WELLHEAD AREA SURVEY
MT. SAVAGE SCHOOL
ACHD SITE NO. 37
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 Mt. Savage School (the School), a public facility of the Allegany County Board of Education located on the east side of New School Road in northwestern Allegany County, Maryland. This site, designated No. 37 by ACHD, is served by two production wells 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 chief custodian suggested that the number of students (600 normally and 300 currently during renovation) combined with school being in session over three-fourths of the year suggest that this system is 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/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 A).

3. **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 School is situated within the Appalachian Plateau physiographic province and is underlain by 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 and faulted, 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 plunge may exert greater-than-usual control on deep groundwater flow directions.

Reported local well yields 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 as specified in COMAR 26.04.01.14. Raw water influent lines manifold together upstream from the first sampling port. Therefore, only composite sampling and analysis was possible.

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 with respect to the analyses performed. The supply appears to be at low risk for surface water influence as defined in the MDE guidance document.

4.0 DELINEATION

ALWI delineated a surveyed area surrounding this site's wells 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 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 50% of the circle (originally 72 acres in size) or 36 acres. Within an assumed 600 gallons per day per acre (gpd/ac) of annualized groundwater recharge (Slaughter and Darling, 1962, Table 37), over 21,000 gallons per day exists within the aquifer beneath this surveyed area. In actuality, the modest demand of this well (approximately 5000 gpd when school is in session) is smaller than 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 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. No interview information was available to corroborate these limited observations.

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** - Steel casing (approximately 6 in. in diameter) was set within a 10-inch diameter hole to approximately 63 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 63 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 76, 171, 247 and 351 feet below grade. These depths lessen surface water influence risks but natural water quality generally worsens (aesthetically) with depth.

5.2 Other Local Contamination Risks

On December 16, 1998, ALWI observed several potential contamination sources in the delineated area, none of which appeared present to a grave or immediate concern. ALWI identified the following potential sources of contamination: an on-site UST, fertilization of the ballfield, and infiltration from the abandoned on-site well. No discharge to groundwater has been confirmed by any of the facilities or practices ALWI observed.

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. **Underground Storage Tank** - Fuel oil is used as a heating source at this facility. School personnel indicated that the fuel is presently stored in an on-site UST of unknown capacity located southeast of the wells. Given the proximity of the UST to the wells and its understood long history of use, one-time analytical testing to confirm the absence of

fuel oil constituents[1] (e.g., naphthalene, and total diesel-range petroleum hydrocarbon compounds) in the water seems appropriate despite the downhill location of this UST. Periodic monitoring and other corrective actions as necessary should then be considered based on the findings.

2. **Ball field Fertilization -** ALWI observed that the wells are located adjacent to ball fields. Fertilization methods, if practiced, may degrade the water quality through the introduction of pesticides, nitrates, or other compounds to the groundwater. Accordingly, ball field fertilization should be minimized.

3. **Infiltration from Abandoned Wells –** The abandoned on-site wells provide direct short-circuit pathways to the aquifer for contaminants from the ground surface. ALWI recommends that the two older wells be permanently sealed and abandoned so as to decrease the risk of aquifer contamination. COMAR 26.04.04.11D(2)(a) outlines the rationale and procedure for well abandonment in greater detail.

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

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.

[1] Any finding of petroleum-contaminated groundwater must be reported to the MDE Oil Control Program. Such a report would open (or reopen) an Oil Control Program case file. MDE Oil Control Program representatives may order additional sampling, monitoring well drilling, and/or other investigative and remedial measures. ALWI suggest that site ownership and ACHD interest consult legal counsel before taking any action that could have adverse financial or environmental liability consequences.

NONCOMMUNITY WATER SUPPLY SANITARY SURVEY

1. System Name: Mt. Savage School	2. WAS: 37

3. System Information:

Address: Route 1, Box 11A
Mt. Savage, Maryland

Phone No.: (301) 759-2000

4. ADC Map/Grid: N/A

5. Tax Map/Plat: N/A

6. Population:

Transient	unknown
Regular	300 current/600 norm
Total	600 +/-

7. Property Information:

Owner's Name: Ernest Piper

Address: Route 1, Box 11A
Mt. Savage, Maryland

Phone No. (301) 264-3220 (301) 759-2000

8. No. Service Connections:

9. Type of Facility:

Food Service	________
Church	________
Campground	________
Daycare	________
Other (specify)	school

10. Contact Person:
Name: Ernest Piper
Phone No. (301) 264-3220

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 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.

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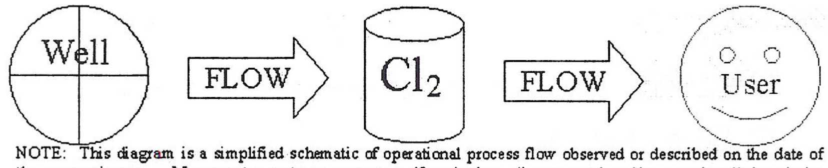
14. Inspected by:	15. Date inspected:	16. System Vulnerability
Mark W. Eisner	12/16/98	Protected x Vulnerable ________

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: ~4,000 gal +/-

21. Untreated water sampling tap? Yes ____ No x

WELL INFORMATION

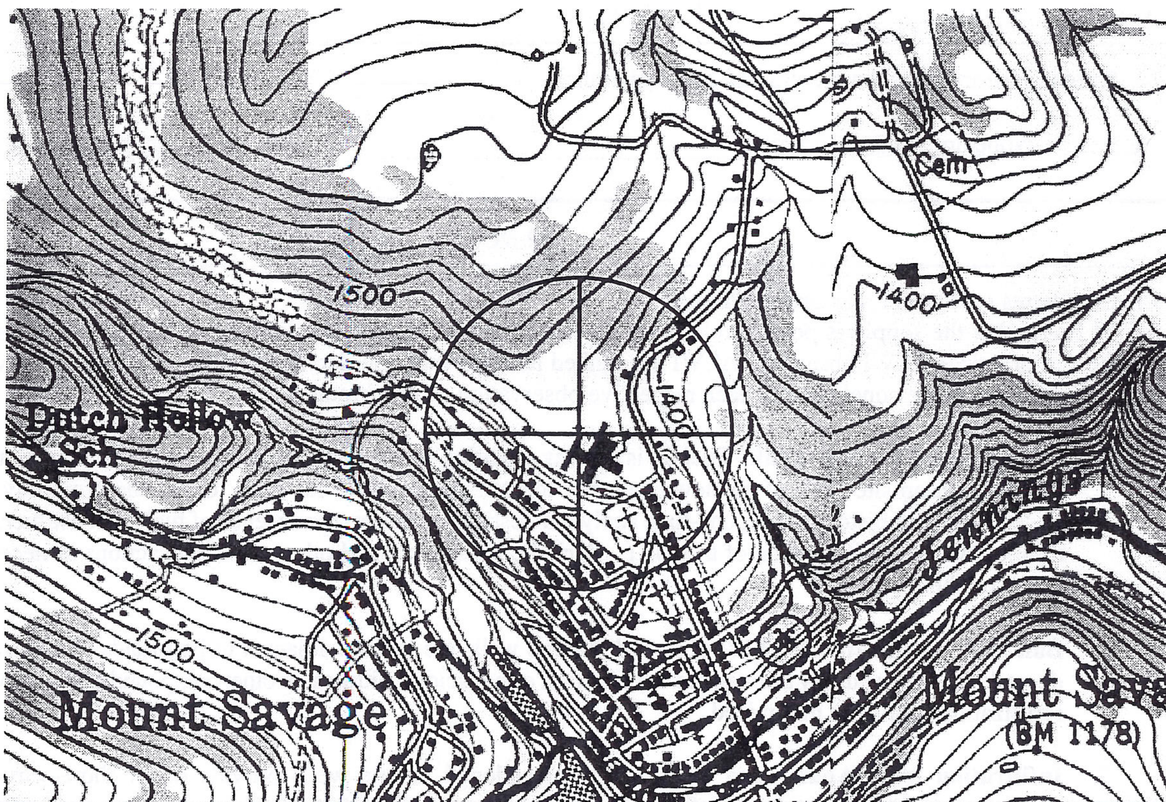
22. Well Information:

Tag Number:	AL-94-0387
Year Drilled:	1997
Casing Depth:	63
Well Depth:	502
Well Yield:	17
Casing Height:	1
Grout Depth:	63
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)	600
Pumping Rate (gpm)	unknown
Hours run per day	unknown

27. Well Cap:

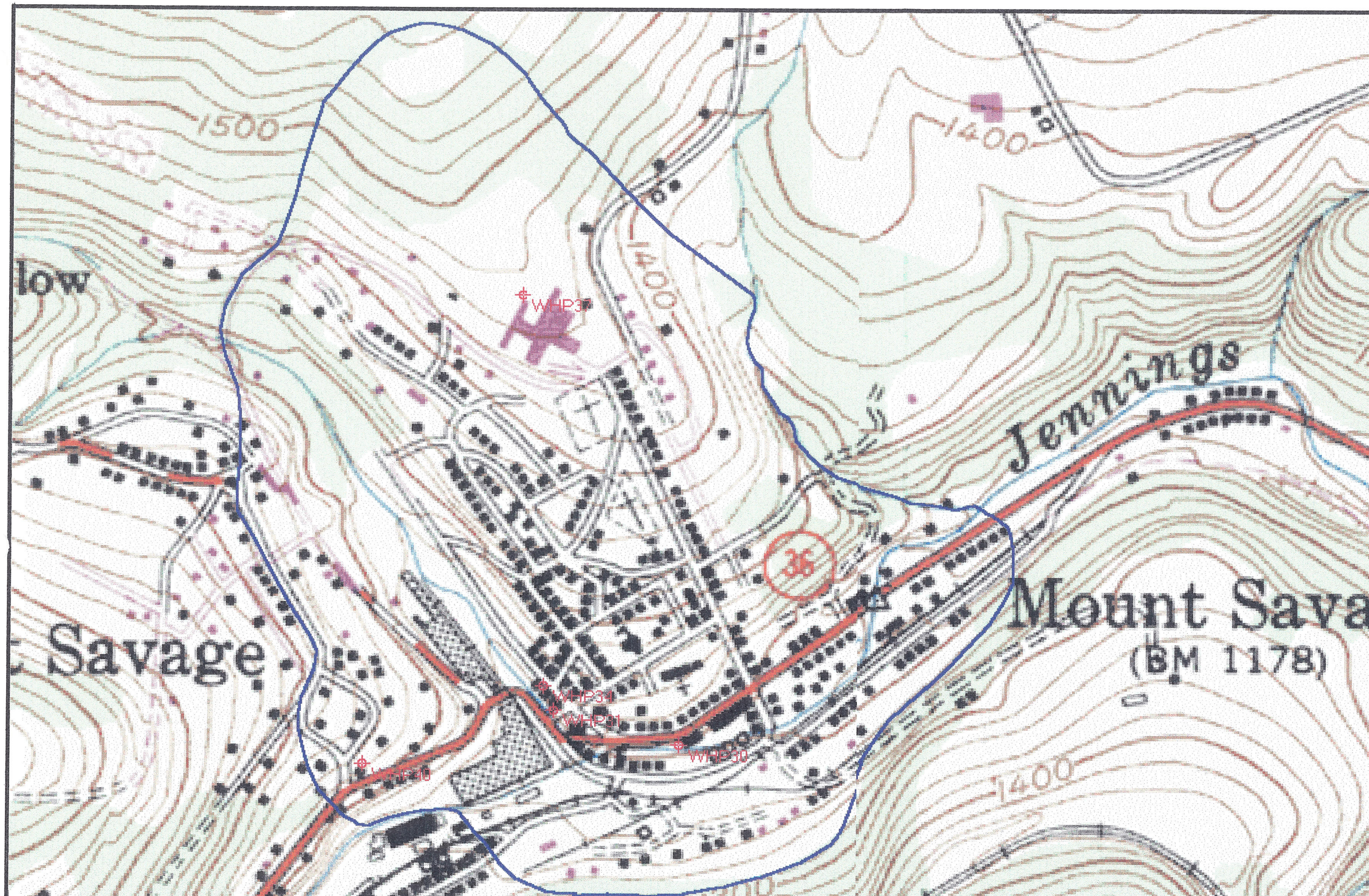
Type?	____
Seal Tight?	O.K.
Vented?	O.K.
Screened?	No
Conduit OK?	O.K.

28. Casing Diameter:

2"	____
4"	____
6"	x
Other	____

29. Casing Type:

PVC	____
Metal	x
Concrete	____



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