

Drinking Water Source and Wells for the City of Avon

DELINEATIONS – WELLHEAD PROTECTION AREA AND DRINKING WATER
SUPPLY MANAGEMENT AREA

VULNERABILITY ASSESSMENTS – WELLS AND DRINKING WATER SUPPLY
MANAGEMENT AREA

August 2, 2023

Summary

Protection Areas - The recharge area for the wells is known as the wellhead protection area, or WHPA, and represents the area that contributes water to the city's wells within a 10-year time period. The area that contributes water within a one-year time period is known as the emergency response area, or ERA. Practical reasons require the designation of a management area that fully envelops the wellhead protection area, called the drinking water supply management area, or DWSMA. Each of these areas is shown in Figure 1.

Geology and Groundwater Flow – The city of Avon has two primary wells screened in a sand aquifer that is buried beneath a layer of clay-rich sediment. Such aquifers are known generically as Quaternary Buried Artesian Aquifers (QBAA). Regionally, groundwater flows towards Avon from the northwest and the south, draining to the northeast.

Table 1 – Supply Well Information

Local Well ID	Unique Number	Use/ Status	Casing Diameter (inches)	Casing Depth (feet)	Well Depth (feet)	Date Constructed/ Reconstructed	Aquifer	Well Vulnerability
Well #3	242069	Emergency	12	50	70	1979	QWTA ¹	Vulnerable
Well #4	696861	Primary	12	231	251	9/26/2003	QBAA	Vulnerable
Well #5	696862	Primary	12	220	240	8/11/2003	QBAA	Not Vulnerable

Note¹: QWTA = Quaternary Water Table Aquifer

Well Vulnerability - The vulnerability of each well has been assessed based on 1) well construction details, especially conformance with standards required by the state well code, 2) the geologic sensitivity of the aquifer, and 3) past monitoring results. Both Wells #4 and #5 (696861 and 696862) meet current construction standards. Well #4 is considered vulnerable to contamination due to tritium being detected in the well water (Table 2). Detectable tritium indicates the presence of young (post-1953) water. This is reinforced by the chloride concentration and chloride/bromide ratios presented below (Mullaney et al., 2009). Higher concentrations or concentration ratios indicate recent recharge from the surface. Well #5 also shows evidence for human impact based on chloride and bromide, but apparently the proportion of young water at this well is lower due to the absence of detectable tritium.

Table 2 - Isotope and Water Quality Results (February 10, 2022)

Well Name (Unique Number)	Tritium	Nitrate (mg/L)	Chloride (mg/L)	Bromide (mg/L)	Chloride/ Bromide Ratio	Arsenic (µg/L)
Well #4 (696861)	1.1	< 0.05	17.8	0.0316	563	5.72
Well #5 (696862)	< 0.8	< 0.05	11.8	0.022	536	7.68

DWSMA Vulnerability - The vulnerability of the city's aquifer throughout the DWSMA is based on the geologic sensitivity ratings of wells and their monitoring data (Table 2). Based on this information MDH has assigned a moderate vulnerability to the DWSMA. This suggests that water and contaminants may travel from the land surface to the city's aquifer within a time span of years to decades. This rating reflects uncertainty about the pathway for young water reaching Well #4 (686861) and water elevated in chloride and chloride/bromide reaching both wells. Although this may be the result of a well casing problem, for the time being it is assumed that the clay-rich sediments that overlie the city's aquifer is leaky. Moderately vulnerable aquifers are prone to a variety of contaminant threats, including chemical storage tanks and abandoned wells which can provide conduits for contaminants to quickly reach the city's aquifer.

Water Quality Concerns - At present, none of the contaminants for which the Safe Drinking Water Act has established health-based standards is found above maximum allowable levels in the city's water supply. However, elevated levels of naturally occurring arsenic have been detected at both wells.

Recommendations - Recommendations have been generated to improve future delineations and vulnerability assessments and should be considered for inclusion as management strategies in the city's wellhead protection plan. These activities include: well locating, downhole well inspection, and water quality monitoring. Further details can be found in the Recommendations section of this report.

Figure 1 Drinking Water Supply Management Area and Vulnerability City of Avon



