WELLHEAD AREA SURVEY
PINEY PLAINS U.M. CHURCH
ACHD SITE NO. 101
Belle Grove, Allegany County, Maryland

ALWI Project No. AL7N001

1.0 INTRODUCTION

Advanced Land and Water, Inc. (ALWI) was retained by the Allegany County Health Department (ACHD), to prepare a Wellhead Area Survey for Piney Plains United Methodist Church (the Church), located immediately east of the southern terminus of Old Mann Road, 0.1 mile northwest of the New Mann Road bridge across the National Freeway (I-68), approximately 2.5 miles west of the Washington County line in eastern Allegany County, Maryland. In addition to the sanctuary, the Church has a banquet room with a kitchenette and public restrooms. This site, designated No. 100 by ACHD, is served by one production well completed in the local bedrock aquifer.

The draft MDE "Transient Water Systems Operations Guidance" manual (herein termed the "Guidance Manual") defines a Non-Transient Non-Community (NTNC) Water System as one that "…serves at least 25 regular consumers over 6 months per year." The small number of employees (typically 1 part-time) and the infrequent use of the banquet facility[1] suggests that 25 regular customers are not served. On occasion, one-day service may exceed this, but such use is not typical. Therefore, this site is a transient non-community system (TNC).

1.1 PURPOSE

The Safe Drinking Water Act (SDWA) of 1974 required the U.S. Environmental Protection Agency (EPA) to develop enforceable drinking water quality standards to protect the public health. In 1986, amendments made to the SDWA strengthened provisions for the protection of underground sources of drinking water. These amendments included provisions for establishing Wellhead Protection Programs by individual states under "umbrella" EPA oversight. The EPA approved a statewide Wellhead Protection Program developed by MDE in June 1991.

The MDE program originally applied to community water supplies, only. A newly proposed broadening of the Federal Clean Water Act will have the result of expanding the MDE Wellhead Protection Program to encompass non-community supplies both transient and non-transient in nature. ACHD, in cooperation with MDE, established this program to bring existing non-community supplies into compliance with the coming regulations.

1.2 SCOPE

[1] According to a December 14, 1998 interview with on-site custodial staff, on the average 20 persons per week (i.e., 3 per day) consume water or food on site.

1.2 Scope

ALWI prepared this Wellhead Area Survey following ACHD requirements, which followed MDE guidelines for transient system operation and wellhead protection.

1. **Site Reconnaissance, Photographic Documentation and Interviews** – ALWI observed the on-site wellhead, storage, treatment, and distribution infrastructure to the degree exposed without excavation or exposure to personal hazards. ALWI used an ACHD-owned digital camera to photograph conditions surrounding the wellhead at the time of the field reconnaissance. Said photographs are stored on ACHD's computer system. ALWI interviewed the owner/operator and/or employee(s) to document information on the use patterns, history, and problems associated with the supply.

2. **Baseline Water Quality Assessment** - ALWI purged the water system and collected samples for analysis in the ACHD laboratory that is affiliated with the Maryland Department of Health and Mental Hygiene (DHMH). ALWI performed this fieldwork in accordance with MDE potable water sampling criteria including in-field measurements of turbidity, chlorine, and pH. ACHD selected the analyte list based on countywide experience with potability concerns and the capabilities of the aforementioned laboratory. The analytes included total and fecal coliform bacteria, nitrates, nitrites, iron, sulfur and manganese (Appendix B).

3. **Contamination Hazard Assessment** – ALWI identified existing and potential contaminant hazards within the delineated WHPA based on visual observations and the techniques enumerated above. ALWI ranked these hazards in term of relative risk and provided concrete suggestions for their appropriate address. More generally, herein ALWI provides specific recommendations for source reduction measures, contingency plans, and other methods that may help better protect against occurrences of groundwater contamination.

2.0 HYDROGEOLOGIC FRAMEWORK

ALWI used published information from the United States Geological Survey and the Maryland Geological Survey to identify and describe the characteristics of the local hydrogeologic setting.

2.1 Bedrock Geology

The Church is situated within the Appalachian Valley and Ridge physiographic province and is underlain by sedimentary rocks of late Devonian age. The Hampshire Formation underlies the site and is part of the Catskill clastic wedge and consists of red-colored sandstones and lesser amounts of shale (Glaser, 1994). These rocks have been intensely folded and faulted, resulting in alternating synclines (concave-upward folds) and anticlines (convex-upward folds).

In three dimensions, the rock formations of such folds dip at right angles to the direction of plunge of the entire fold system. In general, dip directions may help govern groundwater (and contaminant) movement directions in the bedrock but plunge directions have no relation. At this location, the bedding planes dip moderately steeply to the west-northwest (Glaser, 1994). Deep groundwater flow directions likely follow.

Reported well yields within the Hampshire Formation are sparse but range from 2 to 8 gpm. Hampshire Formation wells completed within sandstone generally have a higher yield because the greater competence of the rock allows the development of longer and wider fractures both along and across bedding planes.

2.2 Saprolite and Soil Mantle

Natural chemical weathering of the shallow portion of the bedrock, due to percolating water, has chemically altered many of the original rock-forming minerals to clays and other secondary minerals. This has resulted in the development of shallow saprolite (weathered bedrock) and the overlying soil mantle. The thickness of the soil and saprolite is generally 2 to 10 feet, but it varies considerably over short distances. In highly fractured zones, enhanced groundwater storage and movement has accelerated the breakdown of the rock-forming minerals and has caused formation of a thicker saprolitic deposit.

2.3 Aquifer Recharge

Precipitation infiltrating through the soil on site and/or in up-gradient areas is the primary source of aquifer recharge to the on-site supply well. Generally, overlying soil horizons act to absorb and then slowly release infiltrating precipitation. However, in areas where fracture zones have formed, percolating groundwater can reach the water table quickly. A portion of the precipitation percolates downward through the soil mantle and then migrates through narrow, interconnected joints, fractures, faults, and cleavage planes in the bedrock.

2.4 Geology-Controlled Groundwater Flow

Generally, bedding plane partings and cross-bedding fracture zones (where present) function as both downward and lateral water conduits. Consequently, such zones receive and transmit water at a rate higher than would otherwise be achievable and, accordingly, are preferential conduits for groundwater flow and contaminant transport.

Despite the bedrock's overall hardness and resistance to erosion, hydraulic permeabilities in bedding planes and fracture zones within the Hampshire Formation may be several times greater than in surrounding less-fractured rock. This intrinsic characteristic portends the possibility for the existence of specific zones with higher-than-normal well yields, higher-than-normal groundwater flow velocities and higher-than-normal susceptibility to groundwater contamination.

3.0 WATER QUALITY ASSESSMENT

Slaughter and Darling (1962) reported the regional water quality as slightly irony (0.01 to as much as .12 micrograms per liter (mg/l), soft (19 to 77 mg/l), and slightly acidic to moderately alkaline (pH range of 6.3 to 8.7). ALWI interpreted that the slight reddish colors of the local rock exposures as likely attributable to the trace presence of iron.

At this location, ALWI collected baseline groundwater samples on December 14, 1998, in accordance with the MDE sampling procedures specified in COMAR 26.08.05. Water enters the building behind walls, in a location completely hidden from view. ALWI observed neither a pressure tank[2] nor treatment of any type. Accordingly, ALWI collected raw water samples as specified in COMAR 26.04.01.14. ACHD's laboratory analyzed the samples for those constituents of countywide concern. These included total coliform bacteria as specified in COMAR 26.04.01.11A-C, alkalinity, color, conductance, hardness, iron, manganese, nitrate-nitrite nitrogen (COMAR 26.04.01.14(4)(a)), nitrite nitrogen (COMAR 26.04.01.14(4)(b)), pH, and total dissolved solids.

The results are included as Appendix A, and suggest potability relative to the samples collected. The presence of moderate turbidity concentrations (3.2 NTU) suggests well bore instability and/or incomplete development of the well. In general, turbidity can be associated with transient bacteriologic and/or pathogenic influxes to the water supply, particularly if correlated with precipitation events and/or shallow sources.

Given the low and infrequent use of this well, reliance on bottled sources for potable uses likely is the most cost-effective means to address water quality uncertainties inferred from the finding of high turbidity. Bottled water use could be either permanent or temporary (e.g., until such time that the Church retrofits the water system with a conventional pressure tank and/or a pump failure causes the need for work within the well bore). The supply appears to be at "low risk" for surface water influence as defined in the MDE guidance document.

4.0 WHPA DELINEATION

ALWI delineated a WHPA surrounding this site's well using generalized criteria developed by MDE for non-community supplies, as modified by ALWI (with ACHD consent) based on the specific topographic setting of the site. ALWI began by using a fixed radius of 1,000 feet around the well. From this radial area, ALWI then excluded downgradient areas more than 100 feet from the wellhead as well as areas unlikely to contribute recharge to the well based on intervening streams and/or drainage divides. Because the light and infrequent use of the well

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[2] Frequent cycles of the pump during purging, as suggested by transient water pressure changes, suggest that no pressure tank is present. ALWI believes that this condition likely causes accelerated pump wear and premature failure.

also likely correlates to a cone-of-depression of limited areal extent, ALWI also excluded steeply-sloping cross-gradient areas.

The resultant delineation is shown on the "Water Plant Information" survey form (Appendix B) and encompasses approximately 25% of the circle (originally 72 acres in size) or 18 acres. Within an assumed 600 gallons per day per acre (gpd/ac) of annualized groundwater recharge (Slaughter and Darling, 1962, Table 37), over 10,000 gallons per day exists within the aquifer beneath this WHPA. In actuality, the modest demand of this well (doubtlessly less than 1,000 gpd) is more than one full order of magnitude smaller than the WHPA, lending a high degree of conservatism to this analysis.

An interview with the owner suggested little if any seasonal peaking in demand, and ALWI used this to interpret little, if any, seasonal fluctuation of the WHPA boundary. Negligible nitrate-nitrogen concentrations were detected in the sample ALWI collected. This obviated the need for a nitrate balance assessment.

5.0 CONTAMINANT THREATS ASSESSMENT

ALWI performed a site reconnaissance on November 23, 1998. During the reconnaissance, local land use conditions were observed with emphasis on the potential use, storage and disposal practices of hazardous materials and petroleum products. Such conditions may have included visual evidence for present or former spills, stained or discolored ground surfaces, stressed vegetation, unusual odors, or visible underground storage tank (UST) facilities. Adjacent and nearby properties were also visually scanned for such evidence from the property and nearby public right-of-ways. Off-site properties were not entered. ALWI relied upon the accuracy of historical interview information provided by the owner and his employees to provide context for some of its observations.

5.1 Potential Hazards At the Wellhead

Design, construction and present condition are important factors in determining a well's susceptibility to contamination. However, no well tag was visible. Accordingly, ALWI could not assess the initial design nor present condition of the casing or grout seal. ALWI observed that the portion of the casing exposed at ground surface appeared intact and was equipped with a conventional pitless-style cap of the type that can sometimes allow insects to enter the well. An upgrade to a more modern cap would provide greater protection against microbial contamination.

5.2 Other Local Contamination Risks

On November 23, 1998, ALWI observed several potential contamination sources in the delineated WHPA. ALWI identified the following potential sources of contamination within the WHPA: surficial and subsurface fuel spills, stormwater infiltration along the well's casing, salt from road deicing, and an upgradient cemetery. ALWI performed a site reconnaissance and conducted limited personal interviews to identify and describe these potential contaminant hazards.

No discharge to groundwater has been confirmed by any of the facilities or practices ALWI observed. ALWI has ranked its observations in decreasing order of overall relative risk. ALWI provides specific recommendations at the conclusion of each respective observation or interpretation.

1. **Underground Storage Tank** - Fuel oil is used as a heating source at this facility. On-site personnel indicated that the present above-ground fuel storage system replaced an older underground storage tank (UST) as part of a recent upgrade, ALWI observed a remnant UST vent, suggesting that the former UST remains on site and has not been removed and closed as required under MDE regulations. Given the proximity of the UST to the well and its understood long history of use, analytical testing to confirm the absence of fuel oil constituents (e.g., naphthalene, and total diesel-range petroleum hydrocarbon compounds) seems appropriate. Maximum cost-effectiveness is likely achieved with the sampling work coordinated with UST removal and closure activities[3]. Periodic monitoring and other corrective actions as necessary should then continue based on the findings.

2. **Subsurface Disposal Facilities** – Older septic tanks of the type likely present may have seams. Though the low nitrate concentrations in groundwater indicate no present release, property ownership interest should embark on a regularly scheduled program of pump-outs. When the septic system needs replacement, the tank should be replaced with a seamless model and no facilities should be relocated uphill or within 100 feet of the well.

3. **Above-Ground Fuel Tank** – ALWI observed an above-ground fuel storage tank (AST) that contains fuel oil. ALWI recommends regular maintenance of this fuel storage and delivery system, including development of specific protocols to be employed in case of a leak or overfill.

4. **Cemetery** - ALWI observed a cemetery with approximately 100 to 200 grave sites located within 100 feet and upgradient of the wellhead. Grave sites may be sources of microbial and/or hydrocarbon contamination of groundwater (e.g., aldehydes and ketones sometimes used in embalming practices). ALWI recommends baseline sampling on an bi-annual basis for those compounds considered likely to be in use as preservatives.

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[3] Any finding of petroleum-contaminated groundwater must be reported to the MDE Oil Control Program, whether or not coincident with UST removal work. Such a report would open an Oil Control Program case file and could result in an enforcement action from MDE given the possibility that a remnant UST remains on site. MDE Oil Control Program representatives may order additional sampling, monitoring well drilling, and/or other investigative and remedial measures. ALWI suggests that site ownership interests consult legal counsel before taking (or choosing not to take) any action that could have adverse financial or environmental liability consequences.

5. **Highway and Parking Area Deicing** – Highway and parking area deicing practices may increase a seasonal risk of sodium and chloride contamination. The State Highway Administration (SHA) is unlikely to curtail or otherwise change deicing practices on nearby state and federal highways. The steepness of the driveway likely precludes replacement of conventional salt with abrasives. However, consideration should be given to using non-chemical abrasives on the parking lot for deicing to the degree possible. Baseline and bi-annual sampling for sodium and chlorides should be considered.

6.0 CONCLUSION AND RECOMMENDATIONS

ALWI did not find acute conditions suggesting non-potability of a type warranting immediate reporting, resampling, or other emergency corrective action. ALWI developed the recommendations within this section following MDE guidelines but also in light of site-specific practicalities. For example, ALWI acknowledges that the on-site well cannot be relocated so far from the church so as to eliminate all risk of contamination of the groundwater supply from the on-site UST and cemetery. ALWI also acknowledges that the presence of a cemetery is intrinsic to church functions.

6.1 Supplemental Investigative Measures

Property ownership interests should collect and analyze groundwater samples for the potential presence of contaminants likely originating from on-site operations (e.g. fuel oil constituents, embalming constituents, sodium and chloride) and indicators of groundwater under the direct influence of surface water (e.g., turbidity, temperature, and bacteria analyses performed daily for four consecutive days immediately after a 0.5-inch rainfall event). For maximum cost-effectiveness, sampling should be times to occur concurrently with UST closure activities. Embalming constituent sampling should be repeated during both seasonal high and low water table conditions, and then repeated bi-annually or more frequently if warranted by the findings.

6.2 Source Reduction Measures

Depending on the results of the analyses indicated above, the ministry and congregation may find greater cost-effectiveness in converting to bottled sources of potable water. Retrofitting the existing groundwater supply with filtration or other costly treatment measures, if warranted by the supplemental analyses recommended herein, may not be cost-effective considering the nature and quantity of on-site uses. If the ministry concurs, appropriate placarding should be provided so as to warn against use of an untested source for potable purposes.

6.0 SELECTED REFERENCES

Glaser, John D., 1994, Geologic Map of the Bellegrove Quadrangle, Allegany and Washington Counties, Maryland: Maryland Geological Survey, 1:24,000.

MDE Public Drinking Water Program, 1998, Transient Water System Operations Guidance; Guidance For Counties With Delegated Responsibilities (Draft), 45p.

Slaughter, Turbit H. and John M. Darling, 1963, The Water Resources of Allegany and Washington Counties: Maryland Department of Geology, Mines, and Water Resources, Bulletin 24, p. 408.

NONCOMMUNITY WATER SUPPLY SANITARY SURVEY

1. System Name: Piney Plains United Methodist Church

2. WAS: 100

3. System Information:

Address: 31661 Green Forest Drive

Little Orleans, Maryland

Phone No.: (301) 478-2325

4. ADC Map/Grid: N\A

5. Tax Map/Plat: N/A

6. Population:

Transient <25
Regular 1
Total <26

7. Property Information:

Owner's Name Doug Sipes

Address: 31661 Green Forest Drive

Little Orleans, Maryland

Phone No. (301) 478-2325

8. No. Service Connections:

9. Type of Facility:

Food Service ____
Church x
Campground ____
Daycare ____
Other (specify) ____

10. Contact Person:

Name: Doug Sipes

Phone No. (301) 478-2325

11. Operator:

Name: ____

Cert. No. ____

12. Sample History (Has the system had any violations?):

Bacteria: None apparent or reported

Nitrate: None apparent or reported

SURVEY RESULTS

13. Comments on System, Recommendations:

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14. Inspected by:	15. Date inspected:	16. System Vulnerability
Mark W. Eisner	12/14/98	Protected ____ Vulnerable yes (see report)

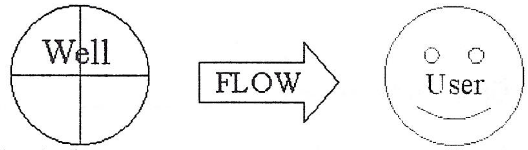
WATER PLANT INFORMATION

17. Type of Treatment:
(Check all that apply)

Disinfection
- Gas Chlorine: ______
- Sodium Hypochlorite ______
- Ultraviolet Radiation ______

Iron Removal ______
Nitrate Removal ______
PH Neutralizer ______
Other ______
Unknown ______

18. System Schematic (Process Flow):



NOTE: This diagram is a simplified schematic of operational process flow observed or described on the date of the reconnaissance. Many water systems possess malfunctioning, disconnected and/or occasionally/regularly-bypassed equipment. Actual treatment processes may differ, therefore, from those shown herein.

19. System Storage:

Ground Storage ______
Elevated Storage ______
Hydropneumatic Tank ______
Other ______

20. Storage Capacity:

Typical Domestic

21. Untreated water sampling tap?

Yes __x__ No _____

WELL INFORMATION

22. Well Information:

Tag Number: not visible

Year Drilled: 1940's

Casing Depth: ______

Well Depth: ______

Well Yield: ______

Casing Height: ______

Grout Depth: ______

Pitless Adapter? ______

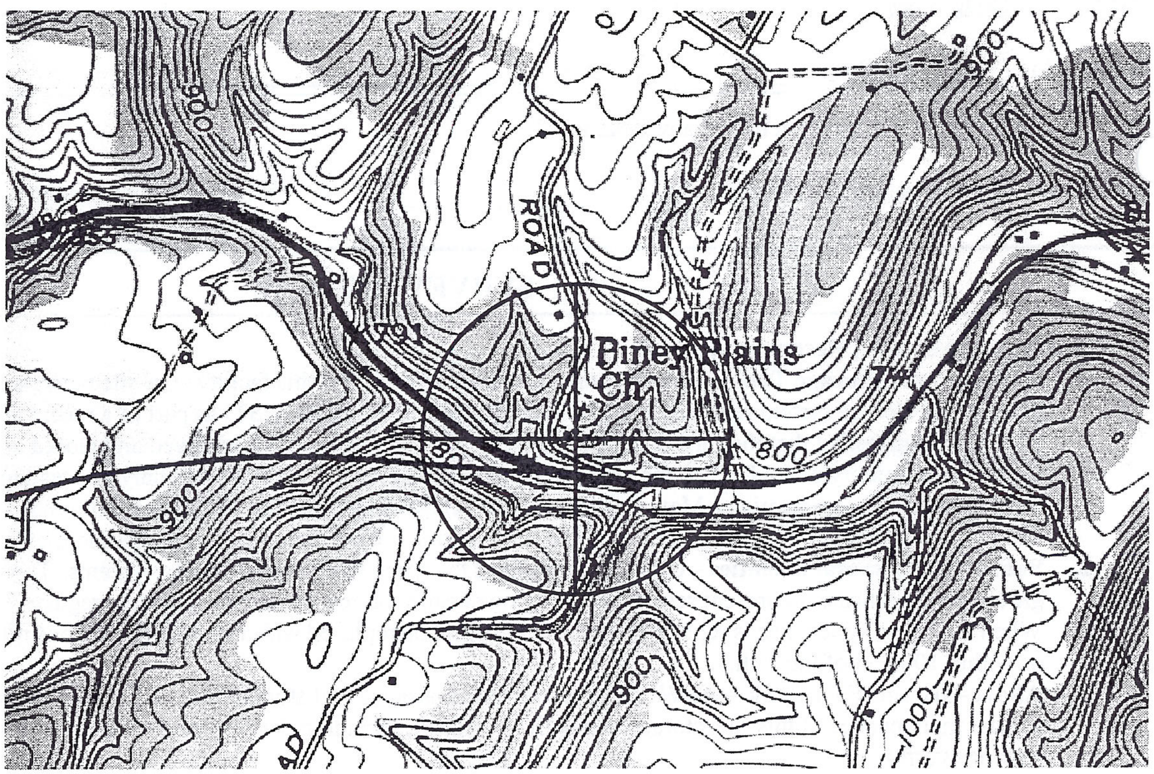
Wiring OK? unknown

Pump OK? unknown

23. Well Type:

Drilled __x__
Driven ______
Dug ______

24. Well Location Diagram (1 in. = 1250 ft.) with Approximate Distances from Potential Contaminant Sources (i.e. septic, sewer lines, structures, petroleum storage, surface water bodies, etc.):



25. Aquifer:

Name: Hampshire____
GAP #: ________________
Confined ______
Unconfined __x__
Semi-confined ______

26. Quantity Used:

Daily Avg (gpd) < 1000
Pumping Rate (gpm) 2 - 8
Hours run per day ______

27. Well Cap:

Type? ______
Seal Tight? O.K.
Vented? O.K.
Screened? No
Conduit OK? O.K.

28. Casing Diameter:

2" ______
4" ______
6" __x__
Other ______

29. Casing Type:

PVC ______
Metal __x__
Concrete ______