SOURCE WATER PROTECTION PROGRAM BENEFITING THE MIDLAND-LONACONING-BARTON WATER SYSTEM (PWSID 001-0018) ALLEGANY COUNTY, MARYLAND

ALWI Project No. MD7S075

July 16, 2013

Prepared for

MIDLAND-LONACONING-BARTON WATER SYSTEM

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

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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 Midland-Lonaconing-Barton Water System (the System), 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 safe drinking water.

In 2004, MDE developed a Source Water Assessment report for the System (Appendix A). This report determined that the Towns of Midland, Barton and Lonaconing are supplied by three small mountain reservoirs, each of which is supplemented by adjacent wells (Figure 1). Also in 2004, the Midland-Lonaconing Source Water Protection Planning Committee and Maryland Rural Water Association developed an initial SWPP, which outlined voluntary management and planning initiatives for the System (Appendix B).

We updated these documents 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 Source Water Assessment report and Source Water Protection Plan for the System were completed in 2004. The 2004 reports 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 2004 reports, SWPAs were termed "source water assessment areas" and "source water protection areas."

While these past efforts recommended certain source protection and management concepts, MDE determined that the System be included in our current work based on a combination of the size of the population served and the vulnerability of the aquifer to potential groundwater

contaminants. Accordingly, the overall purpose of this contract is to assist the System 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, which established wellhead protection programs for each state under the oversight of the EPA. The 1996 Amendments to the SDWA mandated the state of Maryland to develop a Source Water Assessment Program. MDE completed such a Source Water Assessment in 2004 (Appendix A) In September of 2011, ALWI was awarded the SWPP contract. The System's participation in the SWPP was voluntary and not a regulatory requirement under the SDWA.

1.3 BACKGROUND SYSTEM INFORMATION

The System (PWSID 001-0018) serves approximately 5,600 customers using the Midland-Gilmore, Charlestown and Koontz reservoirs (Appendix A). Each one of the reservoirs is supplemented by nearby groundwater wells. The Midland-Gilmore and Koontz reservoirs are both supplemented by three wells each, while the Charlestown reservoir is supplemented by two wells (Figure 1). Each of these three reservoirs has a corresponding SWPA. The Midland-Gilmore, Koontz and Charlestown reservoirs are located in Allegany County.

System representatives have advised that approximately 1,900 connections are on the System; some of these have been connected more recently than the 2004 reports. All three of the reservoirs and their surrounding watersheds are within the Georges Creek river basin and have approximate MDE-estimated capacities as follows:

- Midland-Gilmore Plant - 288,000 gallons per day (gpd);
- Koontz Plant - 128,000 gpd; and
- Charlestown Plant - 128,000 gpd

ALWI divided the sum total of these plant capacities (544,000 gpd) by the number of reported connections to derive an estimated use per connection of 286 gpd. We judged this value plausible for older municipalities with a largely residential customer base.

System representatives have indicated that the Koontz Reservoir is being replaced by a three million gallon precast concrete impoundment which will be located in the vicinity of the old dam. Construction is scheduled to begin in the spring of 2013, and the impoundment is planned to go into service in the summer of 2014. The current reservoir will be restored back to a natural stream.

Plant officials have stated that the water treatment process involves gravity filtration, as well as the addition of chlorine, alum, soda ash, potassium permanganate and a polymer. Previous

reports also have stated that System wells have high iron and manganese concentrations. Potassium permanganate is used for iron removal.

1.4 PREVIOUS SOURCE WATER ASSESSMENT

In 2004, MDE compiled a Source Water Assessment report for the System, which encompassed both groundwater and surface water and was performed at the watershed scale (Appendix A). MDE recommended that the System form a local planning committee to implement a SWPP for the three reservoir watersheds, while continuing to monitor contaminants listed in the SDWA. As an outgrowth of this recommendation, the Midland-Lonaconing Source Water Protection Planning Committee was formed and in 2004 drafted an initial SWPP (Appendix B).

One of ALWI's overall SWPP goals is to assist the Midland-Lonaconing-Barton Source Water Protection Planning Committee in moving forward with select recommendations from the previous reports so as to support implementation of feasible protection measures. The SWPP effort now underway updates the 2004 recommendations based on presently applicable regulations and guidelines.

2.0 EXISTING ORDINANCES

A meeting was held on Wednesday, May 30, 2012 to discuss many of the findings and recommendations presented within this SWPP. At the time of this meeting, attendees (herein referred to as the "Steering Committee;" Chapter 6) participated from the perspective that all three SWPAs were within Allegany County and thus, subject to the Allegany County Collective Ordinance §360-84 (the "Allegany Ordinance;" Appendix C).

When later it was determined that approximately 90% of the Koontz SWPA is situated in Garrett County, System and Allegany County representatives then came to feel that the existing Garrett County Sensitive Areas Ordinance (the "Garrett Ordinance;" Appendix D), would be adequately protective of the Koontz SWPA. We later discussed this concept with Garrett County officials and they were receptive to our recommendation to update their Ordinance Map to include the portion of the Koontz SWPA within Garrett County jurisdiction. The Midland-Gilmore and Charlestown SWPAs, however, are entirely within Allegany County. Therefore, System and Allegany County representatives believe that these SWPAs are protected by the existing Allegany Ordinance.

Herein we explain our interpretation of the existing ordinances and which ones apply as they lay as of the date of this report.

2.1 ALLEGANY COUNTY COLLECTIVE ORDINANCE §360-84

The Allegany County Conservation District, referred to as the "C Conservation District" in the Allegany Ordinance (Appendix C) (http://ecode360.com/14700058) is designed to protect, among other things, public supply watersheds. This ordinance protects 100% of the Midland-Gilmore and Charlestown SWPAs and approximately 10% of the Koontz SWPA (including the wells and reservoir) by requiring or prohibiting the following:

- Site plan approval (for a land development project with a SWPA) requires the avoidance or mitigation of public supply watersheds.

- Permitted land uses include but are not restricted to various agricultural and residential buildings, airports, sawmills and communication towers. Conditions for allowable special exceptions are set forth in the Allegany Ordinance §360-83 (Appendix C), "A Agriculture, Forestry and Mining Districts" (http://ecode360.com/14700020).

- In "areas specifically identified as public supply watersheds" (i.e., SWPAs), developers need approval from the county Board of Appeals to undertake any of the permitted uses or special exceptions outlined in §360-83.

As mentioned in Chapter 6, System representatives believe that this Ordinance, as written, obviates the need for revisions and/or additional ordinances. We found, however, that the Ordinance is silent with regard to potentially SWPA-incompatible land uses associated with energy resources exploration and development. Coal and natural gas exploration programs and production facilities may cause the release or migration of groundwater contaminants (and surface water contaminants as well). Notwithstanding the Steering Committee's desire not to revise existing protective measures, ALWI recommends that such land uses be prohibited in the SWPAs (Chapter 7).

2.2 GARRETT COUNTY SENSITIVE AREAS ORDINANCE

The Garrett Ordinance (Appendix D) originally was adopted on June 24, 1997, and amended May 25, 2010. The Ordinance includes a map of its applicable areas outlined in red. Presently, the Koontz SWPA is not included.

The Garrett Ordinance establishes requirements and prohibitions to protect community well and spring sources from potential groundwater contamination. Largely, its groundwater protections are accomplished through restrictions on incompatible land uses within SWPAs. Although, the Ordinance does not appear intended for or otherwise protective of surface water sources, Zone 2 of the SWPA has coincident groundwater and surface water delineations.

We recommend that the System request Garrett County to amend its Ordinance to include the Koontz SWPA. We anticipate that such an amendment is feasible because Garrett County representatives already have conceptually agreed to make similar amendments for other systems subject to this contract.

Once the Garrett Ordinance is updated to include the Koontz SWPA, its specific protective measures would offer the following protections:

- Hazardous substance storage tanks located within the SWPA, but more than 500 feet from a community water supply system well, shall be placed above ground and be surrounded by a one-hundred percent catchment basin or double-walled containment and a spill protection overfill alarm.

- Uses which involve, as a principal use, the manufacture, storage, use, transport, or disposal of hazardous materials; or any use which involves hazardous materials in quantities greater than associated with normal household use are prohibited.

A more complete list of use restrictions is included in Appendix D.

3.0 SWPA DELINEATIONS REMAIN UNCHANGED

ALWI reviewed the 2004 SWPA delineations for conformity to present site conditions, operational practices and current MDE guidance. For each of the three SWPAs, we determined whether or not delineation updates were necessary. SWPAs are depicted on Figure 1; the 2004 source water assessment (including its narrative support for delineation methods) is provided in Appendix A.

The 2004 assessment covered both surface water and groundwater sources and delineated protection areas. The 2004 delineations were based on upgradient topographic areas that contribute directly to the reservoirs themselves, which may or may not also reflect upgradient groundwater capture zones.

Updates to the 2004 SWPAs were not necessary for any of the three SWPAs since no new sources were added to the system, and there has been no increase to the System's water appropriation permit.

Considering the nature of groundwater reliance as both infrequent and supplemental to the reservoirs, applying the existing surface water delineations to the groundwater incorporated adequate conservatism. Consequently, we recommend that the existing SWPA delineations remain unchanged but that particular care be given to land use activities and practices within a standard 500 foot radius around each wellhead. Specific land use restrictions and practices were suggested to System representatives, as summarized in Chapter 6 of this report.

4.0 CONTAMINANT THREATS ASSESSMENT

ALWI performed a regulatory database review, field reconnaissance and limited interviews to update the 2004 inventory of potential sources of contamination within the SWPAs delineated by MDE. Both point and non-point sources of contamination were considered. Additionally, MDE specifically suggested that the compatibility of existing and future natural resources development projects within the SWPAs be considered. Such natural resources projects may include but are not necessarily restricted to coal mines, natural gas wells and timbering operations.

4.1 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 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 points source hazard inventory (Section 4.4) of this report.

4.2 FIELD RECONNAISSANCE WITHIN SWPAS

ALWI performed a field reconnaissance on December 19, 2011, guided by system representatives. 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 near the wells and elsewhere in the delineated SWPAs.

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 facilities. Adjacent and nearby properties were visually scanned to the degree practicable from public rights-of-way.

Though ALWI did not observe specific contamination threats warranting further investigation or corrective action, (1) contaminant hazards may exist and could remain undetected due to 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.

No point-source hazards, significant land use or waste disposal changes were noted. ALWI notes that the SWPAs are extensively forested, inaccessible by vehicle and not visible without substantial trespassing on private property. The possibility of concealed point-source contamination hazards remains, consequently.

4.3 PHYSICAL CONDITIONS AT WELLHEADS

ALWI performed a field reconnaissance on December 19, 2011, guided by system representatives. During this reconnaissance, we learned that each of the wells (when pumped) discharges to its corresponding neighboring reservoir. None pump water directly to the system without first being treated at the surface water filtration plants. The system has centralized chlorination, but the individual wells discharge to the reservoirs without individual treatment. We made the following specific observations:

- **Charlestown Wells** - The Charlestown reservoir historically was served by two wells. We found that Well 1 is no longer in commission, inasmuch as the pump column and assembly had been removed. We did not observe the presence of a well cap. If the System has no plans to bring the well back online, we recommend that it be properly abandoned and sealed. Charlestown Well 2 also was inoperable because (according to System representatives) a section of its electric supply cable had been cut and stolen. At the time of our reconnaissance, the Charlestown reservoir had no functioning wells. This theft evidences unauthorized access to the wellhead; ALWI recommended better site security. The System has since replaced the electric supply cable to Charlestown Well 2, making the well operable once again.

- **Koontz Wells** - The Koontz reservoir is served by three wells; "Well 1", "Well 2" and "Artesian." The casing stick-ups for the three wells appeared to be capped and without extensive damage or perforations at the time of our reconnaissance. The Artesian well reportedly produces water under flowing artesian conditions during or just after rain events.

- **Midland-Gilmore Wells** - Three wells were connected to the Midland-Gilmore reservoir at the time of our reconnaissance. Midland-Gilmore Well 1 was located within a pump house; observation of Midland-Gilmore Wells 2 and 3 were limited due to overgrown vegetation and black plastic, respectively. ALWI observed an overflow of rust-colored water, on the land surface coming from the pump house of Midland-Gilmore Well 1. In 2004, MDE reported high iron concentrations in the Midland-Gilmore reservoir. but dilution (via blending of surface and groundwater sources) at the treatment plant is understood to achieve secondary drinking water standards as reflected in the post-treatment water quality data we reviewed for this assessment (See Section 5.4). System representatives plan to fix the overflow problem when other well repairs are needed. Midland-Gilmore Well 2 is currently not in use and plans exist to abandon it because of excessive concentrations of iron.

In general, gated entrances to the reservoirs have failed to keep trespassers away from the wells, as was demonstrated by signs of alleged vandalism and theft observed at Charlestown Well 2. ALWI recommended that all reservoirs and wells be locked behind fencing. At the time of this writing, the System had begun the process of constructing fencing around each of the reservoirs.

4.4 POTENTIAL POINT SOURCE CONTAMINATION HAZARDS

Based on our field reconnaissance of December 19, 2011, ALWI did not identify potential point sources of anthropogenic contamination within the SWPAs. Up-gradient land uses generally are forested and not otherwise developed as discussed in the next section. Point source hazard

databases provided by MDE (Section 4.1) did not indicate the presence of sources of potential contamination within the SWPAs for the System.

4.5 POTENTIAL NON-POINT SOURCE CONTAMINATION HAZARDS

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 1. Each of these has implications in terms of non-point contaminant sources (e.g., septic systems). Note that public sewer service areas do not exist within the SWPAs (Figure 1).

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

- **Septic System Discharges** - These include nitrate- and bacteria-laden discharges concordant with the intended design of septic systems. They also can include the inappropriate discharge of hazardous and other regulated liquids through such systems, arising from ignorance or intent. For this reason, MDE guidance suggests consideration and mapping of the public sewer service area(s), with the inference that those areas not sewered are on septic systems. Sewer system maps available from the Maryland Department of Planning (Figure 1) suggest that 100% of the SWPA lies outside of the sewered area. In the 2004 SWAP, MDE identified improperly functioning septic systems as a concern given their age, proximity to surface water bodies and placement on relatively steep slopes, such as those found adjacent to Elklick Run. Though sparse in geographic expanse, these septic systems are still used today and their potential failure could act as a source of contamination for viruses, bacteria, disinfection byproduct (DBP) precursors and nutrients, such as nitrate.

- **Agriculture** - Fertilization of cultivated fields, livestock wastes, and agri-chemical releases constitute the primary sources of groundwater contamination from agricultural sources. Agricultural lands within the SWPAs may be sources of nutrients (including nitrates), DBP precursors, herbicides, insecticides and/or animal wastes. Land use coverage maps (Figure 1) indicate that only 11% of the total SWPA is in agriculture and that farming land uses do not exist closer than 550 feet from any of the wells, and 430 feet of any of the reservoirs.

- **Energy and Other Natural Resources Operations** - Natural resources extraction and utilization activities possibly could imperil groundwater quality based on similar occurrences reported elsewhere in the country. Major timbering operations, coal mines, and natural gas exploration and production operations may warrant greater scrutiny and/or protective measures before they come to exist or expand within the SWPAs. Land use coverage maps may not reflect the full extent of such existing and planned land uses, but suggest that only 2% of the total SWPA is classified as a "mined land." However, according to MDE, currently 97 acres of land surrounding Elklick Run are owned by Allegany Coal while an additional 338 acres are owned by the Barton Mining Company. ALWI identified via maps obtained from the Garrett County website that a substantial amount of lands are either leased and/or had mineral rights sold to energy companies, though it is our understanding that many of the leases have expired (Appendix E). Allegany County maps of such holdings were not available for a similar assessment of the Midland-Gilmore and Charlestown SWPAs.

However, review of 2006 Department of Assessment and Taxation data shows that 260 acres of land within the Charlestown SWPA are owned by Vindex Energy Corporation. Some recommendations relating to future operations of mined lands are offered in Chapter 7.

- **Sediment and Stormwater** - Commercial and industrial land uses, particularly those with substantial impervious areas, may contribute to contaminant- and sediment-laden stormwater within the SWPA. Available mapping data suggests that 0% of the SWPA is in such land uses, though some measure of future development (particularly in pursuit of natural resources) remains possible.

- **Heating Fuel Use and Storage** - Liquid petroleum products commonly are used as a heating fuel. Though the extent of reliance on heating fuels within the SWPA is unknown, and determining the degree to which heating oil is used was outside of the scope of this SWPP, it is safe to assume that some use exists within the SWPA. Leaks and spills associated with the use and storage of heating fuels may expose System sources to hydrocarbon contamination.

Sources of the information summarized in this subsection included 2010 land use and recent public sewer service areas Geographic Information System data obtained from the Maryland Department of Planning (Figure 1). We have found that actual sewer service areas differ from those provided by the Maryland Department of Planning. Table 1 reflects dominant land uses by type, within each delineated zone within the SWPA. Figures 2, 3 and 4 reflect this information in pie chart form.

5.0 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 equal or 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 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 potential contamination hazards relative to System water sources and SWPAs (note that no such hazards were identified within the SWPAs for the System),

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

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

This susceptibility analysis was not an evaluation of System compliance. The finding of susceptibility does not indicate or suggest an out-of-compliance condition or a need for immediate, corrective action. Matters of compliance are addressed through MDE-mandated sampling programs.

5.1 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 2000 to 2011. These databases were filtered to isolate only groundwater contaminants affecting System groundwater supplies. System representatives told us that source-specific water quality data for the period since 2000 are unavailable.

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 inorganic compounds including radiological species, inorganic and organic compounds. In most cases, the available water quality records only reflect post-treatment, composite water samples (of largely surface water) and not raw groundwater sources. As such, mixing, blending and treatment efficacy substantially overprints 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.

3. **Special Consideration of Disinfection Byproducts** - Disinfection byproducts (DBPs) form in the distribution system as a consequence of mixing chlorine (used for water disinfection in the treatment system) with organic and/or inorganic carbon in drinking water. DBPs do not themselves naturally occur in groundwater and the presence of DBP precursors requires specialized analyses (usually not performed). Because they can be drinking water health hazards, they are addressed herein even though no condition of direct groundwater susceptibility to DBPs can be interpreted.

4. **Identify Instances When Sample Results Are Above 50% of the MCL** - In order to evaluate the water quality samples, 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 contributing to a finding of susceptibility. Procedurally, this was accomplished by sorting the database by analyte and concentration.

5. **Assess Frequency and Relative Percentage of Sample Concentrations Contributing to Susceptibility** - 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. Contaminants with results equaling or above 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 surpass 50% of the MCL more than 10% of the time.

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

The Midland-Lonaconing-Barton plant operator generally has advised that well water is pumped into reservoirs during periods of low recharge and is treated in the same manner as surface water. Notwithstanding this generalized, overall practice, hypotheses regarding which well(s) may contribute to a specific condition of susceptibility, therefore, remain unverified as of this writing.

5.2 KEY WATER QUALITY FINDINGS

Overall, the System's source water is of high quality, as the available data indicate that concentrations of IOC, VOC, SOC and radionuclide contaminants do not indicate conditions of susceptibility. While the System is not susceptible to constituents with a primary MCL, the available water quality data reflect occasional and/or historic detections of copper and lead. These detections (as detailed below) are not of immediate health concern, as they do not constitute conditions of susceptibility. These periodic detections likely arise from distribution system piping (including residential and/or commercial piping), as opposed to source water.

System and MDE officials have indicated that lead and copper samples were collected from homes on the distribution system in compliance with Lead and Copper Rule Monitoring Requirements. For these tests, sample sites were selected to represent homes in the system with the highest potential for elevated lead, due to the presence of lead soldering predating current prohibitions. Additionally, these samples were taken as first draw early morning samples, maximizing the likelihood of a positive sampling result due to extended exposure to lead and copper piping.

Twenty lead and copper samples are collected from various locations in the distribution system every three years. Out of the 80 copper samples collected between 2003 and 2012, 17 samples were above 50% of the MCL, with one sample above the MCL of 1.3 mg/L. Copper is not believed to be in the source water, but no laboratory analyses were available to confirm our hypothesis that copper originates from distribution system piping leachate.

Out of the 80 lead samples collected between 2003 and 2012, only two samples were above the MCL. We suspect that these two samples were from homes or businesses using lead soldering, and do not originate in the source water. Elevated lead and copper concentrations likely are the result of leachate from residential or system piping when the water remains stagnant (such as during overnight periods when use is minimal).

5.3 DBPS IN DISTRIBUTION SYSTEM

DBPs are reported as Total Trihalomethanes (TTHM) and Total Haloacetic Acids (THAAs or HAA5), as described in applicable EPA guidance

(http://www.epa.gov/enviro/html/icr/gloss_dbp.html). Assuming a complete dataset, between 2000 and 2011, 106 TTHM and 103 THAA distribution system samples were collected and analyzed. Of these samples, only five had concentrations above 50% of the MCL for TTHM. The overall distribution system is not susceptible to TTHM formation as a complication of treating System water. Additionally, only 13 of the samples had concentrations above 50% of the MCL for THAA, with one of these samples (66.04 µg/L) slightly over the MCL of 60 µg/L, resulting in a 12% occurrence. The system is therefore marginally susceptible to THAA formation as a complication of treating System water, the precursors of which are further discussed below.

Based on the land use data provided by the Maryland Department of Planning, DBP formation in the Midland-Lonaconing-Barton System likely is predominantly derived from natural organic matter from forested lands within each SWPA. A study in a forested, southern Appalachian stream suggests that as much as 37% of Dissolved Organic Carbon (DOC), a DBP precursor, inputs during autumn and winter are derived from leaf-litter leachate, where much of the DOC generated comes from the rapid leaching of recently shed leaves that have fallen directly into stream channels (Meyer, 1998). This same study further suggests that DOC export in streams is higher during increased discharge (storm events) compared to baseflow.

The upper soil horizons of forested lands also tend to contain natural organic matter derived from various stages of litter decomposition and plant residues (Mulholland, 1997). In some ecosystems, temporal variations in DOC concentrations are primarily controlled by the hydrological flushing of catchment soils. A cursory overview of the soils within each watershed suggests that soils typically have at least four inches of plant material that have undergone various stages of decomposition (NRCS Web Soil Survey, 2012). Other natural, potential sources of DBP precursors may exist across the SWPAs.

The relatively small amount of agricultural land in each SWPA (Figures 2, 3 and 4) likely produces low concentrations of DBP precursors. However, low and sporadic detections of Dalapon[1], an herbicide, in System water suggest that water potentially from agricultural and/or residential lands reaches the Systems sources, via overland or subsurface flow. DBP formation may be reduced by working with local farmers to help ensure that adequate buffer areas exist between the limited agricultural lands, residential areas and surface waters. Larger buffer strips are more effective in reducing anthropogenic nutrient input into streams. Clear-cutting practices may contribute to the leaching of DBP precursors from previously forested soils, as explained in Section 7.3.2

[1] The EPA identifies Dalapon as a colorless liquid herbicide used to control grasses in a wide variety of crops, though it is also used in non-crop applications, such as on lawns, drainage ditches and railroad tracks (EPA, n.d.). MDE had indicated that Dalapon is used to clear rights of way for landscaping purposes. The System should consider reviewing maintenance practices related to landscaping to ensure that the least harmful chemicals are used and that they are properly applied. The party responsible for Dalapon application should ensure they follow all application requirements. All maintenance staff should also be certified by MDA's Pesticide Regulation Division.

5.4 OTHER WATER QUALITY OBSERVATIONS

The Charlestown, Koontz and Midland-Gilmore reservoirs are vulnerable to periods of increased manganese concentrations, particularly in the summer, when the System uses manganese-bearing groundwater to supplement the reservoirs (Appendix A).

Manganese has a secondary MCL; elevated concentrations are aesthetic considerations only. Based on the limited available data and our collective experience elsewhere, we believe that the groundwater naturally possesses a high concentration of manganese. Iron was not detected at any of the treatment plants, though limited sampling data for iron exists. Two samples were taken (one in April, 2005, the other in December, 2005) at the Charlestown and Midland-Gilmore treatment plants. Only one sample was taken at the Koontz Treatment Plant in April, 2005.

Though MDE reported high concentrations of iron in all three reservoirs in the 2004 SWAP, the limited data since that assessment suggest that the System is not susceptible to iron contamination. However, ALWI noted that iron samples were not collected during the summer, when the wells are more frequently used to supplement low stream flow rates. Additional sampling should be conducted when the groundwater wells are pumping.

6.0 STEERING COMMITTEE INTERACTIONS

ALWI met with the Midland-Lonaconing-Barton Steering Committee on Wednesday, May 30, 2012. The Steering Committee was comprised of members representing the System and Allegany County. Garrett County was not represented, as the meeting took place at a time predating our understanding of a substantial portion (90%) of the Koontz SWPA being in Garrett County. Specific members included:

- Dave Dorsey (Acting Planning Coordinator; Allegany County),
- Mike Garner, MDE Water Management Administration Mining Program,
- Tom Reed (Contract Operator for Midland-Lonaconing-Barton Water System),
- Warren “Whiz” Foote (Water Commissioner, Town of Lonaconing),
- Aaron Wilt (Administrator, Town of Lonaconing), and

ALWI presented a slide show summarizing the basis for then-current but nevertheless preliminary recommendations related to water quality issues. Salient topics of discussion included:

1. **Marginal and Uncertain Conditions of Groundwater Susceptibility** - None of the available water quality data suggested an acute condition of obvious groundwater susceptibility warranting immediate action or undue concern. Discussions then focused on DBPs, considering their presence in the only samples collected from the Gilmore and Koontz plants. Technically, when considered statistically this is a condition of susceptibility, but

based only on scant and possibly spurious data. Further, DBP precursors usually are more common in surface supplies than in groundwater supplies. Groundwater source protection is more the focus of our MDE-contracted effort. We recommend additional and source-specific sampling before corrective or protective measures are otherwise contemplated.

2. **Recommended Ordinance -** We recommended an Ordinance to restrict/prohibit incompatible land uses in the SWPAs. Specifically, we recommended prohibiting natural resources development projects (e.g., coal mining, natural gas well exploration, logging, etc.) in the SWPAs. In response, the Steering Committee brought to our attention Allegany Ordinance (Appendix C), which they believed already accomplished many of the contemplated land use restrictions.

3. **Abandonment of Unused/Unneeded Wells** - ALWI discussed the hazards associated with unused wells that may remain present in the SWPAs. We recommended that unused wells be abandoned and that out of service wells be repaired without undue delay. System representatives indicated that plans exist to accept this recommendation.

4. **Wellhead Security** - At the time of our reconnaissance, we found several wells accessible without obstruction. We also discussed the circumstance where Charlestown Well 2 was inoperable due to alleged vandalism or copper theft. The System plans to construct fencing as a means to thwart thieves and vandals; ALWI recommended that all reservoirs and wells be locked behind fencing.

5. **Public Workshop** - We discussed the prospect of a public workshop, and its benefit in garnering proactive buy-in regarding measures such as newly contemplated ordinances. The Steering Committee felt that a workshop would not be necessary, because (at that time) no new or revised ordinance was contemplated. The Steering Committee instructed us to delay workshop planning until a draft SWPP was available for their review and comment.

As mentioned earlier in this report, a significant portion of the Koontz SWPA exists within Garrett County jurisdiction. This situation was discussed with the Steering Committee and committee members agreed that source water protection for the portion of the Koontz SWPA that exists within Garrett County would be best achieved by the Garrett Ordinance. We were directed by the Steering Committee to discuss the matter with Garrett County officials. In so doing, we learned that Garrett County was receptive to the idea of updating their official ordinance map to include the Koontz SWPA.

Given Garrett County's intention to protect the Koontz SWPA under the Sensitive Areas Ordinance, the Steering Committee later accepted our recommendation to participate in what became a multi-system public workshop. Garrett County, who owns and operates two other systems that are subject to this SWPP contract (McHenry and Mountain Lake Park), already was committed to participating in a public workshop. Like the Midland-Lonaconing-Barton system, the City of Frostburg also participated in the public workshop, as portions of their SWPA also exist within Garrett County jurisdiction.

The Steering Committees for each of the four related Systems came to agree to convene a joint public workshop on source water protection. A joint workshop was held on May 15, 2013 (Appendix F) at Garrett County offices in Oakland, Maryland.

7.0 RECOMMENDATIONS

ALWI proposes the following recommendations for consideration. We endeavored to consider matters of cost and practicality in forming these recommendations. The need and order of these easily could change based on investigative findings, available funding and future System priorities.

7.1 INVESTIGATIVE RECOMMENDATIONS

Below, in order of decreasing priority, we provide a list of measures that we recommend for consideration, funding and implementation. We recommend execution of these to help verify certain findings that presently are tenuous because of limited data, the budget supporting this SWPP effort and/or the non-invasive nature of SWPP development efforts.

1. **Sample Individual Sources Directly -** Collecting raw water samples directly from wells, as opposed to treatment plants or the distribution system, would make it easier to identify and interpret water quality results, allowing for a more representative susceptibility analysis. Sampling from raw sources helps prevent misinterpretations associated with reduction or oxidation reactions as a complication of treatment processes and allows a more accurate assessment of potential point sources of contaminants. The timing of sampling also should be considered, such as in the case of raw samples being collected from each individual well while they are pumping.

2. **TOC Sampling and Analysis** - The System currently samples for total organic carbon (TOC), a DBP precursor, on a quarterly basis. Results have been as high as 2.0 mg/L, but are generally in the range of 1.0 to 1.5 mg/L. ALWI recommends continued TOC monitoring. Additionally, the System has the option of sampling reservoirs and wells separately for TOC, to determine whether or not individual sources are more likely to contribute organic matter that would lead to DBP formation. We suggest working closely with MDE to limit unneeded expense and maximize the benefit-cost ratio of this undertaking.

3. **Continue Monitoring for Other Primary MCL Constituents** - The System should consider continued monitoring of specific primary drinking water constituents as required by MDE and with particular focus on DBPs. In the circumstance that natural gas development via hydraulic fracturing comes to be approvable in Maryland, ALWI also suggests periodic baseline analyses for regulated volatile organic compounds, given their potential presence and use in the fracturing process. The System should also monitor chloride and bromide, given their natural presence at depth.

4. **Clear Vegetation Around Wells** - The System should clear vegetation growing around and on wells serving the system, so as to preserve both the physical and sanitary integrity of each source. Clearing the wellhead of vegetation will reduce insect habitat, minimizing the risk of

insects entering and potentially contaminating the well. Clearing such vegetation also will enable System operation and maintenance personnel to have a clearer view of the wellhead, for periodic inspection for perforations, corrosion, etc.

7.2 REMEDIAL RECOMMENDATIONS

Below we provide a list of remedial recommendations, again presented in decreasing order of our present sense of their relative importance, implementation feasibility (including cost) and benefit.

1. **Limit DBPs in the Distribution System** - Evaluate water treatment methods and chemicals to limit unneeded chlorination. These actions may simplify existing treatment methods and may reduce the incidence of DBPs in the distribution system. The System should consider working with local farmers to construct adequate buffer areas (if not already present) between agricultural lands and surface waters. Larger buffer strips are more effective in reducing anthropogenic nutrient input into streams. The System should consider removing organic matter from the reservoirs (via dredging or other methods) on a regular basis. System representatives have indicated that such a process was carried out for the Charlestown Reservoir last year and for the Koontz Reservoir two years ago. The Gilmore Reservoir may undergo the same process next year if funding is available.

2. **Manage and Maintain Wells** - ALWI recommends that the system abandon wells that are no longer planned for use as public supplies. System representatives indicated that plans exist to accept this recommendation. Such wells may function as a conduit through which contamination at the surface may enter groundwater aquifers at depth. We also recommend that wells be secured with an appropriate cap (specifically Charlestown Well 1) to prevent trespass, damage and/or consequent potential public health risks. Particular care should be given to land use activities and practices within a 500-foot radius of each wellhead.

7.3 PROTECTIVE RECOMMENDATIONS

Below we provide a list of protective recommendations, again presented in decreasing order of our present sense of their relative importance, implementation feasibility (including cost) and benefit.

ALWI agrees that the existing Allegany County ordinance provides minimally adequate protection for the Charlestown, Gilmore and (portions of the) Koontz SWPAs. Better would be if the ordinance(s) clearly prohibited energy resources development projects in the SWPAs. Furthermore, no protection presently is afforded for the Koontz SWPA and it is needed. Our protective recommendations, therefore, are as follows:

1. **Proactive Coordination with Garrett County** - A formal agreement between the System, Allegany County and Garrett County should be ratified to ensure that all parties understand and agree that the majority of the Koontz SWPA (90%) exists within Garrett County jurisdiction and therefore is protected by the Garrett County Sensitive Areas Ordinance. If no other recommended revisions to existing ordinances are accepted by the System, the System

ostensibly agrees that the Garrett County Sensitive Areas Ordinance Map should be updated to include the SWPA for the Koontz wells and reservoir. For other systems on this contract Garrett County has such plans, and Garrett County has expressed an interest in doing the same for the portion of the Koontz SWPA within Garrett County jurisdiction. It would be prudent for the System to work proactively with Garrett County officials to have them add the Koontz SWPA at the same time that they make similar updates for other systems.

2. **Limit Incompatible, Upgradient Land Uses** - ALWI judges that the greatest measure of source water protection would arise from the protection of upgradient watershed areas from incompatible land uses. Largely, the respective Allegany and Garrett County ordinances accomplish this.

   - Energy Resources Exploration - Based on the setting of the System, we further judge that the most likely form of potentially incompatible land use would be in the form of operations and facilities associated with energy resources exploration and development. Coal, deep mining activities and natural gas exploration programs and production facilities may cause the release or migration of groundwater contaminants (and surface water contaminants as well).

   - Timbering Practices - According to System representatives, there have been no known timbering operations within the SWPAs over the last five years. Nonetheless, timbering practices, particularly those using a clear cutting method, may increase stream water turbidity and sedimentation, alter stream flow (and therefore reservoir) volume, and increase leaching of nutrients (such as nitrate) following cutting. Further, the practice of timbering on areas with steep slopes risks damaging well-established root systems which can result in further increases to turbidity and sedimentation levels, and ultimately DBP precursors within decomposed leaf litter. In many ecosystems, a consequence of deforestation is the leaching of nutrients from catchment soils, which manifest as dissolved load in streams, potentially having undesirable effects such as eutrophication and deterioration of public water supplies (Goudie, 2000). Timbering can increase both the concentration and fluctuation of DOC, and the cumulative effects on both runoff and DOC concentrations from relatively small harvested areas can generate increased DOC concentrations further down the stream network (Ohman, 2009). However, such effects vary due to climate, soil properties, topography, land use, the timing and duration of disturbance events such as timber harvesting and other factors. Further study would need to be done on DOC fluctuations in the Midland-Lonaconing-Barton watersheds to understand the relationship between clear-cutting harvest events and the potential for anthropogenically derived (as opposed to that proportion derived from natural leachate) DBP precursors.

   Notwithstanding the Steering Committee's desire not to revise existing protective measures, it would be best if such land uses were outright prohibited in the delineated SWPAs. We find such revisions particularly important, given the large proportion of lands leased or mineral rights sold to energy companies within the Koontz SWPA alone. For this reason, we recommend that the System further consider actively petitioning both counties to prohibit energy resources development projects in the SWPAs via revision to existing ordinances.

3. **Alternatives to Land Use Restrictions -** If prohibition is infeasible or untenable, ALWI would recommend conservative and comprehensive baseline water quality analyses before any such energy project is approved to begin, as well as monitoring throughout the project's lifetime. Strictures requiring the application and uses of the best available protective techniques and technologies should be considered as well. Timbering practices may still be viable if the clear cutting method is abandoned in favor of a method that involves less concentrated land disturbance. When issuing timbering permits, the System/County should ensure that Best Management Practices are being enforced so as to minimize soil compaction and erosion of the soil surface.

4. **Consider Land Acquisition** - Approximately 85% of the Koontz SWPA is forested, with 37% of the SWPA considered part of the Savage River State Forest, suggesting that 48% of the remaining forested lands within the SWPA are privately owned. Likewise, approximately 87% of the Midland-Gilmore SWPA is forested, with 59% of the SWPA considered part of the Dan's Mountain Wildlife Management Area, suggesting that 28% of the remaining forested lands are privately owned. Finally, roughly 90% of the Charlestown SWPA is forested, with 21% of the SWPA considered part of the Dan's Mountain Wildlife Management Area, suggesting that 69% of the remaining forested lands are privately owned. As economically feasible, the System should consider purchasing such lands, particularly those closest to the reservoirs, to better protect their sources from alternative land uses (agriculture and timbering) and natural resource exploration. Acquisition of abandoned deep and strip mining properties also should be considered for similar reasons. Purchasing such lands would enable the System to proactively mitigate exposed spoil areas.

5. **Promote Participation in Forest Conservation and Management Program** - The System also should consider encouraging landowners within the SWPAs to manage their forested lands by way of the Maryland Department of Natural Resources (DNR) Forest Conservation and Management Program. The program allows for a legal agreement between the landowner and the DNR to be recorded in the land records of the County in which the property is located. The landowner agrees to manage their forest land according to a plan that is prepared for the property in return for a reduced and/or frozen property tax assessment (generally reduced and frozen at a low agricultural rate). The minimum acreage to participate in the program is five acres and the minimum term of the agreement is fifteen years. If the agreement is breached through failure to comply with the plan, sale of the property to someone unwilling to assume the responsibility or a landowner who simply wants to be out of the program, back taxes will be levied and will be computed back to the beginning of the agreement. The agreement can be amended to increase or decrease acreage and it can be transferred to a buyer if the buyer is willing to assume the responsibilities of the agreement.

6. **Encourage Compliance With Applicable Nutrient Management Standards** - The System should consider requesting that MDE and Maryland Department of Agriculture carefully review environmental compliance matters at the agricultural facilities within and near the SWPAs. To the degree voluntary or enforced nutrient management compliance is not readily achievable; the System also should consider asking State and County officials to require strict nutrient management compliance practices at potential nutrient source properties within

the SWPAs.

7.4 OTHER RECOMMENDATIONS

If the System is successful in compelling a dialogue with either County on ordinance content changes, the following are secondary, beneficial goals as SWPA prohibitions:

- No intensive, agricultural land uses or groundwater discharge permittees;
- Evaluate the integrity of System wells constructed prior to 1970;
- Public awareness and community outreach measures (homeowner focused);
- Proper abandonment of unwanted and unneeded wells (via enforcement); and
- Encourage property owners within SWPAs to replace failing septic systems.

8.0 REFERENCES

Basic Information about Dalapon in Drinking Water in Drinking Water. EPA, n.d. Web. 10 Apr. 2013. <http://water.epa.gov/drink/contaminants/basicinformation/dalapon.cfm#two>.

Goudie, Andrew. *Human Impact on Natural Environment 5e*. N.p.: MIT Press, 2000. 251-54. Web. 9 Jan. 2013. <http://books.google.com/books?id=r8l-DMj3XTgC&dq=hubbard+brook+deforestation+and+stream+water+quality&source=gbs_navlinks_s>.

Maryland Department of the Environment. 2004. Source Water Assessment for the Midland-Lonaconing Water System. p. 60.

Midland-Lonaconing Source Water Protection Planning Committee. 2004. Source Water Protection Plan for Midland-Lonaconing Water System. p. 14.

Meyer, Judy L., Bruce J. Wallace, and Sue L. Eggert. "Leaf Litter as a Source of Dissolved Organic Carbon in Streams." *Ecosystems* 1 (1998): 240-49. Web. 19 Oct. 2012. <http://coweeta.ecology.uga.edu/publications/99.pdf>.

Mulholland, Patrick J. "Dissolved Organic Matter Concentration and Flux in Streams." *Journal of the North American Benthological Society* 16.1 Mar. (1997): 131-41. Web. 19 Oct. 2012. <http://www.jstor.org/discover/10.2307/1468246?uid=3739584&uid=2129&uid=2&uid=70&uid=4&uid=3739256&sid=21101297305621>.

Ohman, Karin, Jan Seibert, and Hjalmar Laudon. "An Approach for Including Consideration of Stream Water Dissolved Organic Carbon in Long Term Forest Planning." *Ambio* 38.7 (2009): 387-93. Web. 9 Jan. 2013. <http://www2.allenpress.com/pdf/ambi-38-07-387-393.pdf>.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed [10/18/2012].