind. It specifically includes an evaluation of aquifer characteristics, well construction, and estimated time for recharging surface water to reach the aquifer within the DWPA, which are the critical factors in determining aquifer susceptibility to microbial contamination. In addition, the delineation effort includes the identification of the 2-year time-of-travel boundary where potential microbial sources of contamination (identified in the PCS inventory) may present an acute (immediate) risk to public health. Potential sources of microbial contamination include, but are not limited to, surface water bodies (lakes, rivers, streams), septic tanks and drainfields, sewer lines, parking lots, confined animal feed lots, landfills/dumps, cemeteries, and land application sites for sewage sludge.

The 2-year time-of-travel identifies the next 2 years of groundwater supply for the City's well field. The 2-year time frame is used as a conservative estimate of the survival time for some viruses. Based on the assessment results, the aquifer is considered to be susceptible to viral contamination since viral contaminant sources (sewer lines and residential housing) have been identified within the 2-year time-of-travel. However, it should be noted that the City currently chlorinates its water as part of its treatment system, which reduces the risk associated this type of contamination.

7. Management of Potential Sources of Contamination

This chapter is divided into the three primary land use categories in the City's Drinking Water Protection Area (DWPA): residential, municipal, and industrial/commercial. Within each category, management goals are formulated. Management goals are broad vision statements describing desired conditions or activities for the future. They provide direction for the development of management strategies. The management strategies more specifically describe a course of action for protecting the DWPA.

The implementation of management strategies is key to the ultimate success of the Plan. Upon the adoption of the Plan, the Mayor will appoint a standing Drinking Water Protection Committee (Ongoing Committee). This committee should meet at least twice a year to coordinate continued activities around specific management goals.

High Risk, and Moderate to Low Risk Uses have been identified in cooperation with the Oregon Department of Environmental Quality (ODEQ) and the Oregon Department of Human Services (ODHS).

7.1. Residential Land Use

High Risk Uses in DWPA:
- High Density Housing

Moderate to Low Risk Uses in DWPA:
- Munsel Lake Residences

Management Goal 7.1.1: Increase awareness among community members about groundwater vulnerability, residence-based sources of contamination, and methods for reducing the potential for contamination.

Purpose: By increasing the knowledge of the community (initially, residents in the DWPA) about the value of and threats to the groundwater resource, individuals can personally take action to protect their groundwater resource.

Management Strategies – 7.1.1

- Develop a DWPA map (overlaid on street map) to show most vulnerable areas.
- Develop a flyer with basic educational information on groundwater. Outreach efforts to educate the community could include any of the following topics:
    - The vulnerability of the City's groundwater.
    - How each citizen's actions can affect groundwater quality.
    - Why it is important to reduce the cumulative effects of groundwater impacts.
    - The consequences of groundwater contamination.
    - Tips on how each citizen can reduce the likelihood of contributing contaminants to the groundwater.
    - Non-toxic alternatives to common contaminants.
    - Safe use, disposal, and storage of toxic materials.
    - Upkeep and maintenance of home heating oil tanks.

- Upkeep and maintenance of septic systems.
- Resources available to citizens.
- What to do in the event of a spill.

- Make the flyer and other information available at various places in and around the City (e.g., the City library, local Chamber of Commerce, banks, doctor's offices and clinics, and restaurants).
- Work with schools to develop age-appropriate curriculum for students, grade school through high school, making use of resources available through the ODHS, DEQ, Oregon Department of Agriculture (ODA), the Lane County Extension Service and Siuslaw Soil and Water Conservation District.
- Develop and maintain a list of groundwater protection tips to be imprinted on the City water/sewer bills on an ongoing basis. Utilize other forms of media like local newspapers and radio to get the message out.
- Work with the Public Works Department to institute a storm drain stenciling program. Investigate acquiring a storm drain stencil; possibly one that includes reference to groundwater or drinking water. Work with the Public Works Department, school classes, scouts, and other civic groups to paint the stencil around town.
- Erect signs to inform people that they are entering a groundwater protection area.

Management Goal 7.1.2: Promote proper disposal of hazardous waste.

Purpose: To raise awareness of the need for proper disposal of hazardous waste products, and to focus on providing opportunities for proper hazardous waste disposal.

Management Strategies 7.1.2:

- Develop a household hazardous waste education program for the groundwater protection area.
- Continue spring and fall hazardous waste collection days in the City.
- Promote existing hazardous waste round-up events.
- Contact local newspapers and radio to publicize these events well in advance of the collection days.
- Promote the use of less hazardous alternatives to common household hazardous waste products.

Background: Residents need to know that their groundwater is a valuable and vulnerable resource. They also need to know what they can do, or not do, to help protect this resource. Many people are unaware that some common activities, such as housecleaning or gardening, may involve toxic chemicals that could have serious impacts on groundwater quality if overused or improperly disposed. Very small amounts of certain contaminants can pollute an entire community's groundwater supply, as can the cumulative effect of numerous minimally toxic sources. To help prevent groundwater contamination, community members need to be educated about how their actions can affect groundwater. Education can lead to understanding, and understanding can lead to behavioral changes that help reduce the risk of groundwater contamination. Furthermore, education about the value and vulnerability of the City's groundwater has the potential of providing far-reaching benefits as people bring this awareness to their friends, family and co-workers.

Threats to groundwater from residential land users primarily relate to the use, storage, and disposal of hazardous materials. Hazardous substances associated with residential use can come from household hazardous wastes, mechanical repair and maintenance products, land and garden care products, swimming pool maintenance chemicals, and stormwater runoff carrying pollutants such as petroleum, pesticides, fertilizers, etc. Improper storage and disposal of these types of substances are a threat to groundwater. The purpose of this goal is to increase awareness of the value of and threats to the groundwater resource among the people who live and work in the DWPA. With increased awareness and knowledge of this resource, community members can personally take action to protect their groundwater resource.

Proper disposal of household hazardous waste is a key strategy to reduce risks to the City's source of drinking water. The strategies will work towards raising awareness of the need for proper disposal of these products, and will focus on providing opportunities to follow through on proper hazardous waste disposal. Information distributed will also address use of non-toxic alternatives, safe use, disposal, storage of toxic materials, and upkeep and maintenance of home heating oil tanks and septic systems. The availability of this information will empower people to reduce the risk that they pose to their drinking water source.

The primary goals for the residential community will be targeted initially to those residences located within the DWPA. Where resources allow, outreach will be conducted to encompass a broader portion of the study area.

7.2. Municipal Land Use

High Risk Uses in DWPA:

- City Sewer Lines
- City Water Treatment Plant

Moderate to Low Risk Uses in DWPA:

- Stormwater Outfall
- Munsel Lake County Park
- Highway 101 (portion within the ten year time of travel)

Management Goal 7.2.1: Maintain Integrity of Sewer and Water Collection System.

Purpose: To ensure that the sewer lines, especially within the DWPA, are carefully monitored to prevent contamination to the drinking water.

Management Strategies 7.2.1:

The City will continue:

- Aggressive infiltration/inflow program meeting federal and state regulations to insure that sewer pipes have limited leakage.
- Pipe replacement projects to repair aging infrastructure where appropriate.
- To perform video surveys of sewer lines.
- To monitor water from the City wells for contaminants of concern on a frequent basis.

Management Goal 7.2.2: Reduce the risk of groundwater contamination from chemical storage, handling, and application.

Purpose: To ensure that the regulatory requirements continue to be maintained by the City and that other municipal entities are encouraged to follow the City's lead.

Management Strategies 7.2.2:

The City will continue to:

- be a role model by maintaining a City policy that only certified, licensed applicators be allowed to apply and have access to pesticides.
- Pay for employee licenses and required associated certification credit training.
- Encourage other community establishments to adopt the same policy.
- Store chemicals in a separate locked area and restrict access to that area.
- Investigate, at least annually, chemicals (pesticides and cleaning products) that are less toxic, have a shorter residual time than those currently used, and that still provide the benefits desired.
- Work with representatives from municipal land uses within the DWPA to increase awareness through informative discussions and presentations on groundwater issues including:
    - Facility locations within the DWPA,
    - The risks associated with municipal uses,
    - The benefits of requiring licensed applicators, and
    - Exploration of ways to reduce groundwater contamination risks.
- Produce and distribute a fact sheet to provide information regarding groundwater-friendly chemical use including:
    - Non-toxic alternatives to traditionally used chemicals.
    - Keeping chemicals away from wells.
    - Following the label (do not overuse).
    - Encouraging backflow devices.
    - How to deal with small spills.

Background: Storage, handling, application, and disposal of hazardous materials are the greatest risks to drinking water contamination from municipal uses. Municipal and quasi-public facilities within the DWPA include City sewer lines, the City Water Treatment Plant, parks, churches, City stormwater outfalls and State Highway 101. Park, school, church, and public facility grounds maintenance activities usually include the use of fertilizers, and of herbicides to control weeds. Several of these facilities also have on-site fuel storage for vehicle and equipment operations. Cleaning products used in the maintenance of public facilities also pose a potential risk to groundwater if handled inappropriately.

Government agencies (local, county, state, and federal) are required by law to allow only licensed applicators to apply pesticides within their jurisdiction. Non-licensed employees are permitted to apply pesticides if supervised by a licensed applicator. An educational effort should be made to be sure that all municipal and non-profit organizations are aware of, and abide by, the requirements regarding licensed applicators, and the need for both supervision and for restricted access to chemicals. The City Public Works Department will continue to be a role model by establishing a City policy that only certified, licensed applicators be allowed to apply and have access to pesticides. The Public Works Department will also take a lead role in investigating new and/or different chemicals that have the desired pest control effects with the least environmental impact.

Management Goal 7.2.3: Take proactive steps to be better prepared to respond to an emergency spill event within the drinking water protection area.

Purpose: To ensure public and personnel safety and to contain the hazardous material should a major spill occur.

Management Strategies 7.2.3:

- Inventory and become familiar with hazardous materials used and transported within the DWPA. Coordinate with Commercial/Industrial strategy implementation requesting hazardous materials information to be collected by the Fire Chief.
- Coordinate communication procedures with multiple agencies that may be responding to such an incident.
- Maintain adequate spill response materials.

Background: This section relates to proactive strategies that will reduce the risk of groundwater contamination in an emergency spill situation. The contingency planning component of this Drinking Water Protection Plan (Chapter Eight) is primarily a process of planning reactive measures to be applied in the event of a spill. A wide range of hazardous materials are located and transported within the DWPA. The west side of the DWPA borders the Highway 101 corridor and has a potential to be a source of a contaminant spills from hauling activities. Businesses handling specified quantities of hazardous materials are already required to identify and provide the State Fire Marshall with a list of hazardous substances on their property. These reports are also maintained at the Siuslaw Valley Rural Fire Protection District office. If a major spill should occur, the local jurisdictions' first priority is to ensure public and personnel safety and to contain the hazardous material. There are a variety of absorbent materials and products that assist in preventing a substance from moving laterally or vertically into the ground.

Management Goal 7.2.4: Protect Upstream Reservoirs/Lakes

Purpose: To reduce contamination of groundwater through the release of toxic substances in surface water bodies.

Management Strategy 7.2.4:

- Post signs at boat access areas to inform users of the DWPA and its vulnerability, with details on what precautions should be taken to prevent contamination.

7.3. Commercial/Industrial Land Use

High Risk uses in the DWPA:
- Ocean Dunes Golf Course

Moderate to Low Risk uses in DWPA:
- Commercial on Highway 101
- B & E RV Park

Management Goal 7.3.1: Encourage responsible use of fertilizers and other common chemicals used in the management of golf courses.

Purpose: To reduce the risk of groundwater contamination through best management practices for coastal golf courses.

Management Strategies 7.3.1:

- Negotiate with local golf courses to obtain annual well reports and integrated fertilizer/pest management plans for the City.
- Promote opportunities for local education and training about best management practices for coastal golf courses.
- Investigate and recommend less toxic alternatives on an annual basis.

Management Goal 7.3.2: Educate business and industry about the vulnerability of groundwater, what they can do to protect the groundwater, and resources available to them.

Purpose: To reduce the risk of groundwater contamination by businesses in the DWPA and to assist businesses in developing groundwater protection strategies supplementing the regulatory structure.

Management Strategies 7.3.2:

- Create and distribute a letter/information flyer to businesses located in the DWPA that informs them of the drinking water protection effort and provides information on technical assistance available at the local, state (DEQ pollution Prevention Program) and federal levels. (See example letter and flyer in Appendix K.)

- The City may require, as part of a development approval, submittal of an Integrated Turf Management Plan for fertilizers, herbicides and pesticides for developments with large turf areas.
- Give presentations to the Chamber of Commerce and other business groups about the City's drinking water protection efforts and provide information to members.
- Encourage local businesses to donate a sign to identify the DWPA and paint stencils on their storm drains.
- Develop a map of the DWPA that is overlaid on streets and maintains shapes so that it can easily be communicated to members and organizations within the City. Identify corresponding township, range, and sections to encompass this area for purposes of identifying locations inside the protection area when reviewing building permit applications.

Management Goal 7.3.3: Encourage safe storage and handling of hazardous materials.

Purpose: Help both new and existing businesses properly store and handle hazardous materials by identifying and addressing potential and existing problems.

Management Strategies 7.3.3:

- When applying for a City business license, require businesses to report whether they are reporting hazardous materials to State Fire Marshall, as a requirement of National Pollution Discharge Elimination System permits or Material Safety Data Sheets.
- City to:
  - Provide hazardous materials regulation form and educational information with business license.
  - Work with the Siuslaw Valley RFP District to establish visits to medium- and high-risk businesses located within the DWPA to discuss safe storage and handling of hazardous materials and to verify locations/quantities of hazardous materials according to their schedule.
  - Work with new businesses on their building's site design to minimize risk to the groundwater.

Management Goal 7.3.4: Encourage proper hazardous waste disposal.

Purpose: To provide businesses information on opportunities to dispose of hazardous waste and to promote new opportunities for disposal of hazardous waste.

Management Strategies 7.3.4:

- Continue local hazardous waste disposal opportunities in which businesses are strongly encouraged to participate.

- Provide information to businesses on how to dispose of hazardous waste through:
    - Collection opportunities,
    - Agency contacts,
    - Private businesses
    - Insurance company or underwriter.
- Continue to publicize this information in a flyer to mail to businesses, distribute with permits, and distribute at the time of Fire District visits.

Background: Commercial and industrial facilities are among the most highly regulated of any land uses through laws such as the Toxic Substances Control Act and the Resource Conservation and Recovery Act. Despite this level of regulation, commercial and industrial facilities can still pose a risk to groundwater. The majority of the regulations applicable to commercial and industrial facilities rely on responses to contamination events, rather than on preventing problems in the first place. Furthermore, businesses often are not aware of the connection between these regulations and the potential for contamination of groundwater and drinking water. The City's management strategies should focus on pollution prevention and on raising awareness of the relation between businesses' actions and drinking water contamination. The City, as part of Design Review or other required review, currently prohibits use of fertilizers and pesticides adjacent to wetlands and routinely requires use of oil/silt separator catch basins.

Management Goal 7.3.5: Generate awareness of Stormwater Best Management Practices(BMPs) that can be applied by individual businesses and the City .

Purpose: Educate businesses on how they can reduce the potential contamination risk by helping to ensure that water leaving impervious surface areas (driveways, parking lots, streets) does not contain pollutants such as chemicals, oil, grease, fertilizers, and herbicides which can percolate down to the groundwater.

Management Strategies 7.3.5:

- Adopt BMPs for groundwater protection.
- Educate the public in the use of area-wide treatment systems such as: oil/water separators, filter strips, grassed swales, and sand filters.
- Develop a fact sheet for businesses that provides information on stormwater treatment (ODEQ or Oregon State Extension Service has this type of information available).
- Request that the DEQ give priority to reviewing and monitoring permits of businesses in the DWPA that are required to have stormwater discharge permits.
- Support adoption of a stormwater systems development charge and a stormwater system user fee to pay for water quality improvements in the stormwater conveyance system and educational components of this goal.

In developed areas, land has been covered by streets, parking lots, and buildings (impervious surfaces) that prevent rain from being infiltrated into the ground. As the runoff flows over these surfaces, it can pick up pollutants—chemicals, oil, grease, fertilizers, and herbicides—that have collected on the surface. Stormwater leaving these impervious surfaces can then discharge onto the ground or enter surface waters where pollutants can eventually percolate down to groundwater. The City commercial/industrial corridor contains significant impervious surface area. Potential contamination risk could be reduced by helping to ensure that water leaving impervious surface areas and entering the ground or surface water does not contain pollutants. Stormwater runoff can be managed on both an individual business and an area-wide basis and involves both businesses and the City Public Works Department. Businesses can reduce their individual stormwater impact by applying Best Management Practices that reduce pollutants at the source to prevent pollution of stormwater runoff discharged from the site. Practices can also be used to divert runoff away from areas of exposure to pollutants, such as raw materials, intermediate products, or finished products. On an area-wide basis, Best Management Practices could be used to direct polluted runoff to natural or other types of treatment. Encouraging businesses to apply source reduction practices as much as practicable is a priority because these practices reduce the amount of pollution generated at the site and prevent contaminants from being exposed to stormwater in the first place. Treating contaminated stormwater to remove pollutants before the runoff leaves the individual site or once it enters the stormwater conveyance system is the next option, although this may transfer the pollution problem from one place or medium to another because treatment will not be completely effective. Source reduction methods are also desirable because they are often less expensive than treatment methods.

Management Goal 7.3.6: Educate seasonal populations that frequent campgrounds/RV Parks.

Purpose: To incorporate seasonal population in outreach education efforts.

Management Strategy 7.3.6:

- Provide educational brochures about the vulnerability of our drinking water and the need to encourage extra care in preventing leaks or spills of automotive fluids and/or septic waste and distribute to the seasonal community.

8.0 Contingency Planning

Risks to the City's drinking water resources have been identified in Chapter 7. Identified high risks in the DWPA are housing, City sewer lines, City Water Treatment Plant, portions of Highway 101 within the DWPA, stormwater outfalls, Munsel Lake Park, Ocean Dunes Golf Course, and an RV Park located within the DWPA.

Contingency planning needs to address procedures for containment in the event of a potential contaminant incident and also for provision of domestic water, both short term and long term should the current source(s) become unusable.

Containment:

The City Water Treatment Plant has an operations manual that provides detailed procedures for containment of spills or other potential contaminant events. The pertinent portion of the Procedures Manual is located in Appendix O. Likewise, Ocean Dunes Golf Course, as part of the requirement for certification for application of agricultural chemicals, also has a spill containment plan.

Breaks or leakage in city sewer lines are repaired by City staff or by a contractor under City direction. Breaks are repaired under an emergency operations plan (see Appendix O). Leaks are identified and repaired through the use of routine TV surveillance of all sewer lines and routine manhole cover surveillance.

Prevention of contaminant incidents related to stormwater is the preferred option. The City's stormwater system is a combination of piped and infiltration facilities. The City requires oil and silt separator catch basins in all development, and has a stenciling program for all storm drains. In the event of a contaminant incident in an infiltration system, standard containment procedures would be utilized according to the Western Lane Hazardous Materials District Oil and Hazardous Materials Emergency Response Plan. In the event of a contaminant incident in a piped system, if identified soon enough, the contaminating substance would be isolated in the affected area of the piped system. If identified only at the time a contaminant was detected at the outfall, standard containment procedures would be utilized. If the outfall were in the Siuslaw River, the Emergency Response Plan would provide for containment of the contaminant to the smallest possible affected area.

Chapter 7 provides the details for education and notification for seasonal residents such as those at the RV Park. Should a spill occur with the potential for contamination, then the RV Park would call the Siuslaw Valley Incident Command Team.

Lane County has established procedures for dealing with potential contaminant incidents at its facilities (see Appendix O).

Of the identified risks, the one with the most potential for serious contamination is a spill from a transport vehicle traveling on Highway 101 within the DWPA. The likelihood of this happening is low, but the potential for contamination, should a spill occur is high. Should an incident like this occur, the Siuslaw Valley Incident Command Team would respond immediately and work to contain the spread of the hazardous material as detailed in their Emergency Response Plan..

Alternate domestic water resources:

The City has an agreement with Heceta Water District (HWD) for the purchase of domestic water (see Appendix O). The source of HWD water is Clear Lake, a surface source located north and up-gradient of the DWPA for the City's well field. HWD has an Emergency Response Plan for incidents affecting their water source.

9.0 New Well Field Analysis

The City of Florence's growing population and industrial development puts an increasing demand on the City's existing water supply. Although current capacity is sufficient, the City will soon need an additional well field to meet the demands of growth. Evaluating potential sites from a groundwater risk perspective allows the City to select a site that has a relatively low-risk potential and to develop proactive approaches to guide existing and future land use activities to protect the area. The City has currently identified one potential new well field site. This chapter provides an evaluation and analysis for this site.

The proposed new well field is located west of Highway 101 and north of Sand Pines Golf Course. This site and its preliminary delineated groundwater protection area are included in Appendix B, Figure 1C. It should be noted that the actual well locations will most likely be farther to the south and west of where they are shown in these figures. The actual WHPA's would also move accordingly to accurately reflect well locations.

The proposed site for this report was analyzed from a groundwater risk perspective. However, it is recognized that a variety of elements such as distribution, productivity, and cost may also be considered in the future for the ultimate selection of the City's next water supply. Such future analysis may also consider other potential sites, demonstrating that by changing the proposed location, drinking water protection benefits or shortfalls may be realized. Selecting a preferred site from a groundwater risk view involves an analysis of various land use components such as property ownership and contamination risks associated with various land uses within that well's delineated protection area.

9.1 Selection Criteria

When selecting a future well field site, consideration should be given to the site's contamination potential using the criteria listed below:

- **City ownership of wellhead property**. City ownership (or possibility of purchase) of the property on which the wells are located is considered a top priority for a new well field. Having control over the immediate vicinity of the wellhead helps ensure protection of this most critical area.
- **Number of property owners.** Protecting and managing a DWPA generally becomes more complex with increasing numbers of property owners within the area. There is a greater chance that some of those property owners will not be supportive of a drinking water protection program and will increase the risk of contamination.
- **Cooperation of property owners.** Cooperative landowners within the drinking water protection area help ensure that the area will be protected to the best ability of those property owners. Property owners who are opposed to a siting of the new well field are less likely to voluntarily take extra precautions in protecting the area.

- **Risks associated with current land uses.** Land uses vary in the type and degree of potential risk to groundwater. The higher the overall risk associated with differing land uses within the DWPA, the less desirable that site is for selection of a new well field location.

- **Risks associated with expected future land uses.** Future land uses can influence the vulnerability of the DWPA if future land uses are expected to pose a higher risk than existing land uses. General future land uses can be estimated by Plan Designations for the area and more specific development proposals are often known by local residents.

9.2 Analysis

The City does not currently own the property containing the proposed future well field, but intend to gain ownership prior to constructing the well field. The most significant risks to development of the proposed well field are as follows:

- **Highway 101 corridor.** A variety of hazardous materials are transported along this corridor, posing a risk primarily due to the potential of a spill event.

- **On-site sewer treatment systems.** The potential risk of on-site sewage treatment systems in areas up gradient of the future well field site should be addressed. The density of septic systems can have a strong influence on nitrate levels because the septic system drainfields allow effluent to percolate into the soil. New septic systems require a permit from the DEQ.

  Lane County administers the permit process for most residential systems within the county as a contract agent of DEQ. Factors that are considered in granting the permit include the seasonal depth to the water table, soil characteristics, density, and required setbacks from waterways, wells, and other features. Housing development greater than 1 or 2 units per acre that rely on septic systems can be of moderate to high risk because of the potential for elevated nitrate levels.

  The safest and most effective way of reducing this risk is to extend the City sewer system out to connect these outlying areas into the City sewer collection system. Alternatively, the City could do the following:

  1. Investigate the types of septic systems that provide the best groundwater protection for the soil types present.
  2. Work with local civic groups to disseminate this information and resources on septic system maintenance to residences that use septic systems in the DWPA.
  3. In order to annex into the City, property currently served by a septic system must develop a plan to connect to the City's sewer system over a specified period of time.