SOURCE WATER PROTECTION PROGRAM
BENEFITING THE CHESTERTOWN WATER SYSTEM
(PWSID 014-00002)
KENT COUNTY, MARYLAND

ALWI Project No. MD7S075

August 23, 2013

PREPARED FOR THE

TOWN OF CHESTERTOWN

IN PARTIAL FULFILLMENT OF MARYLAND DEPARTMENT OF THE ENVIRONMENT IFB SOLICITATION NO. U00R1400308

ADVANCED Land and Water, Inc.
Global Environmental Solutions
7540 Main Street, Suite 7 • Sykesville, MD 21784
PHONE 410-795-4626 • FAX 410-795-4611 • www.alwi.com

SOURCE WATER PROTECTION PROGRAM
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THE TOWN OF CHESTERTOWN

Reviewed and Approved By:

Mark W. Eisner, P.G.
President

Prepared and Submitted By:

David L. Pielmeier
Operations Manager

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1.0 INTRODUCTION

Advanced Land and Water, Inc. (ALWI) was engaged by the Maryland Department of the Environment (MDE) to assist 12 community groundwater systems, including the Chestertown Water System (the Town), in developing and implementing Source Water Protection Programs (SWPPs). These programs will help protect public health by identifying implementable measures to address existing and potential contaminant threats to groundwater supplies of drinking water.

In 2003, MDE developed a Source Water Assessment Plan (SWAP) for the Town (Appendix A). This report stated that the Town is supplied by seven wells, with six constructed in the unconfined, Aquia Formation (Wells 2 through 7; Permit No. KE1970G004/05) and one constructed in the confined, Magothy Formation (Well 1; Permit No. KE1992G011/02). Since that time, a new well (Well 9) has been constructed within the Magothy Formation and has been added to the same permit as Well 1.

We updated this SWAP for currency, following technical guidance and advice received from the Water Supply Program of MDE. Notwithstanding this, source water assessment is an intrinsically dynamic process. The currency of this assessment continuously is affected by new data, changing regulations and the evolving experience and professional judgment of those involved in developing and implementing this assessment and the recommendations herein.

1.1 PURPOSE

Maryland's Source Water Assessment Program was approved by the U.S. Environmental Protection Agency (EPA) in November 1999, and the initial SWAP for the Town was completed in 2003. The 2003 assessment included recommendations for ongoing management and protection, as well as periodic updates to reflect changes to the water system, appropriation permit and/or land uses within Source Water Protection Areas (SWPAs) as they may periodically occur. Note that in the 2003 report, SWPAs were termed "wellhead protection areas."

While these past efforts recommended certain source protection and management concepts, MDE determined that the Town be included in our current work based on a combination of the size of the population served and an agency perception of its ongoing vulnerability to potential groundwater contaminants. Accordingly, the overall purpose of this work is to assist the Town in developing a more refined and ongoing SWPP, which includes specific guidance on implementing feasible source protection measures.

1.2 REGULATORY FRAMEWORK

ALWI followed MDE's source water assessment and wellhead protection guidelines, which stem from The Safe Drinking Water Act (SDWA) of 1974 and its later amendments. The SDWA established wellhead protection programs for each state under the oversight of the EPA. The 1996 Amendments to the SDWA mandated that the State of Maryland develop a Source Water Assessment Program. MDE completed a Source Water Assessment in 2003 (Appendix A).

In September of 2011, ALWI was awarded the SWPP contract. The Town's participation in the SWPP was voluntary and not a regulatory requirement under the SDWA.

1.3 BACKGROUND INFORMATION

The Town's system (PWSID 014-0002) currently serves approximately 5,400 people using eight active wells, six of which are completed in the Aquia Formation (Wells 2 through 7). The other two wells (Wells 1 and 9) are completed in the deeper Magothy Formation. One additional well (Well 8) is completed in the unconfined Aquia Formation, but is not currently in use due to past Methyl-Tert-Butyl-Ether **(**MTBE) contamination from Kent and Queen Anne's County Hospital. According to MDE databases, Well 2 was replaced back in 1996; original Well 2 was abandoned.

In 2003, MDE recommended that Chestertown form a local planning committee to implement a source water protection plan for the wells, while continuing to monitor contaminants listed in the Safe Water Drinking Act. Additionally, MDE recommended that Chestertown:

- Implement a local ordinance for protection of its water supply, whereby the State's Model Wellhead Protection Ordinance (Appendix B) should be considered;
- Conduct a detailed survey to ensure that there are no other potential or historical sources of contamination within or adjacent to the SWPAs;
- Adopt a regular inspection and maintenance program for the wells to help ensure their integrity and to protect the aquifer(s) from surficial contamination; and
- Frequently monitor the gasoline dispenser and above ground storage tank in the well field to safeguard against product spills or leaks onto the ground.

One of ALWI's overall SWPP goals was to assist the Town in moving forward with many of these and other recommendations.

1.4 DELINEATIONS REMAIN UNCHANGED FROM 2003 SWAP

In 1992, MDE delineated a Wellhead Protection Area (WHPA) for the Chestertown wells in response to a known contamination release near the Town well field. These WHPAs later served as the Town SWPAs, as written by MDE in the 2003 SWAP. The two SWPAs (Figure 1) were based on 1-year (Zone 1) and 10-year (Zone 2) travel zones. To delineate these zones, in 1992

MDE used a combination of the EPA WHPA Code and the Florida Method to address the variability in groundwater flow gradient and direction. Otherwise, delineation methods and parameters are summarized in Appendix A and are not repeated herein for brevity.

For this report, updates to SWPAs were not necessary because the addition of Well 9 to the system did not alter the Town's water appropriation permit. Well 9 is screened in the confined Magothy Formation. ALWI judged that the Zone 2 delineation for the Magothy Formation was conservative enough given its areal extent and would not be significantly altered by the addition of Well 9, because the total amount of water withdrawn from the aquifer within the SWPA would not change. Furthermore, the protective measures employed within even the Zone 2 SWPA for wells constructed in an unconfined aquifer (in this case the Aquia) as a rule of thumb are more conservative than those employed within SWPAs associated with wells constructed in confined aquifers (in this case the Magothy).

2.0 CONTAMINANT THREATS ASSESSMENT

ALWI performed regulatory database reviews, field reconnaissance and limited interviews to update the 2003 inventory of potential sources of contamination within the SWPAs delineated by MDE. Both point and non-point sources of contamination were considered.

2.1 STATE ENVIRONMENTAL DATABASE REVIEW

MDE provided ALWI the following state-maintained environmental databases to incorporate into point-source hazard inventories, with the date of database publication provided parenthetically as follows:

- Municipal and Industrial Groundwater Discharge Permits (6/14/2012);
- Pesticide Dealers (1/12/2012);
- Land Restoration Program Sites (Voluntary Cleanup Program and Comprehensive Environmental Response, Compensation, and Liability Act) (1/16/2012);
- MDE Oil Control Program (OCP) databases (10/14/2011);
- Supplemental database listing of solid waste facilities, wood waste disposal sites and other hazardous waste generators. (2/2012); and
- Resource Conservation and Recovery Act sites (6/18/2012).

The databases helped with interpretations of groundwater susceptibility, in that the listed facilities may be generators of hazardous materials, petroleum products and/or other drinking water contaminants. Results of this review are integrated with the results of the field reconnaissance included later in this chapter.

2.2 FIELD RECONNAISSANCE WITHIN SWPAS

On February 6, 2012 and again on July 8, 2013, ALWI supplemented the database review with a visual reconnaissance within the SWPAs. Results of this updated inventory are displayed on Figure 1 and summarized in Table 1.

During this reconnaissance, local land use conditions were observed with emphasis on the potential use, storage and disposal practices of hazardous materials and petroleum products in such a location where Town wells potentially could entrain related contaminants. Such conditions may have included visual evidence of present or former spills, stained or discolored ground surfaces, stressed vegetation, unusual odors or visible underground storage tank appurtenances. Adjacent and nearby properties were visually scanned to the degree practicable from public rights-of-way. Additionally, ALWI reviewed satellite imagery to assess land use changes, as well as contaminant threats. No significant land use or waste disposal changes were noted.

Though ALWI did not observe specific contamination threats warranting further investigation or corrective action, (1) contaminant hazards may exist that remain undetected because of limitations in the methods employed (concealed visual evidence, etc.) and/or (2) new contamination hazards may develop in the future. For these reasons, the measures employed herein for identifying contaminant hazards should be repeated periodically for the assessment to remain current.

The systems municipal production wells appeared to possess good physical integrity; though no subsurface or invasive work of a confirmatory nature was performed. We did not observe evidence of direct contamination emanating from areas immediately surrounding the wells. Wells 3 and 4 are located within locked well houses, though the other wells are located outside and are not secured by additional gating.

2.3 POTENTIAL POINT SOURCE CONTAMINATION HAZARDS

ALWI performed an update to MDE's 2003 point source hazard reconnaissance. In so doing, we observed the existence (or continuing existence) of the point source hazards listed herein (Table 1; Figure 1). Point source hazards reported by MDE in 2003 but not observed during the course of this work were omitted from this list. The point source hazard inventory included the following categories ("Types" in Table 1):

- **Underground Storage Tanks (USTs)** - USTs are primarily used for gasoline/gasohol storage for commercial industries, or heating oil storage for institutional and commercial sites. As of 10/14/2011, 27 USTs remained active at 12 locations. Also worth noting is that three of the UST sites identified in Table 1 have open OCP cases (Bennett's, Bennett's II and Kent and Queen Anne's County Hospital). Kent and Queen Anne's County Hospital also is listed as a Leaking Underground Storage Tank (LUST) site.

- **Controlled Hazardous Substances (CHS) -** ALWI confirmed the continuing existence of three CHS facilities within the SWPAs; Park Rug Cleaners (now Admiral Cleaners),

Bennett's II and Chestertown Wire Center (now Verizon).

- **Groundwater Discharge (GWD)** - Geno's Automotive Services, Inc. was identified as a permit holder within the MDE GWD database.

- **Other Point Source Hazard Types** - Admiral Cleaners, which already was identified in the CHS database, also was identified within the miscellaneous landfill, National Pollutant Discharge Elimination System and Land Restoration Program databases.

A full list of these potential point source hazards can be found in Table 1.

2.4 NON-POINT SOURCE CONTAMINATION HAZARDS AS SUGGESTED BY LAND USE

In order to evaluate the hazard represented by non-point sources of contamination, MDE guidance suggests consideration and mapping of the public sewer service area and land use data within the SWPAs. Pertinent land use acreages and percentages by SWPA are listed in Table 2. Each of these has implications in terms of non-point contaminant sources (e.g., septic systems). Please note that 100% of the SWPAs exist within Town sewer service area (Figure 2).

Potential sources of non-point-source contamination may include but are not restricted to:

- **Sewer Leaks and Inappropriate Discharges** - Nitrate- and bacteria-laden discharges may occur from sewer systems leaks, particularly if the system is aged. Inappropriate discharge of hazardous and other regulated liquids through leaky systems, arising from ignorance or intent, may also find their way into the groundwater. Sewer system maps suggest that the entire SWPA lies inside of the sewered area. The eight active Town wells exist inside of the mapped sewer service area.

- **Residential-Scale Fertilizer and Pesticide Use** - Residential areas (64% of the area within the combined SWPAs) may have wide-spread fertilizer and/or pesticide use. Though relatively small in scale, the collective application of such chemicals may result in nitrate and/or Synthetic Organic Compound (SOC) contamination of the groundwater, particularly for those Town wells drawing water from the unconfined Aquia Formation.

- **Sediment and Stormwater** - Commercial and institutional land uses (19% and 17% of the overall SWPA, respectively), particularly those with substantial impervious areas, may contribute to contaminant- and sediment-laden stormwater within the SWPA. In addition, highway spills, including accidental automobile discharges, may act as non-point sources of various synthetic or Volatile Organic Compounds (VOCs).

Sources of the information summarized in this Section included 2010 land use and recent public sewer service areas Geographic Information System data obtained from the Maryland Department of Planning (Figure 2). We have found that actual sewer service areas sometimes differ from those provided by the Maryland Department of Planning. Table 2 reflects dominant land uses by type, within each delineated zone within the SWPA.

2.5 STEERING COMMITTEE INTERACTIONS

ALWI met with the Chestertown Steering Committee on Thursday, June 28, 2012. The Committee was composed of Mr. Bob Sipes (the Town Water Superintendent) and representatives from the Permitting and Development and Critical Area and Stormwater Departments. ALWI delivered a PowerPoint presentation to the Steering Committee summarizing the local hydrogeology, potential sources of contamination, water quality statistics and recommendations related to source water protection issues.

Recommendations made to the Steering Committee are presented in Chapter 4 of this report. The Steering Committee chose to dismiss recommendations proposed by ALWI, particularly recommendations related to adopting a simplified version of MDE's Model Wellhead Protection Ordinance (Appendix B) that would work to restrict UST practices and incompatible land uses. The Steering Committee directed that we end our work at the SWPP report stage, and that public participation would not be necessary since a source water protection ordinance was not being considered by the Town.

3.0 CONTAMINANT SUSCEPTIBILITY

ALWI completed a review of available groundwater quality records, integrated with other findings herein, to support an assessment of groundwater susceptibility. MDE guidance defines a threshold for regarding a water source being "susceptible" to a given contaminant as being either:

- When the concentrations exceed 50% of the Maximum Contaminant Level (MCL) for 10% or more of the documented samples for a regulated contaminant and/or

- When a persistent but lower concentration is either increasing or chemically appears associated with an unknown or unexpected source.

In addition to these water quality data considerations, ALWI also considered the following factors in evaluating overall susceptibility:

1. The spatial position of sources of potential contamination relative to Town water sources and SWPAs;

2. Observed conditions of wellhead integrity and treatment supplies management, and

3. The natural chemical properties of the source water within contributing aquifers.

3.1 PROCEDURES

ALWI completed the susceptibility assessment in accordance with the following step-wise procedure:

1. **Obtain and Filter Water Quality Databases** - ALWI reviewed available electronic databases of water quality analyses provided by MDE for the period 2003 to 2011. The databases were filtered to isolate only prospective groundwater contaminants affecting Town groundwater supplies.

2. **Consider Chemical Classes and Sampling Conditions** - The furnished databases were developed by MDE as an incidence of operational compliance record-keeping. They contained analytical records for surface pathogens, inorganic compounds (IOCs) including radiological species, VOCs and SOCs. In most cases, the available water quality records only reflect post-treatment, composite water samples and not raw groundwater sources. As such treatment efficacy is reflected in the water quality results as furnished to us. Generally the absence of comprehensive analytical results of raw groundwater samples hampered correlating specific water quality findings to specific wells, aquifers and contributing SWPAs.

3. **Review of MDE Paper Files -** In order to gain a more thorough understanding of raw water quality by well, ALWI supplemented the MDE databases with raw groundwater quality laboratory reports available in MDE paper files and Town records. Specifically, we were able to obtain limited IOC and VOC data for Wells 2 through 9.

4. **Identify "Exceedance" Instances** - To identify water quality sample exceedances, we compared each specific analytical result to published MCLs (in COMAR 26.04.01 as of September 2011). Guided by MDE, we judged that a concentration of greater than or equal to 50% of a given MCL should be considered an "exceedance." Procedurally, this was accomplished by sorting the database by analyte and concentration.

5. **Assess Frequency and Relative Percentage of Exceedance Instances** - The number of times that a given analyte was detected in a concentration greater than 50% of its respective MCL was discerned in terms of overall frequency, percentage of total number of samples and date range of exceedance. Contaminants with results equaling or exceeding 50% of the MCL more than 10% of the time were considered *prima facie* susceptible. ALWI also identified changes in contaminant trends over time, even for those that did not equal or exceed 50% of the MCL more than 10% of the time.

6. **Integrate Information** - ALWI then considered these identified exceedances in the context of the results of the contamination hazard reconnaissance to correlate water quality results to specific field observations suggestive of a condition of susceptibility.

ALWI noted that the 2003 MDE-prepared Source Water Assessment reports susceptibility to certain water quality parameters and chemical classes (e.g., trichloroethylene and 1,1,2-trichloroethane). We also observed that hydrogeological conditions (unconfined aquifers) and land uses (generally anthropogenic development) suggest a level of future risk of contaminant entrainment (including but not restricted to VOCs) irrespective of the content of the water quality records reviewed for this SWPP and discussed herein.

For conservatism and appropriate source water protection, generally ALWI recommended a source water protection ordinance (see Sections 2.6 and Chapter 4), guided by the MDE Model Wellhead Protection Ordinance (Appendix B), to help limit the likelihood of future contamination from point and non-point sources, whether or not presently contributing to conditions of quantitative susceptibility.

3.2 TETRACHLOROETHENE (PCE) SUSCEPTIBILITY

In 2003, MDE found the Town's system susceptible to VOC contamination, largely supported by tetrachloroethene water quality results. MDE ascribed the elevated frequency and concentrations of PCE to a dry cleaning facility (in 2003 known as Park's Rug and Dry Cleaners, now called Admiral Cleaners; Letter J on Table 1 and Figure 1) within the SWPA. MDE reported that "extremely high" concentrations of PCE were detected at this facility. Within this dry cleaning facility was a floor drain, which provided a direct conduit to the groundwater. Prior to issuance of the 2003 SWAP, the floor drain was sealed and an onsite heating oil UST was removed.

Since composition of the 2003 report, we only were provided with between one and four raw groundwater samples from each well. A summary of PCE susceptibility is based on this limited data, as follows:

- **Well 2**[1] - The only samples provided for Well 2 were collected on December 1, 2004, June 8, 2006 and June 12, 2006. The sample collected December 1, 2004 had a concentration of 3.3 µg/L, which exceeds 50% of the MCL. The sample collected on June 8, 2006 had a concentration of 23.7 micrograms per liter (µg/L), approximately four times higher than the primary MCL of 5 µg/L. The sample collected on June 12, 2006 had a concentration of 32.6 µg/L, approximately seven times higher than the primary MCL. Based on available data, this well exhibited an increasing trend over time. Well 2 is susceptible to PCE contamination, and its location suggests that the unconfined aquifer southwest of the well field (in Town) is likewise susceptible to PCE contamination. Additional recent data would help improve interpretations of this well's susceptibility to PCE contamination.

- **Well 6** - Samples were provided for this well from December 1, 2004, June 8, 2006 and June 12, 2006. The sample collected December 1, 2004 had a PCE concentration of 0.5 µg/L, whereas the samples collected June 8, 2006 and June 12, 2006 had concentrations of 1.11 µg/L and 3.44 µg/L, respectively. The sample collected on June 12, 2006 had a concentration greater than 50% of the MCL. Based on this limited data, this well exhibited an increasing trend through time. Well 6 is susceptible to PCE contamination, and its location further suggests that the unconfined aquifer near Well 2 and further southwest of the well field (in town) is susceptible to PCE contamination. Additional recent data would help improve interpretations of this wells susceptibility to PCE contamination.

[1] MDE water quality databases indicate sampling results for "Well 2" and "Well 2(R)." Irrespective of these different labels, records post-dating the 2003 MDE SWAP were evaluated collectively. This approach is supported by a MDE database listing original Well 2 as abandoned, and the replacement Well 2 being constructed in 1996.

- **Well 5** - Samples were provided for this well from December 1, 2004, June 8, 2006 and June 12, 2006. The sample collected December 1, 2004 was the only sample to exceed 50% of the MCL, with a concentration of 2.6 µg/L. Since that sample, concentrations have leveled off around 1.3 µg/L. Despite these relatively low concentrations, Well 5 is susceptible to PCE contamination because of (1) its construction within the unconfined aquifer and (2) the known existence of nearby contamination sources (Table 1; Figure 1).

- **Wells 3, 4, 7 and 8** - PCE concentrations in these wells did not exceed 50% of the MCL. Additionally, samples collected in these four wells have exhibited a general decrease in PCE concentrations over time. Despite these relatively low concentrations, these wells are susceptible to PCE contamination because of (1) their construction within the unconfined aquifer and (2) the known existence of nearby contamination sources (Table 1; Figure 1).

- **Well 9** - PCE was never detected in Well 9, which is screened in the confined Magothy Formation. The Magothy Formation, including Well 9, is not susceptible to MTBE contamination.

In the course of our point source contamination assessment we identified Admiral Cleaners (formerly Park Rug & Dry Cleaners Corp.) as an existing dry cleaner within the delineated SWPAs (Table 1). As MDE suspected in the 2003 report, this site is the most likely source of PCE contamination in the Town wells.

3.3 MTBE SUSCEPTIBILITY

In 2003, MDE found the Town's system susceptible to VOC contamination, and by extension MTBE. Since composition of the 2003 report, we only were provided with between one and four raw groundwater samples from each well. A summary of MTBE susceptibility is based on this limited data, as follows:

- **Well 2** - The only samples provided for Well 2 were collected on December 1, 2004, June 8, 2006 and June 12, 2006. The sample collected December 1, 2004 had a concentration of 6.6 µg/L, which does not exceed 50% of the action level. The sample collected on June 8, 2006 had an estimated concentration of 61.8 µg/L, approximately three times higher than the action level of 20 µg/L. The sample collected on June 12, 2006 had a concentration of 74.6 µg/L, approximately four times higher than the action level. Well 2 is susceptible to MTBE contamination, and its location suggests that the unconfined aquifer southwest of the well field (in Town) is likewise susceptible to MTBE contamination. Additional recent data would help improve interpretations of this well's susceptibility to MTBE contamination.

- **Well 6** - Samples were provided for this well from December 1, 2004, June 8, 2006 and June 12, 2006. While no one sample has exceeded 50% of the action level for MTBE, concentrations in this well have been increasing over time, from 0 µg/L to 1.05 µg/L. Consequently, Well 6 is susceptible to MTBE. This wells location relative to Well 2 further suggests that the unconfined aquifer near Well 2 and further southwest of the well field (in Town) is susceptible to MTBE contamination.

- **Well 4** - Samples were provided from this well from December 1, 2004 and August 31, 2011. The sample collected December 1, 2004 had a concentration of 40 µg/L, which is double the action level of 20 µg/L. However, MTBE was not detected in the sample collected August 31, 2011. Considering the foregoing detection history, Well 4 is susceptible to MTBE contamination because of (1) its construction within the unconfined aquifer and (2) the known existence of nearby contamination sources (Table 1; Figure 1).

- **Wells 3, 5, 7, 8** - MTBE concentrations in these wells did not exceed 50% of the action level. Additionally, samples collected in these four wells have exhibited a general decrease in MTBE concentrations over time. Despite these relatively low concentrations, these wells are susceptible to MTBE contamination because of (1) their construction within the unconfined aquifer and (2) the known existence of nearby contamination sources (Table 1; Figure 1).

- **Well 9** - MTBE was not detected in Well 9, which is screened in the confined Magothy Formation. The Magothy Formation, including Well 9, is not susceptible to MTBE contamination.

In the course of our point source contamination assessment we identified three open OCP cases and one LUST site within the delineated SWPAs (Table 1). These sites likely are the source of MTBE contamination in the Town wells. Because VOC contamination ordinarily is linked to anthropogenic activities, the open OCP/LUST cases, or an otherwise unidentified release site, seem even more likely the source of MTBE contamination.

3.4 RADIONUCLIDES

In 2003, MDE found the Town's system susceptible to radionuclides based on (1) an elevated short-term gross alpha sample concentration of 8.44 picocuries per liter (pCi/L), which exceeds 50% of the MCL (MCL of 15 pCi/L) and (2) The known presence of radionuclides in the Magothy Formation, where high levels of radium have been detected in other water supplies. Radionuclide occurrence is attributed to the decay of naturally occurring minerals like uranium in the aquifer sediments.

Our review of water quality data indicated that no additional sample results were available for these contaminants in the MDE provided water quality database. However, during our MDE paper file review, ALWI found a raw water sample taken in Well 9 on August 14, 2006. This sample indicated a gross alpha value of 2.5 pCi/L. Therefore, the Town sources remain susceptible to radionuclides until data prove otherwise. The Town should conduct additional sampling for radionuclides (especially gross alpha) to make this determination.

3.5 OTHER GROUNDWATER CONSTITUENTS

We did not otherwise find the wells, or by extension, the aquifers, susceptible to the following constituents:

- **Previous Susceptibility Findings** - Certain contaminants that MDE made special note of in the 2003 SWAP remained well below 50% of the MCL, but had additional detections since

MDE's previous analysis (e.g., nitrate, trichloroethylene and 1,1,2-trichloroethane). Though the Town wells are not presently susceptible to these three parameters, because they have shown continuous but sporadic detections over time, we recommend monitoring with greater frequency than otherwise required by MDE.

- **Other Volatile Organic Compounds -** Certain VOCs have been detected very rarely (cis-1,2-dichloroethene) or in very low concentrations (chloroform). Though the wells are not susceptible to these contaminants, given the unconfined status of the Aquia Formation in the vicinity of the Town wells, it would be prudent for the Town to monitor these specific contaminants with greater frequency than otherwise required for compliance purposes.

- **Inorganic Compounds -** The only inorganic compound detected equivalent to, or in excess of 50% of its associated MCL, was arsenic. Of seven samples taken between 2001 and 2010, only one was equivalent to the 50% MCL in 2005. Three subsequent samples since then have resulted in non-detects. In 2003 MDE reported an increasing trend in nitrate concentrations. Since that report, nitrate concentrations have generally been around 2.5 mg/L to 2.0 mg/L, exhibiting an overall, generally decreasing trend in concentration over time. Based on the foregoing, the Town's system is not susceptible to IOC contamination.

- **Disinfection By-Products (DBPs) -** The two most common measures of DBPs are total Trihalomethanes, which is reported as the sum of several closely-related chlorinated methane compounds and Total Haloacetic Acids, which is reported as the sum of several closely-related acetic acids. Neither DBP was found to be in excess of 50% of its respective MCL in any sample over the nine year period.

- **Synthetic Organic Compounds -** In analyzing the results of all water samples collected over the nine year period, we did not observe SOCs exceeding 50% of their respective MCLs.

- **Microbial Contaminants -** Our review of water quality data indicated that Town sources are not susceptible to microbial contaminants.

4.0 RECOMMENDATIONS

ALWI has developed the following recommendations to improve overall source protection in light of the observations, analyses and interpretations presented herein:

1. **Adopt a Source Water Protection Ordinance** - Though the recommendation to the Town to adopt a source water protection ordinance was rejected by the Steering Committee, ALWI continues to urge the Town to consider adopting a simplified version of the MDE Model Wellhead Protection Ordinance (Appendix B). The Ordinance should feature similar restrictions across both SWPA zones, and may allow for grandfathering, with the exception of USTs. The Ordinance may require buildings reapplying for permits to adopt Best Available Technologies. This would require gas stations to replace USTs with vaulted aboveground storage tanks, which are easier to maintain and better for preventing leaks.

2. **Increase Frequency of Monitoring for Select Contaminants** - Given past or present conditions of susceptibility, or an increasing trend toward susceptibility, the Town should consider sampling with greater frequency than otherwise required for compliance purposes for the following contaminants:

   - ❑ PCE
   - ❑ MTBE
   - ❑ Radionuclides
   - ❑ Trichloroethylene
   - ❑ 1,1,2-trichloroethane
   - ❑ Cis-1,2-dichloroethene

   Sampling for these contaminants will help verify that concentrations are not increasing with time. Particular emphasis should be placed on VOC contaminants in the unconfined, Aquia Formation wells, as the confined, Magothy Formation wells act in hydrologic isolation from the Aquia Formation wells and have not indicated conditions of susceptibility. While the specific contamination concerns vary from well to well, as a precaution, sampling should be conducted for each raw groundwater source, ideally quarterly to capture seasonal variations.

3. **Improve Site Security** - ALWI recommends that Chestertown consider enclosing all wells within a locked gate or well house to protect from vandalism or other damage occurring from natural or man-made hazards.

4. **Community Outreach and Public Education** - The Town should consider a SWPA-wide community outreach and awareness program, concentrating on residential and commercial landowners who may frequently apply fertilizers and/or pesticides to their land. The Town should consider a mass mailing with pertinent information on best management practices for the handling of chemicals as a measure to educate landowners on contamination issues.

5. **Create a Spill Notification System** - The potential exists for surficial spills to infiltrate the unconfined aquifer. A spill notification system would give water plant managers notice of potential contaminants that could impact drinking water quality. This would allow them ample time to design and incorporate preventative measures to reduce the impact of these spills. This effort should include members of the Chestertown Fire Department and other appropriate entities.

6. **Post "No Dumping" Signs Within SWPA** - The Town and County should consider posting "No Dumping" signs at various locations within the SWPAs to discourage the informal disposal of hazardous wastes and petroleum products. Similarly, the Town and County periodically should examine the SWPAs for evidence of dumping, while removing unwanted debris and waste items at the same time.

7. **Abandon Unused Wells** - Unused wells, owned by the Town or other entities (i.e., private wells) within the SWPAs, should be abandoned. Such wells may function as a conduit through which contamination at the surface may enter groundwater aquifers at depth.

8. **Future Town Wells** - If the Town plans to add future wells or replace wells, they should consider using the Magothy aquifer, since it is confined and better protected from sources of contaminants identified in the SWPA.