WELLHEAD AREA SURVEY
THE CASTLE BED AND BREAKFAST
ACHD SITE NO. 40
Mount Savage, 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 the Castle Bed and Breakfast, located on the west side of Mount Savage Road in Mount Savage, in northwestern Allegany County, Maryland. The Castle is a privately owned bed and breakfast with two levels, including some bedrooms with private baths. This site, designated No. 40 by ACHD, is served by one 6-inch diameter, steel-cased 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." An informal interview with the owner suggested that the regular clientele, the year-round operations, and the lack of nearby tourist attractions drawing transient customers all combine to suggest that this water system is indeed a non-transient non-community system (NTNC).

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 interviewed the owner 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 surveyed 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 Castle is situated within the Appalachian Plateau physiographic province and is underlain by consolidated sedimentary rocks of Pennsylvanian age. The Casselman Formation underlies the site and consists of fine-grained sedimentary rock (Brezinski, 1988). These rocks have been gently folded, resulting in broad synclines (concave-upward folds) and anticlines (convex-upward folds).

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. However, at this location, the bedding planes are nearly horizontal, which suggests that the gentle southwesterly structural plunge may exert greater-than-usual control on deep groundwater flow directions.

Reported well yields within the Casselman Formation are sparse but range from 1 to 170 gpm (Slaughter and Darling, 1962). Casselman Formation wells completed within sandstone beds 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 Casselman 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 groundwater quality from the Casselman Formation as locally variable (iron concentrations range from 0.02 to as much as 6.0 micrograms per liter (mg/l); hardness ranges from 17 to 303 mg/l; and pH ranges from 6.5 to 8.3). 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 16, 1998, in accordance with the MDE sampling procedures specified in COMAR 26.08.05. ALWI collected raw water samples in the basement before the water entered the chlorinator as specified in COMAR 26.04.01.14. Treated water samples were collected from the bathroom sink in the lobby.

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 (post-chlorinator only), 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 (both pre- and post-chlorinator).

The results are included as Appendix A, and suggest potability relative to the samples collected. The supply appears to be at low risk for surface water influence as defined in the MDE guidance document.

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. 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. 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 90% of the circle (originally 72 acres in size) or 65 acres. Within an assumed 600 gallons per day per acre (gpd/ac) of annualized groundwater recharge (Slaughter and Darling, 1962, Table 37), slightly less than 40,000 gallons per day exists within the aquifer beneath this surveyed area. In actuality, the modest demand of this well (1800 gallons every two weeks) is much smaller than the total available in the surveyed area, 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 surveyed area 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 December 16, 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 to provide context for some of its observations.

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 top of the casing terminates in a non-watertight subsurface vault, in apparent violation of several provisions[1] within COMAR 26.04.04.07F. Stormwater and other liquids, such as animal waste, may enter and accumulate in this. Such liquids could entrain microbial contaminants from the dark recesses of the vault as well as various other potential contaminants.

ALWI suspects that the well is contaminated with bacteria, which could enter the well through open ports in its sanitary seal. ALWI also observed an incandescent light fixture in the vault that was designed to prevent the water line from freezing. However, the light did not function properly at the time of ALWI's visit, which may allow the line to freeze and possibly burst. Accordingly, extension of the casing to above natural grade and the addition of a pitless adapter and conduit well cap would provide greater protection against possible contamination and freezing.

On December 16, 1998, ALWI performed a reconnaissance in an attempt to identify potential contamination sources elsewhere in the delineated area. ALWI identified no obvious sources of contamination other than the on-site risks listed above.

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. 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.

1. **Subsurface Well Completion –** The well should be retrofitted with a pitless adapter and casing extended to above-grade. The well vault should be backfilled with inert material taking care to adhere to casing and grouting requirements in so doing. The addition of a modern conduit cap will help prevent the entrance of bacteria into the well. Access for pump repairs and replacements should be maintained as well.

2. **Subsurface Disposal Facilities** – Various homes and businesses in Mount Savage 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. Perhaps a consortium of neighbors could join to negotiate more favorable pricing

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[1] This regulation prohibits frost pits, requires pitless adapters, and specifies that the finished height of well casings extend at least 8 inches above natural grade.

from septic contractors. 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. **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 also be considered.

4. **Low Pressure** – ALWI observed low water pressure from your fixtures. Having the existing pressure tank and/or conditioning equipment serviced can solve this.

Depending on the results of the analyses indicated above, the Castle may find greater cost-effectiveness in converting to bottled sources of potable water. Retrofitting the existing groundwater supply with an extended casing may not be cost-effective considering the nature and quantity of on-site uses. If the site owner concurs, appropriate placarding should be provided to warn against use of an untested source for potable purposes.

7.0 SELECTED REFERENCES

Brezinski, David K., 1988, Geologic Map of the Avilton and Frostburg Quadrangles, 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: The Castle

2. WAS: 40

3. System Information:

Address: 15925 Mt. Savage Road

Mt. Savage, Maryland

Phone No.: (301) 264-4645

4. ADC Map/Grid: N/A

5. Tax Map/Plat: N/A

6. Population:

Transient ______
Regular ______
Total unknown

7. Property Information:

Owner's Name Rolanda A. Port

Address: 15925 Mt. Savage Road

Mt. Savage, Maryland

Phone No. (301) 264-4645 (301) 831-4455

8. No. Service Connections:

9. Type of Facility:

Food Service ______
Church ______
Campground ______
Daycare ______
Other (specify) Bed & Breakfast

10. Contact Person:

Name: Rolanda A. Port

Phone No. (301) 831-4455

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:

ALWI did not find acute conditions suggesting non-potability of a type warranting immediate reporting, resampling, or other emergency corrective action. 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.

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4. **Low Pressure –** ALWI observed low water pressure from your fixtures. Having the existing pressure tank and/or conditioning equipment serviced can solve this.

14. Inspected by:
Mark W. Eisner

15. Date inspected:
12/16/98

16. System Vulnerability
Protected ______ Vulnerable yes (see report)

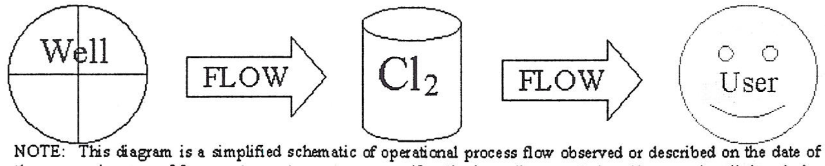
WATER PLANT INFORMATION

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

Disinfection
- Gas Chlorine: ______
- Sodium Hypochlorite _x____
- 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 __x____
Other ______

20. Storage Capacity:

Typical domestic

21. Untreated water sampling tap?

Yes _x___ No _____

WELL INFORMATION

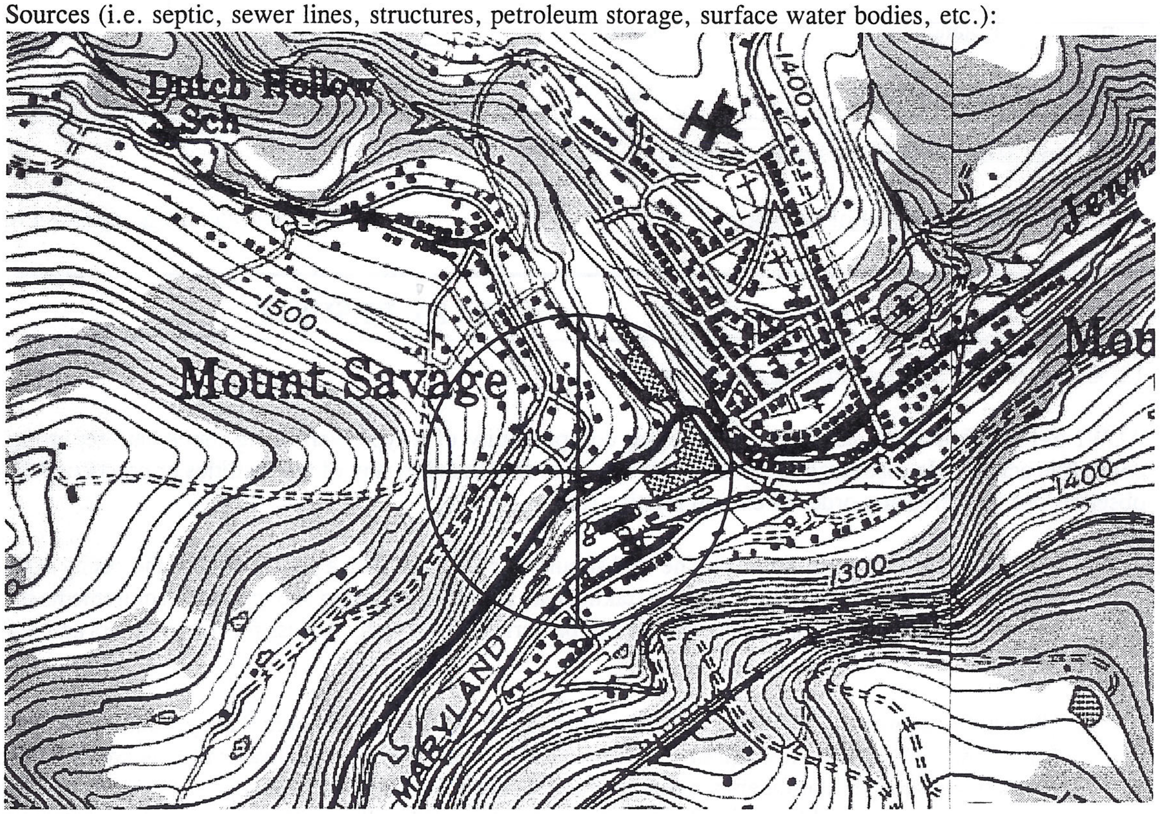
22. Well Information:

Tag Number: not visible
Year Drilled: ______
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: Casselman_______
GAP #: _______________
Confined _____
Unconfined _x___
Semi-confined _____

26. Quantity Used:

Daily Avg (gpd) 125___
Pumping Rate (gpm) unknown
Hours run per day unknown

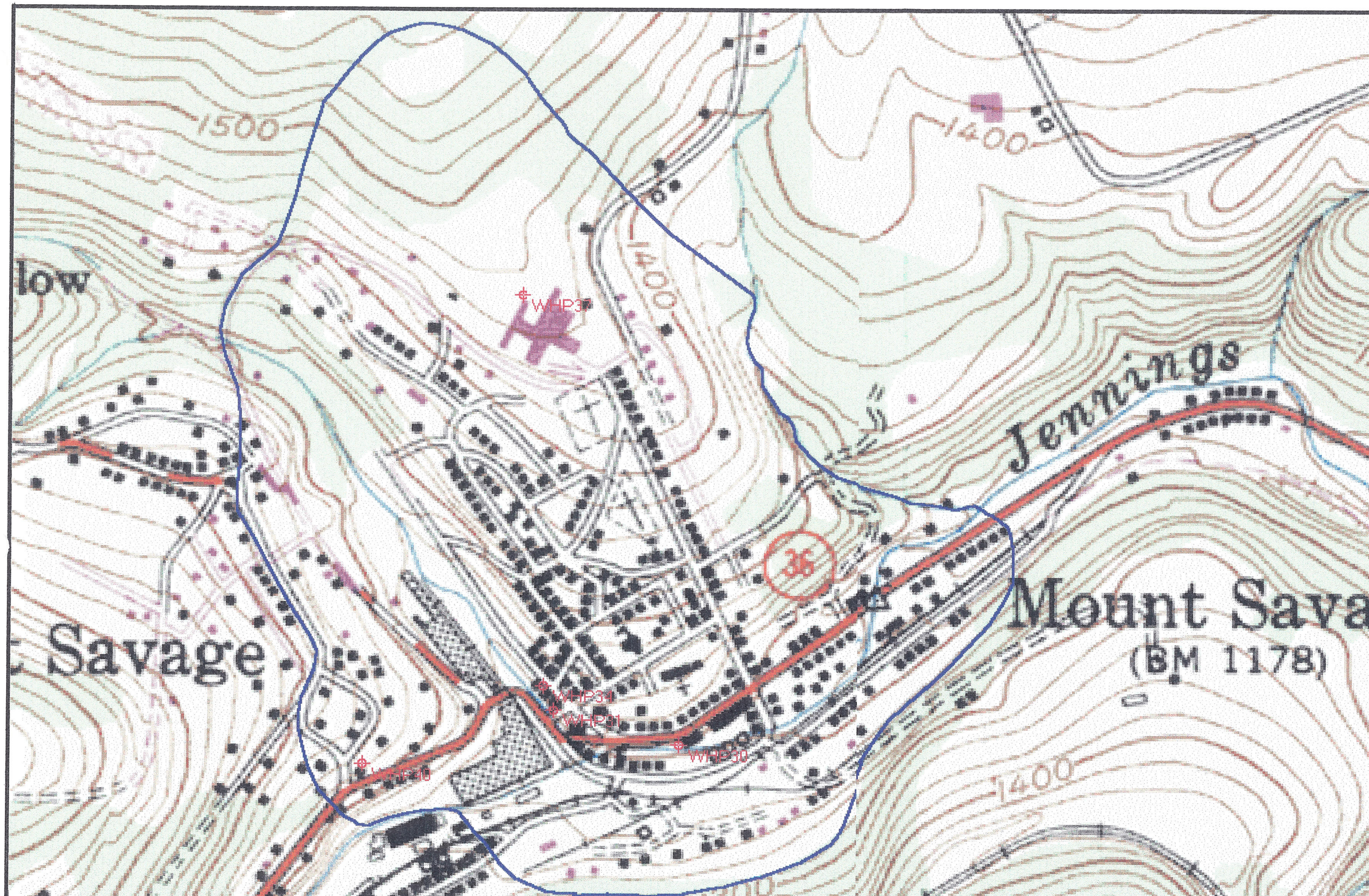
27. Well Cap:
Type? _____
Seal Tight? No
Vented? O.K.
Screened? No_
Conduit OK? O.K.

28. Casing Diameter:

2" ______
4" ______
6" _x____
Other ______

29. Casing Type:

PVC ______
Metal _x____
Concrete______



Preliminary Draft
Subject to Revision

N

EXPLANATION:

⊕ **TNC or NTNC well**

30 → Indian Cheers
31 Green Arrow Restaurant
34 Mount Savage Comm. Center
37 Mount Savage School
40 The Castle

topographically-constrained sourced water protection area [includes areas within 1,000 feet of each surveyed well unless clear hydrogoelogic evidence suggested a need for a site-specific modificaiton of this MDE criterion.

APPROXIMATE SCALE 1"=1100 FT

0 1100 2200

Notes:

1 Base map imported from digital USGS topographic quadrangle maps for Frostburg and Cumberland, MD (1981 revision), provided to ALWI under liscence by Maptech, Inc.
2 This figure is integral to a written report and should only be used in that context.
3 This figure is solely intended to facilitate regulatory review and is not intended to be used for boundary verification, well location or survey control purposes.

Client:
ALLEGANY COUNTY HEALTH DEPARTMENT

Advanced Land and Water, Inc. — Global Environmental Solutions

Project:
NON-COMMUNITY GROUNDWATER SOURCE ASSESSMENT PROGRAM

Prepared Pursuant to the Requirements of:
MD DEPT. OF THE ENVIRONMENT
PUBLIC DRINKING WATER PROGRAM

Figure 2. Composite Source Water Protection Area for Mount Savage

October, 1999