WELLHEAD AREA SURVEY
NATIONAL PIKE SUNOCO
ACHD SITE NO. 68
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 National Pike Sunoco, located on the south side of Old National Pike (Scenic US Route 40), in northern Allegany County, Maryland. The National Pike Sunoco is a small commercial gasoline and convenience store with public restrooms and a residence. This site, designated No. 68 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 2 or 3 per shift) and the nature of the clientele (highway travelers passing through) suggests that 25 regular customers are not served, though overall service likely exceeds this from a purely volumetric perspective. 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

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 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

National Pike Sunoco is situated within the Valley and Ridge physiographic province and is underlain by limestone of Silurian age. The McKenzie Formation, which mainly consists of limestone and calcareous shales (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 (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. Limestones can dissolve in the presence of groundwater resulting in the formation of sinkholes, caves and other topographic features. These features collectively termed karst topography, store and transmit unusual large quantities of groundwater that is often non-potable due to microbial contamination and/or high concentrations of particulates. The absence of observed karst features despite the favorable lithology may be explained by the intense structural deformation of the rocks. Accordingly, the health hazards typically associated with carbonate rocks may be less prevalent or absent altogether, at this location.

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 deep groundwater flow directions may follow. Reported local well yields are sparse but average around 5 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 and/or dissolution 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 Brallier and Harrell formations 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 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.

At this location, ALWI collected baseline groundwater samples on December 15, 1998, in accordance with the MDE sampling procedures specified in COMAR 26.08.05. 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. However, the proximity of the well to the nearby stream 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).

4.0 DELINEATION OF SOURCE PROTECTION AREA

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 1000 gpd) is much 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 identified the following potential sources of contamination within the delineated area: surficial and subsurface fuel spills, salt from road deicing and highway deicing. ALWI performed a site reconnaissance and conducted limited personal interviews to identify and describe these potential contaminant hazards.

ALWI performed a site reconnaissance on December 15, 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 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 Drought and Surface Water Susceptibility

No discharge to groundwater has been confirmed by any of the facilities or practices ALWI observed. Design, construction and present condition are important factors in determining a well's susceptibility to contamination. Because, no well tag was visible, ALWI could not assess the initial design or present condition of the casing or grout seal. An interview indicated that the well is 55 feet deep. This shallow depth makes the well both drought and surface water susceptible. With a limited amount of available drawdown, the well may go dry in extreme drought situations.

5.2 Underground Storage Tanks

Gasoline is sold at this facility, and is stored in seven-year-old USTs. The interview indicated that there has been one spill during that time, but no details were available. Based on past experience, ALWI has observed that UST sites may achieve compliance and pass leakage detection tests even with low to moderate degrees of subsurface petroleum contamination. Given the proximity of the UST field to the well, analytical testing to confirm the absence of gasoline and diesel oil constituents (e.g., benzene, toluene, ethylbenzene, xylene, methyl-tertiary-butyl ether [MTBE], naphthalene, and totals for gasoline- range petroleum hydrocarbon compounds seems appropriate.

Such testing should occur during late winter and late summer to assess variances due to seasonal differences in groundwater elevation. Periodic monitoring and other corrective actions as necessary should then continue based on the findings.

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 USTs to eliminate all risk of petroleum contamination of the groundwater supply. ALWI also acknowledges that the UST operations are essential to the existing commercial operation.

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. petroleum 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). Petroleum constituent sampling should be repeated during both seasonal high and low water table conditions, then repeated annually or more frequently if warranted by the findings.

6.2 SOURCE REDUCTION MEASURES

Depending on the results of the analyses indicated above, property owner interests 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 groundwater continues to be relied upon for potable supply purposes, the following additional source reduction measures should be considered:

1. **Remain Vigilant About Fuel Handling and Storage** – Property ownership interests should remain abreast of UST and AST systems regulations. Any release or suspected release should trigger an additional round of sampling with continued monitoring at more frequent intervals until the hazard is abated.

2. **Use Discretion in Parking Lot Deicing** - The degree to which the use of conventional road salt should be predicated on existing sodium and chloride concentrations. A wise precaution would involve the use of non-chemical abrasives to replace some salt usage. The degree of salt in the mix can be guided, in part, on sampling results.

7.0 SELECTED REFERENCES

Glaser, John D., 1994, Geologic Map of the Flintstone Quadrangle, Allegany County, 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: National Pike Sunoco

2. WAS: 68

3. System Information:

Address: P.O. Box 150

Flintstone, Maryland

Phone No.: (301) 478-2334

4. ADC Map/Grid: N/A

5. Tax Map/Plat: N/A

6. Population:

Transient ______
Regular ______
Total unknown

7. Property Information:

Owner's Name Jeffrey J. McCray

Address: P.O. Box 150

Flintstone, Maryland

Phone No. (301) 478-2334

8. No. Service Connections:

9. Type of Facility:

Food Service ______
Church ______
Campground ______
Daycare ______
Other (specify) Gas Station

10. Contact Person:

Name: Jeffrey McCray

Phone No. (301) 478-2334

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. 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 USTs to eliminate all risk of petroleum contamination of the groundwater supply. ALWI also acknowledges that the UST operations are essential to the existing commercial operation.

14. Inspected by:

Mark W. Eisner

15. Date inspected:

12/15/98

16. System Vulnerability

Protected ______ Vulnerable Yes (see report)

WATER PLANT INFORMATION

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

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

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 _____ No __x__

WELL INFORMATION

22. Well Information:

Tag Number: not visible

Year Drilled: ______

Casing Depth: ______

Well Depth: ______

Well Yield: ______

Casing Height: ______

Grout Depth: ______

Pitless Adapter? ______

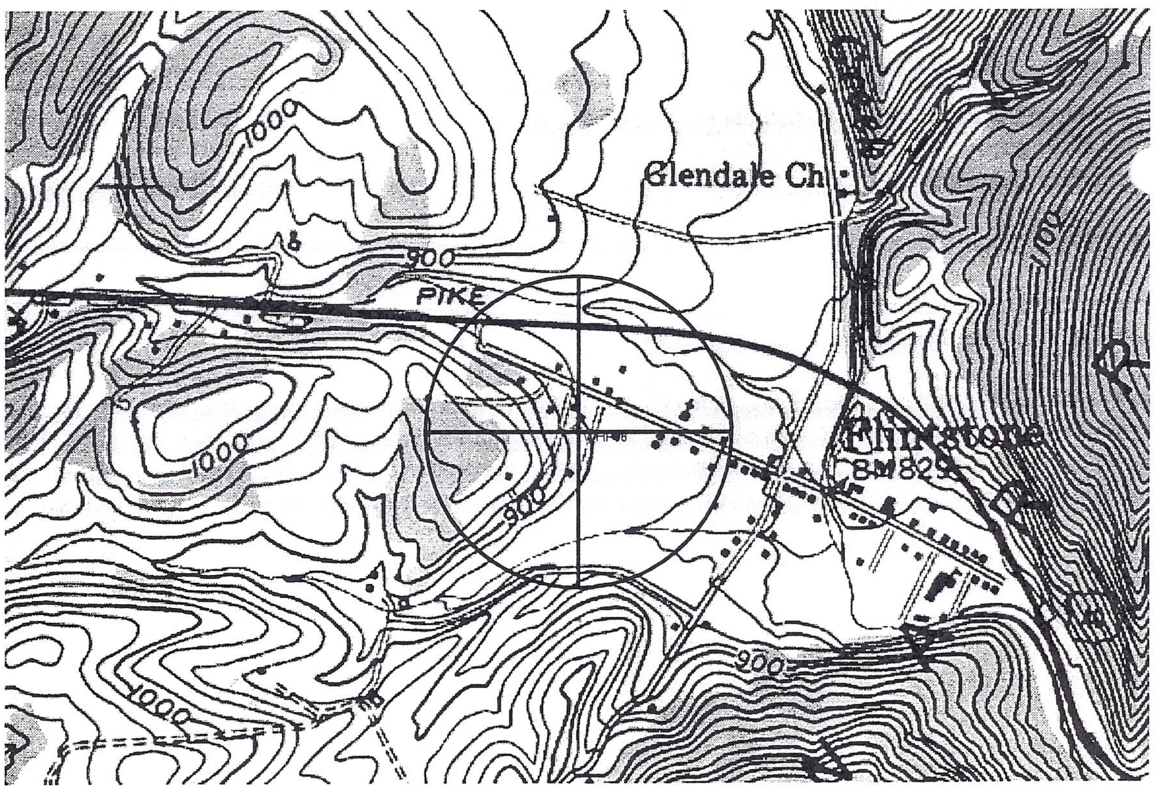
Wiring OK? unknown

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: Keyser/Helderberg
GAP #: ______________
Confined ______
Unconfined __x____
Semi-confined ______

26. Quantity Used:

Daily Avg (gpd) 300
Pumping Rate (gpm) ______
Hours run per day ______

27. Well Cap:

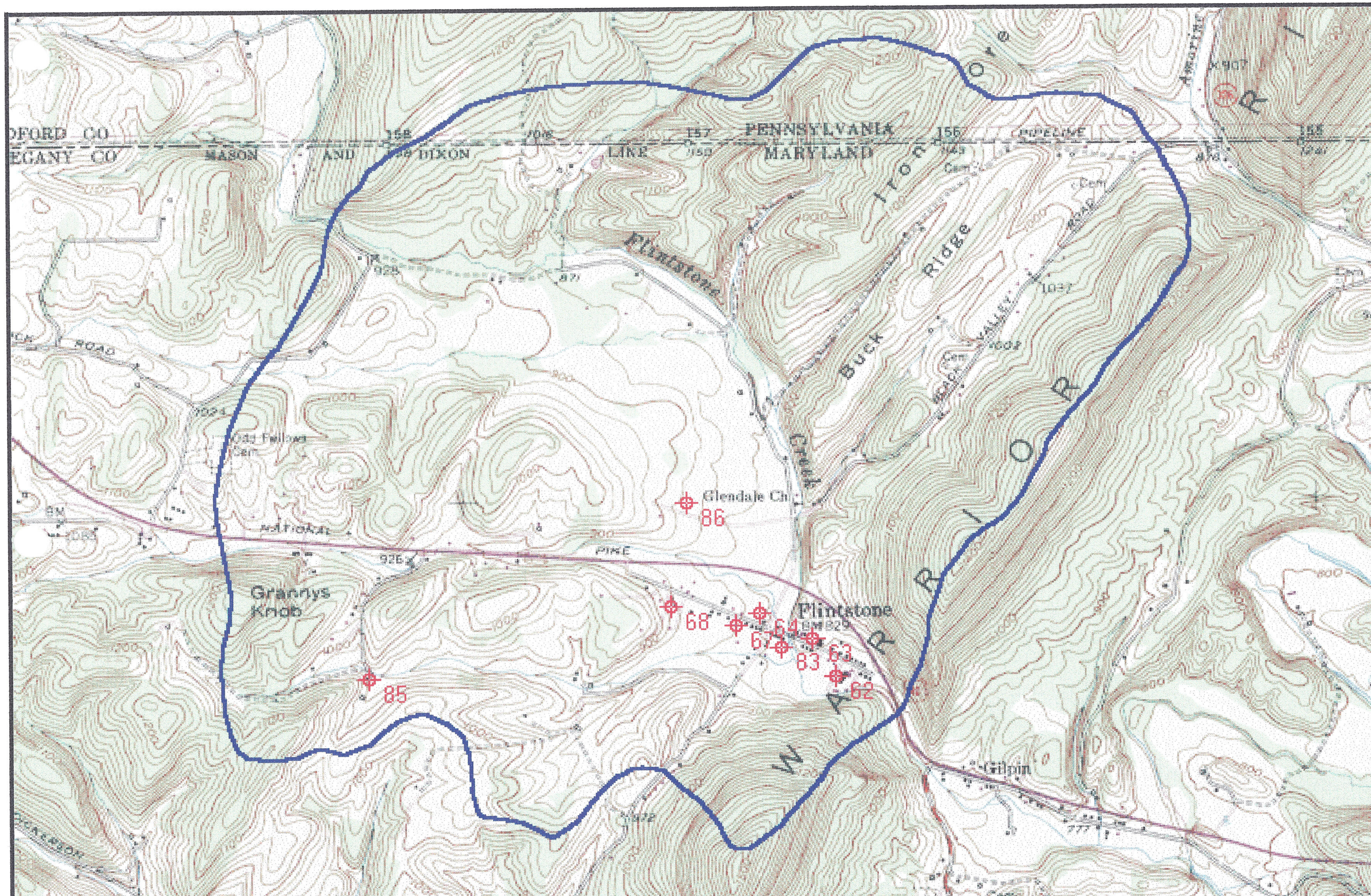
Type? ______
Seal Tight? O.K.
Vented? O.K.
Screened? No
Conduit OK? O.K.

28. Casing Diameter:

2" ______
4" ______
6" __x____
Other ______

29. Casing Type:

PVC ______
Metal __x____
Concrete______



Preliminary Draft

Subject to Revision

N

EXPLANATION:

⊕ **TNC or NTNC well**

62 → Flintstone High School
63 Flintstone VFD
64 Dawn's
67 Helmick's Grocery
68 National Pike Sunoco
83 Vanmeter's Gas & Grocery
85 Mt. Valley Farm Bed & Breakfast
86 Alpine Pantry

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"=3000'

0 3000 6000

Notes:

1 Base map imported from digital USGS topographic quadrangle maps for Flintstone, MD (1974 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 3. Composite Source Water Protection Area for Flintstone

October, 1999