WELLHEAD AREA SURVEY
PROSPERITY UNITED METHODIST CHURCH
ACHD SITE NO. 77
Flintstone, 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 Prosperity United Methodist Church (The Church), located on the west side of Pleasant Valley Road, and east of Rocky Gap State Park northern Allegany County, Maryland. This site, designated No. 77 by ACHD, is served by one production well completed in the local bedrock aquifer.

The draft Maryland Department of the Environment (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." No interview information was available to corroborate ALWI's observation that the church is in use infrequently. This and its small parking lot supports its classification as 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

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 attempted to interview the owner/operator and/or employee(s) to document information on the use patterns, history, and problems associated with the supply. However, no one was present at the time of a site visit and several attempts at correspondence with the site owner were unsuccessful.

2. **Contamination Hazard Assessment** – ALWI identified existing and potential contaminant hazards within the delineated area 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 Valley and Ridge physiographic province and is underlain by limestone of Silurian age. The Keyser and Helderberg formations (undifferentiated) underlie the site and mainly consist of limestone (Glaser, 1994). These rocks have been folded and faulted, resulting in synclines (concave-upward folds) and anticlines (convex-upward folds). The Keyser and Helderberg formations consist mainly of limestone. Such carbonate aquifers can be subject to dissolution in the presence of groundwater. Limestones can dissolve in the presence of groundwater resulting in the formation of sinkholes, caves and other topographic features. These features termed karst topography store and transmit unusual large quantities of groundwater that is often non-potable due to microbial contamination or high concentrations of particulates. The absence of karst features despite the favorable lithology may be explained by the intense structural deformation of the rocks.

In three dimensions, the local rock formations dip at right angles to the direction of plunge of the fold system. In general, dip directions may help govern groundwater (and contaminant) movement directions in the bedrock but plunge directions have less relation. At this location, the bedding planes dip to the east, which suggests that the gentle southwesterly plunge may exert greater-than-usual control on deep groundwater flow directions. Reported local well yields are sparse but range from 1 to 20 gpm (Slaughter and Darling, 1962).

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 varies considerably over short distances depending on the thickness of Quaternary alluvial deposits and other factors. 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 and Quaternary alluvium 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.

3.0 WATER QUALITY ASSESSMENT

Slaughter and Darling (1962) reported the groundwater quality from the Wills Creek Formation as locally variable (hardness averages 46 mg/l; and pH ranges from 7.5 to 8.3). ALWI interpreted that the slight reddish colors of the local rock exposures as likely attributable to a trace presence of iron.

Despite repeated attempts to contact the owner by mail, phone and in person, ALWI was unable to collect interview information. A final site visit was completed on September 22, 1999. No one was present to interview or to allow access for collection of water samples and the facility was closed. Therefore, this report has been prepared without the results of such analyses.

4.0 DELINEATION

ALWI delineated an area of potential concern 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. The resultant delineation is shown

on the "Water Plant Information" survey form (Appendix B). ALWI used a fixed radius of 1,000 feet around the well, which creates an area of approximately 72 acres. Within an assumed 600 gallons per day per acre (gpd/ac) of annualized groundwater recharge (Slaughter and Darling, 1962, Table 37), slightly more than 43,000 gallons per day exists within the aquifer beneath this surveyed area. In actuality, the modest demand of this well (doubtlessly less than 100 gpd) is more than two orders of magnitude smaller than the total available in the surveyed area, lending a high degree of conservatism to this analysis.

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 September 22, 1999. 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 on the accuracy of interviews for this information.

5.1 POTENTIAL HAZARDS AT THE WELLHEAD

Design, construction and present condition are important factors in determining a well's susceptibility to contamination. An existing well completion report for one of the wells (Appendix C) suggests the following:

1. **Casing and Cap** – According to the well completion report (Tag No. AL-85-0153), steel casing (approximately 6 inches in diameter) was set within a 10 inch diameter hole to approximately 36 feet below ground surface (BGS). ALWI observed that the portion of the casing exposed at ground surface appeared intact for both wells.

2. **Grout** - Neat Portland cement originally sealed the annular space from 36 feet to ground surface. ALWI could not observe the condition of this grout. If the subsurface grout is missing, bridged, or otherwise degraded, surficial contaminants could find a "short-circuit" pathway to groundwater by flowing down the outside of the casing.

3. **Water Bearing Zones** – Multiple water-bearing zones were encountered at approximately 40, 161, and 167 feet below grade. Surface water influence risks still exist as the shallow water zone is not cased off, and natural water quality generally worsens (aesthetically) with depth.

5.2 OTHER LOCAL CONTAMINATION RISKS

ALWI observed several potential contamination sources in the delineated area: an on-site OST, a neighboring water treatment plant and a nearby artificial lake. No discharge to groundwater has been confirmed by any of the facilities or practices ALWI observed. ALWI performed a site reconnaissance to identify and describe these potential contaminant hazards.

However, the proximity of the well to the nearby lake and it's location in a carbonate aquifer places it at "high risk" for surface water influence as defined in the MDE guidance document. This risk would be better quantified with better information on subsurface borehole conditions (e.g., depth of casing) and the potential for variance in surface water indicator parameters (raw water bacteria; temperature and turbidity) with differing precipitation regimes. Ultimate decisions regarding possible filtration retrofits or bottled water conversion are appropriately driven by economic considerations (the capital and operational costs of domestic-scale filtration vs. the daily consumption of water).

6.0 CONCLUSION AND RECOMMENDATIONS

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

1. **Surface Water Influence** - Property ownership interests should collect and analyze groundwater samples for 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). ALWI recommends that conversion to bottled sources be considered if surface water influence is confirmed.

2. **On-Ground Storage Tank** – ALWI observed one OST on-site. The tank was raised on railroad ties but still in contact with the ground. This OST appeared in good condition. 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.

3. **Neighboring Water Plant** – ALWI observed a package water treatment plant on park property approximately 400 feet southwest of the well. Placarding on the outside of the door indicated hazardous chemicals might be stored here, although in a cross-gradient direction.

4. **Subsurface Disposal Facilities** – Various homes and businesses in the area doubtlessly have septic systems varying in age and condition. Though the low nitrate concentrations

detected in the groundwater sample collected indicate no present release, property ownership interests should embark on a regularly scheduled program of pump-outs.

5. **Parking Area Deicing** – Parking area deicing practices may increase a seasonal risk of sodium and chloride contamination. 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.

7.0 SELECTED REFERENCES

Cleaves, Emery T., Jonathan Edwards Jr. and John D. Glaser, 1968. Geologic Map of Maryland: Maryland Geologic Survey, 1:250,000.

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: Prosperity United Methodist Church

2. WAS: 77

3. System Information:

Address: Route 1

Flintstone, Maryland

Phone No.: (301) 478-2369 (301) 777-5253

4. ADC Map/Grid: N/A

5. Tax Map/Plat: N/A

6. Population:

Transient _____
Regular _____
Total unknown

7. Property Information:

Owner's Name Prosperity United Methodist Church

Address: Route 1

Flintstone, Maryland

Phone No.: (301) 478-2369 (301) 777-5253

8. No. Service Connections:

9. Type of Facility:

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

10. Contact Person:

Name: _____

Phone No. _____

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:

1. **Surface Water Influence** - Property ownership interests should collect and analyze groundwater samples for 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). ALWI recommends that conversion to bottled sources be considered if surface water influence is confirmed.

2. **On-Ground Storage Tank** – ALWI observed one OST on-site. The tank was raised on railroad ties but still in contact with the ground. This OST appeared in good condition. 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.

3. **Neighboring Water Plant** – ALWI observed a package water treatment plant on park property approximately 400 feet southwest of the well. Placarding on the outside of the door indicated hazardous chemicals might be stored here, although in a cross-gradient direction

4. **Subsurface Disposal Facilities** – Various homes and businesses in the area doubtlessly have septic systems varying in age and condition. Though the low nitrate concentrations detected in the groundwater sample collected indicate no present release, property ownership interests should embark on a regularly scheduled program of pump-outs.

5. **Parking Area Deicing** – Parking area deicing practices may increase a seasonal risk of sodium and chloride contamination. 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.

14. Inspected by:	15. Date inspected:	16. System Vulnerability
Mark W. Eisner	9/23/99	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 x

18. System Schematic (Process Flow): unknown

19. System Storage:

Ground Storage _____
Elevated Storage _____
Hydropneumatic Tank x
Other _____

20. Storage Capacity:

Typical Domestic

21. Untreated water sampling tap?
unknown

Yes _____ No _____

WELL INFORMATION

22. Well Information:

Tag Number: not visible

Year Drilled: _____

Casing Depth: _____

Well Depth: _____

Well Yield: _____

Casing Height: _____

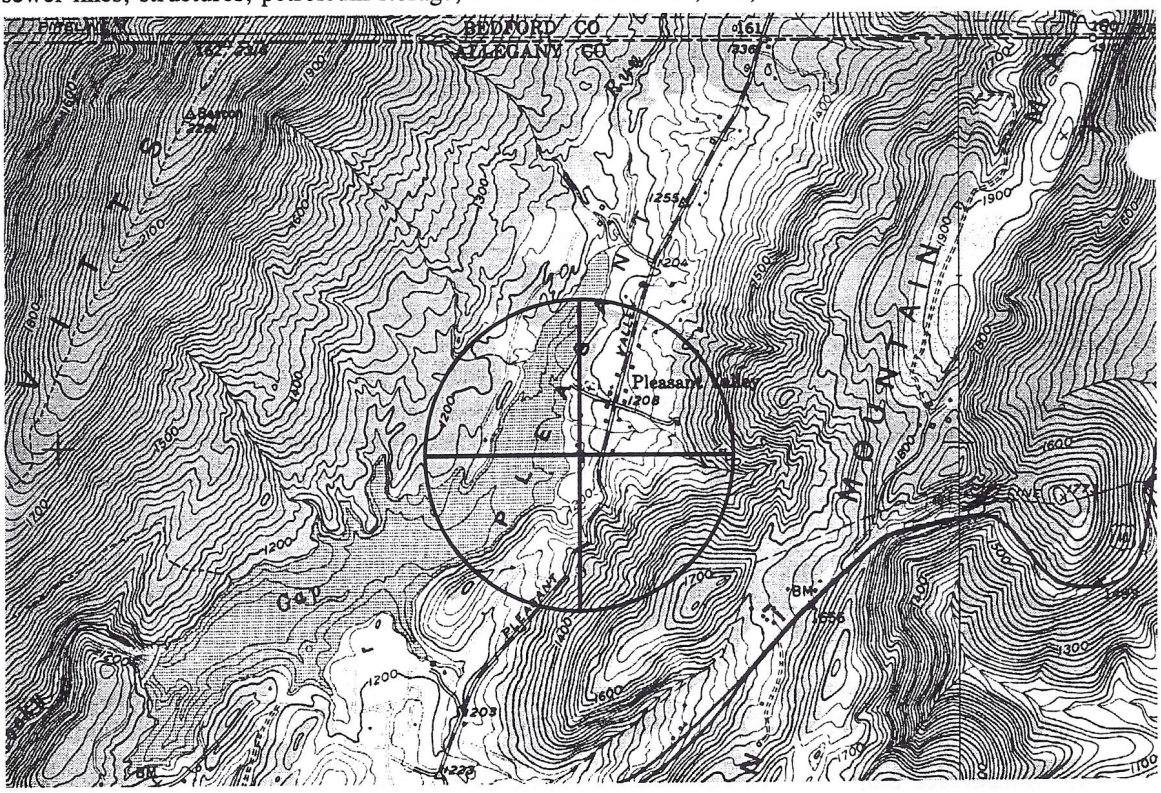
Grout Depth: _____

Pitless Adapter? _____

Wiring OK? unknown

Pump OK? unknown

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



23. Well Type:

Drilled x
Driven _____
Dug _____

25. Aquifer:

Name: Keyser/Helderberg
GAP #: _____
Confined _____
Unconfined _____
Semi-confined _____

26. Quantity Used:

Daily Avg (gpd) _____
Pumping Rate (gpm) _____
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 _____