

APPENDIX M

Black Diamond Wellhead Protection Area by RH2 Engineering

SOURCE WATER PROTECTION

WELLHEAD PROTECTION PROGRAM

OVERVIEW

This Wellhead Protection Program was prepared as a component of the City of Black Diamond's (City) previous water system planning efforts in order to meet requirements of the Department of Health (DOH) and the Environmental Protection Agency (EPA)¹. The Black Diamond Spring Field is located on a 58-acre parcel that is owned by the City. The Black Diamond Spring Field is fed from the Cumberland Aquifer which is located southeast of the Green River. However, the recharge area to the southeast of the springs is not within the City's jurisdiction.

There are recent large lot developments created in the spring recharge area that have been created by Palmer Coking Coal Company in the Hyde Lake Area. The City has notified King County and DOH of the close proximity of these new developments to our source recharge area.

SUSCEPTIBILITY ASSESSMENT

A susceptibility assessment for the Black Diamond Spring Field was previously completed and submitted to the DOH.

WELLHEAD PROTECTION AREA INFORMATION

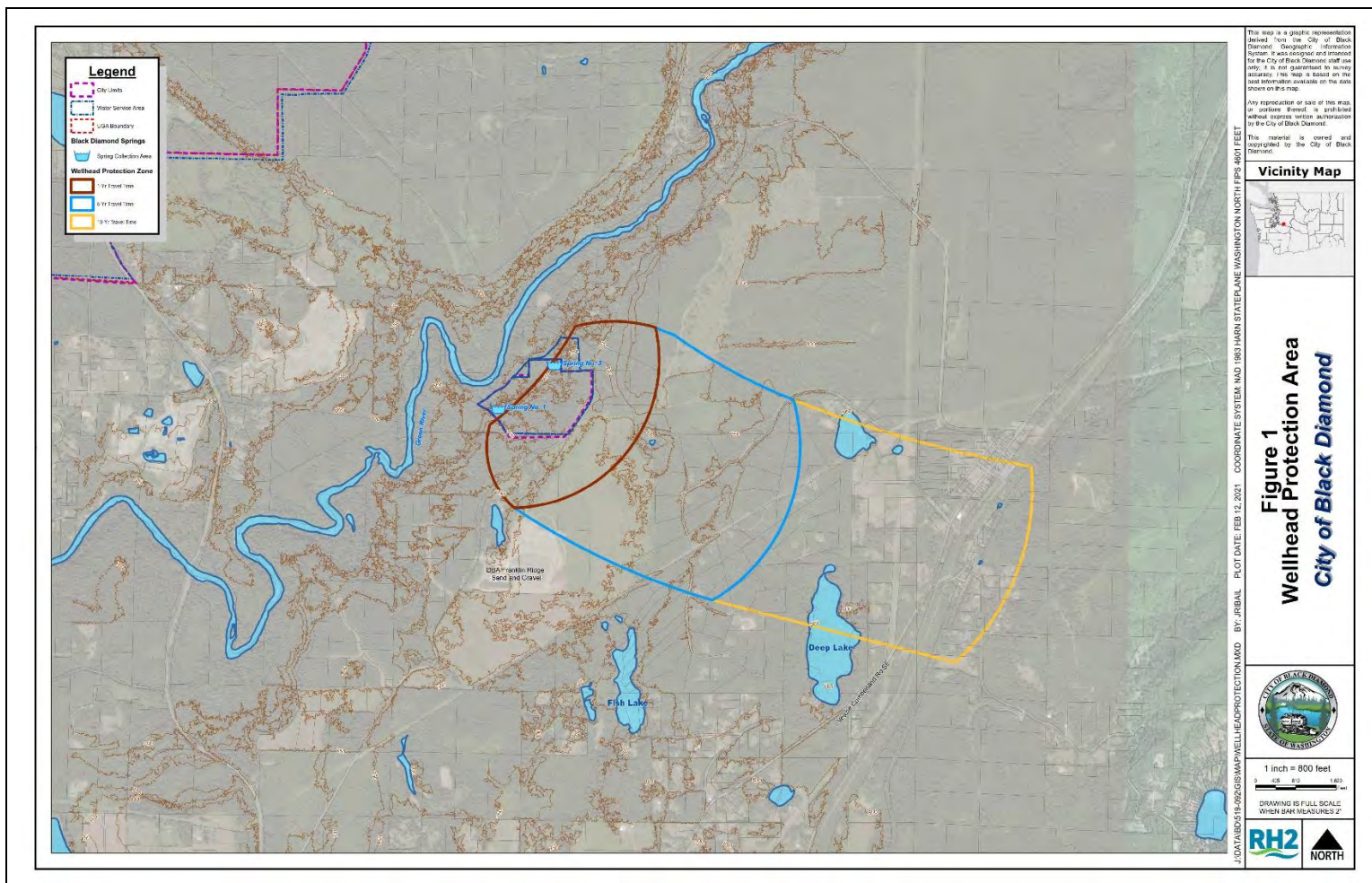
The City's wellhead protection areas are shown in **Figure 6.1, Wellhead Protection Zones**. The protection zones, also known as zones of contribution, are the areas that are most likely to contribute pollutants to the groundwater. It is important that land use is managed within zones of contribution in order to protect the City's spring source. The delineation of zones of contribution and the hydrogeological methods used to develop the zones are the Fixed Radius Method, the Analytical Method, and the Numeric Method.

Fixed Radius Method

The simplest method of modeling groundwater is the Fixed Radius Method. In this method, concentric areas around the wells delineate the zones of contribution by a set distance. Alternatively, the Calculated Fixed Radius Method delineates the zones of contribution based on known or assumed aquifer characteristics and pumping data.

¹ The analysis of the City of Black Diamond's Wellhead Protection Areas was completed in conjunction with the 2000 2016 Water System Plan update.

**Figure 6.1
Wellhead Protection Zones**



Analytical Method

The analytical method utilizes basic physical characteristics of the aquifer such as aquifer thickness and direction of groundwater flow. The analytical method makes assumptions and simplifies the hydrogeologic processes. However, by utilizing information regarding the physical characteristics of the aquifer, the analytical method is a more realistic representation of groundwater flow than the Fixed Radius Method.

Numeric Method

The numeric method is an even more complex and costlier delineation method than the analytical method. The numeric method models groundwater by superimposing a grid over the study area. Each of the squares in the grid is identified by its physical characteristics which are collected from a variety of sources. These sources may include geologic and hydrogeologic maps, geophysical data, well logs, groundwater elevation data, meteorological data, and stream flow

discharge. The numeric method results in a more accurate representation of groundwater flow than the Analytical or Fixed Radius Methods.

Black Diamond Wellhead

The City's wellhead protection areas were delineated through the use of a computerized analytical model from the Wellhead Protection Area (WHPA) that was developed by EPA. It was determined that the Fixed Radius Method was inappropriate for the Black Diamond Spring Field as water does not flow to the discharge point from a 360-degree radius due to geographic constraints along the Green River embankment.

Table 6.1, Wellhead Delineation Factors includes data from a previously completed report that was inputted into the model in order to determine the one, five, and ten year zones of contribution.

Table 6.1
Wellhead Delineation Factors

Description	Value
Direction of groundwater flow within the Cumberland Aquifer	Generally to the northwest
Constant discharge rate from the Spring Field collection area	20 cfs
Porosity	0.22
Hydraulic Gradient (feet per foot)	0.02
Aquifer Thickness (feet)	100

If the City develops the North Bank supply options currently under consideration, then the wellhead protection area for that source will need to be assessed and included in the City's wellhead protection plan.

CONTAMINANT SOURCE INVENTORY

An inventory of all potential contaminants is necessary in order to identify past, present, and future activities which may potentially be a source of contamination to the City's spring field. The majority of the identified spring recharge area is undeveloped, forest lands. However, the Town of Cumberland is within the 10-year zone of contribution, as well as recent large-lot developments in the Hyde Lake Area.

In order to maintain an effective full inventory, all known and potential sources should be identified and mapped. There are many activities that may be a potential source of contamination, such as: landfills; underground storage tanks; septic tanks; land use and zoning practices; commercial and industrial operations; dry wells and catch basins; and known sites of contamination.

CONTINGENCY PLAN

Contingency planning plays an important role in the development of a wellhead protection program. Contingency planning addresses the long-term replacement of the City's spring source. A contingency plan allows for the City to be prepared to respond to emergency situations. For

the City, a worst case scenario would be if the Black Diamond Spring Field experienced groundwater contamination. Contamination could occur due to illegal discharges, leaks, or spills in and around the Spring Protection area.

Previously, the Black Diamond Spring Field was the City's only source of supply. Within recent years, the City has negotiated with the City of Tacoma and an intertie has been completed between the City's water system and the City of Tacoma's Second Supply Pipeline. This intertie connection has resulted in an alternate source of supply for the City in the event of contamination of the Black Diamond Spring Field.

RECOMMENDATIONS AND NOTIFICATION OF FINDINGS

The City will take the following actions in order to minimize the risk of contamination to the Black Diamond Spring Field. The City will notify commercial businesses, hazardous waste generators, and septic system owners of their presence within the City's wellhead protection area. The City will also assertively notify King County of the potential impact that developments approved by their jurisdiction may have on the water quality of the City. The City will utilize management strategies provided by the King County Groundwater Protection Program.