ROCKFISH VALLEY CORRIDOR WATER AND SEWER STUDY

Prepared For:

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and

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EXECUTIVE SUMMARY

According to the County's Comprehensive Plan, the Rockfish Valley corridor along State Routes 151 and 664 is expected to have a high growth rate over the next 20 years. However, there is speculative evidence that on-site wells and sanitary drain fields will not be appropriate to promote the desired economic growth.

Draper Aden Associates has been contracted by the County and the Nelson County Service Authority to provide a water and sewer study for the Rockfish Valley corridor.

The purposes of this Study are:

- to evaluate short term solutions to solve the immediate problems in the Nellysford area
- to evaluate options to provide public water and sewer systems to other areas of the corridor such as Beech Grove and Avon/Afton as development pressures continue
- to provide a preliminary long term water and sewer master plan for providing water and sewer service as the service areas along the Route 151 Corridor develop

For the purposes of this Study, the corridor has been divided into five (5) service areas. These service areas will be referred to as the Beech Grove, Nellysford, Rockfish Central, Avon, and Afton areas. These areas are illustrated on Figure 1, which shows an overall map of the corridor.

The only large development that has an existing water and sewer system is Stoney Creek, which is a private development owned by Wintergreen Partners that is located along Route 151 adjacent to Nellysford.

Preliminary flow projections have been made for each of the five (5) service areas and are shown in Table 1. Since most of the land is not built out, and there is no record of actual water and sewer usage, it is necessary to make projections of units of flow per acre developed. Within each service area, a primary and secondary service area has been defined based on the topography of the land and the proximity to the main road corridor.

The concept for the long term water master plan is straightforward; run water lines down Route 151 to serve the primary service areas and divide the areas into pressure zones using tanks,

booster pumps and pressure reducing valves. However, determining how to develop the system in phases so that all five of the major components are satisfied becomes more complex.

A groundwater study is included in Appendix II. Although the groundwater study concludes that it may by possible to obtain as much as 1-1.5 mgd of groundwater over the whole corridor, groundwater may not be a practical long term solution for the capacity needs of the corridor. Water quality in this area tends to be good. The only treatment that is anticipated for groundwater (wells) is the addition of chlorine disinfectant. The ultimate long term solution may be to build and impoundment on one of the creeks along the corridor to store water for a surface water treatment plant. Plate 1 illustrates several possible impoundment locations.

The development of the sewage collection system will generally follow the phasing of the service areas of the water system. The main difference will be the treatment plant locations. It is generally more cost effective to construct a single plant with a large capacity than to have several smaller plants. However, a customer base needs to be established before a larger regional plant can be constructed. The interim solution may be to construct small, subsurface package treatment plants until the customer base can support a larger facility.

Cost Estimates for each service area for both water and sewer improvements are included in Appendix III.

In order to provide affordable user fees to the customers of the proposed systems and to establish rates that recover the costs of funding and operating the systems, low interest loans and grants or significant contributions from nelson county or private developers will be required. In section 7.0, several sources for potential funding options for the financing of the rockfish valley corridor water and sewer systems are discussed. A preliminary cost feasibility analysis is also presented for several of the initial service area phases and one of the long term options. These analyses indicate the cost of providing infrastructure in the rockfish valley corridor with the proposed customer base initially will most likely not generate enough revenue to be self-sufficient, even with significant grant funds contributed to the construction costs.

An environmental assessment was performed for the corridor, which is included in Appendix IV. This assessment is general in nature, and will need to be refined once a specific alignment is chosen before any permits can be obtained.

The corridor is too large to consider installing utilities throughout the entire length at one time. Therefore, the corridor was broken down into five service areas. The master plan for the corridor is to develop each of the areas in phases until they can ultimately be combined to a single system.

For water, we recommend that negotiations be made with Stoney Creek to the Nellysford area to the Stoney Creek water system. The Nellysford system would be extended in phases, and eventually would be connected to Beech Grove. The Afton and Avon water systems would be developed from scratch. Due to the elevation difference, it is not anticipated that Afton will be connected to any system. Eventually Avon could be connected to Nellysford, which would open up the Rockfish Central area for water service.

The water source for the corridor will initially need to be groundwater. A groundwater supply study was performed (Appendix II) that indicated that there may be up to 1-1.5 mgd of groundwater available in the corridor. However, it may not be practical to tap into that entire source. Therefore, the long term solution for the corridor may be to construct an impoundment and construct a surface water treatment plant.

The master plan for sewer should also begin with Nellysford. We recommend that negotiations be made to purchase capacity in the existing Stoney Creek WWTP. While this plant will not meet the projected buildout flows of the service area, it should satisfy the flows for many years. Beech Grove would connect to Nellysford, and eventually the Stoney Creek WWTP would be replaced with a larger regional facility.

A sewer system in Avon would also be developed with a package WWTP (flows up to 25,000 gpd). The flow from Afton would be treated at this plant. Eventually when the regional facility is constructed in Nellysford, the Avon plant would be replaced with a pump station that would transfer waste to the new facility. This would also open up the Rockfish Central area as a force main system.

There are two major options for a sewer collection system. The gravity option has a higher initial cost to the NCSA, and a relatively low cost to the customer. It also has a much lower operation and maintenance cost, and would result in a lower monthly bill to the customers. The force main option has a significantly lower capital cost to NCSA, but a much higher cost to the customer because of the grinder pump station that they would have to purchase, plus the higher monthly service fees.

The Nellysford area has the highest priority because of several failing drainfields along Route 151. Several options were presented along with the proposed phasing of the options. The recommended option is to negotiate with the WVUC to allow NCSA to connect to their water and sewer systems.

The total (water and sewer) NCSA estimated cost for the initial phase is $560,000 for a gravity system, and $376,000 for force main system. The total estimated cost to the customers is $26,400 for a gravity system and $168,000 for a force main system. This does not include any costs that the WVUC may charge to allow the connection.

If this cannot be negotiated, then the only option would be to develop an independent water and sewer system. The cost would probably be much higher for NCSA, $1,367,000 for a gravity system and $1,125,000 for a force main system, the capacity would be far less than connecting to Stoney Creek, and there would probably not be fire protection.

This water and sewer master study is intended to layout the initial framework for providing utility services to the areas along the Rockfish Valley Corridor. Some of the tasks we believe are important for the NCSA and the County to consider in the near future are:

1. Proceed with Nellysford Area - Phase 1 – Gravity Sewer and Water Main and negotiate to purchase entire system or some capacity.

2. Perform pilot test well study to define if ample wells exist in possible growth areas.

3. Perform a more detailed surface water impoundment study in the near future as environmental permitting and property acquisition can be a major obstacle to overcome if not acted upon in a timely manner.

4. Perform detailed Preliminary Engineering Reports for options developed in the study as service areas develop.

5. Encourage developer participation towards long-term water and sewer master plan in each of the service corridors.

6. Update this initial water and sewer master plan at reasonable time frames (at least every 5 years) as County planning/zoning and development potential evolve.

1.0 INTRODUCTION

1.1 Project Scope

The Nelson County Service Authority (NCSA) and Nelson County have contracted with Draper Aden Associates to develop a water and sewer study for providing service to the Rockfish Valley corridor. This report is partially funded through a Virginia Department of Health Planning Grant (for the water system portion), and the sewer portion of the report is funded by Nelson County.

According to the County's Comprehensive Plan, the corridor is expected to have a high growth rate over the next 20 years. However, there is speculative evidence that on-site wells and drainfields will not be appropriate to promote the desired economic growth. According to the local health department, several of the drainfields in the Nellysford area have experienced past failures, or are constructed in high water tables. While not confirmed, it is also suspected that shallow bored wells in the area may have a higher potential for contamination due to the high water table and possible drain field failures.

The purposes of this Study are:

- to evaluate short term solutions to solve the immediate problems in the Nellysford area
- to evaluate options to provide public water and sewer systems to other areas of the corridor such as Beech Grove and Avon/Afton as development pressures continue
- to provide a preliminary long term water and sewer master plan for providing water and sewer service as the service areas along the Route 151 Corridor develop

1.2 Physical Description of Study Area

The Rockfish Valley Corridor is located in the northwestern corner of Nelson County, Virginia. It generally follows Route 151 from U.S. Route 250 and I-64 south towards Beech Grove Road, which leads to the entrance of Wintergreen Mountain Resort. The total length of the corridor is approximately 15 miles. The terrain is mostly hilly with the Blue Ridge Mountains to the west with some broad, flat land sloping towards the Rockfish River to the east.

For the purposes of this Study, the corridor has been divided into five (5) service areas. These service areas will be referred to as:

- Beech Grove
- Nellysford
- Rockfish Central
- Avon
- Afton

The areas are illustrated on Figure 1, which shows an overall map of the corridor.

1.2.1 Population

According to the 2000 Census, the population in the Rockfish District is 4,484 residents. This is a 22% increase in population from 1990, which is the highest increase of any area in Nelson County. This high growth rate is not a recent trend and is expected to continue. Population projections for the Rockfish District for the year 2010 are approximately 5,300 and for the year 2025 are approximately 7,000.

1.2.2 Soil Types and Applicability for Sanitary Septic Systems

As shown on the figures in Appendix I, some areas could potentially support a sanitary septic system. These areas are predominately underlain by loamy soils that are very deep, well drained and have a moderate infiltration rate when thoroughly wet. Although moderate loamy soils are not ideal for development of a sanitary septic system, limitations that occur in these soil types can be overcome via design and maintenance. Specific soils properties are also summarized in Appendix I.

It is important to note that the majority of the soils along the primary corridor do not appear to be suitable for sanitary drain fields, but the secondary areas do show some potential. If it is desirable to utilize conventional drain fields or even modified options (low pressure distribution, drip irrigation) for development along the corridor, a more detailed analysis in specific locations will be necessary.

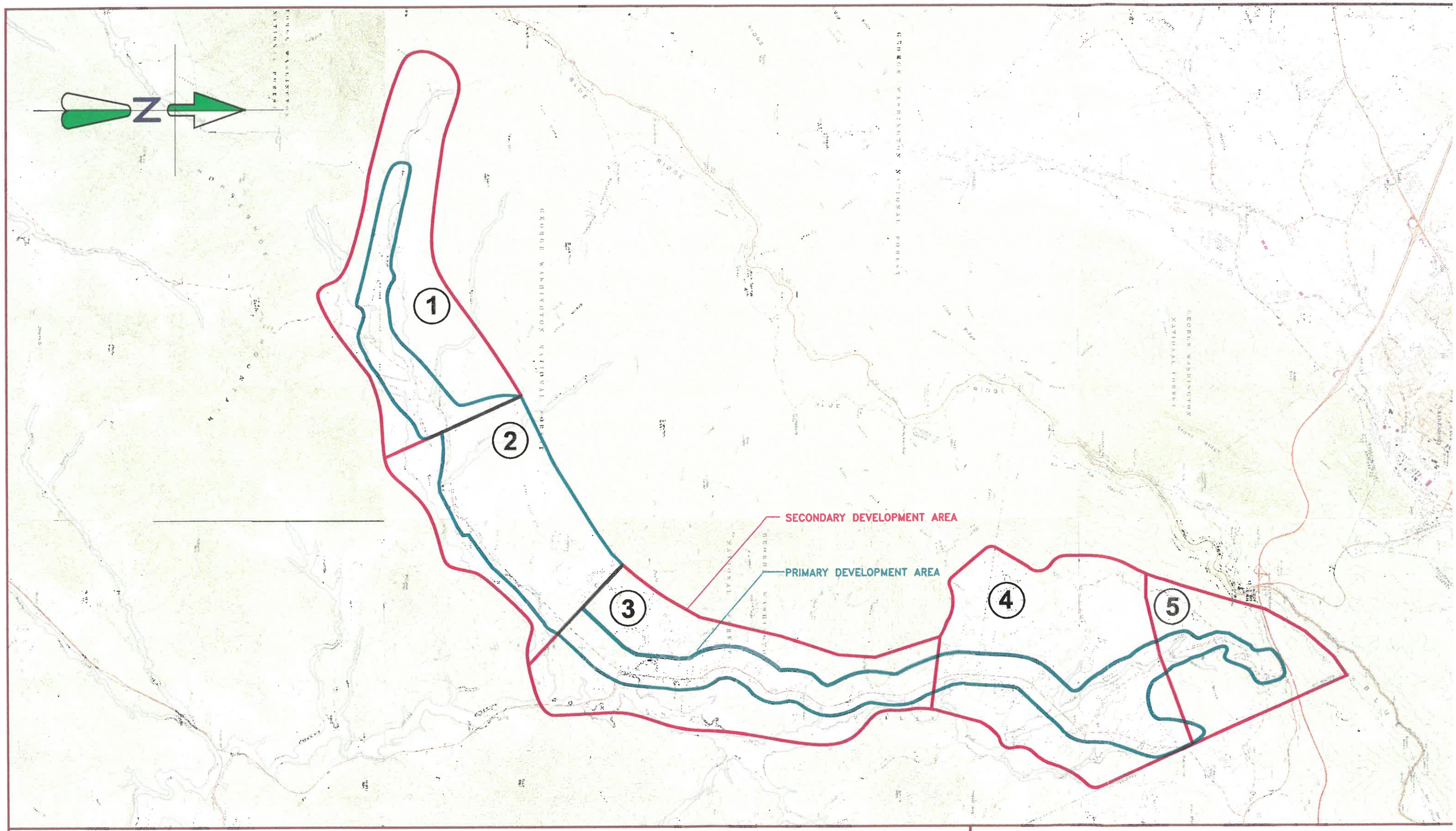

FIGURE 1 - PROPOSED SERVICE AREAS

ROCKFISH VALLEY CORRIDOR WATER AND SEWER STUDY

1. BEECH GROVE
2. NELLYSFORD
3. ROCKFISH/CENTRAL
4. AVON
5. AFTON

SCALE: 1" = 6000'

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- APPROXIMATE FLOOD PLAIN LIMITS

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2.0 EXISTING UTILITY INFRASTRUCTURE

2.1 Unincorporated County Areas

The Beech Grove, Nellysford, Avon, and Afton areas are all on individual wells and drainfields. There are currently no public utilities available.

2.2 Wintergreen Mountain

Wintergreen Mountain resort has public water and sewer, but is not included in the study area because the utility system has no available capacity to serve additional areas. If capacity does become available in the future, infrastructure costs to connect to the Route 151 corridor would be very extensive and would probably be cost prohibitive.

2.3 Stoney Creek

Stoney Creek is a private development owned by Wintergreen Partners that is located along Route 151 adjacent to Nellysford. The Wintergreen Valley Utility Company (WVUC), a subsidiary of Wintergreen Partners, owns and operates a private water and sewer system on the development.

2.3.1 Water System

The Stoney Creek water system consists of several wells, a 400,000 gallon storage tank, a pressure reducing valve (PRV), and approximately 12.5 miles of distribution main. The system is currently permitted for 107,200 gallons per day (gpd), and serves approximately 125 customers. The limiting factor on the capacity is the capacity of the wells. Three (3) additional wells have been constructed and tested, and can be added to the system as additional customers are added to the system. The capacity of the system if all five (5) wells are added would be 223,200 gpd. However, the WVUC is not confident that this capacity can be achieved during periods of prolonged drought.

The storage tank is located on the side of a mountain, so all of the storage is considered effective (the elevation is high enough to provide at least 20 psi to all customers). A few customers are located above the elevation that the tank can provide gravity service. These

customers are served by a 500-gallon pressure tank. The tank provides enough effective storage for 800,000 gpd demand.

Stoney Creek is in the early stages of development. Currently the average daily demand is approximately 25,000-30,000 gpd. Therefore, they have adequate capacity to serve some additional customers in the immediate future.

Draper Aden Associates and the Nelson County Service Authority personnel met with representatives from the WVUC to discuss the possibility of allocating any of the available capacity to the Service Authority. The WVUC indicted that they may be willing to allow a connection to their system for fire flow and pressure purposes, but they would not be willing to allocate any water source capacity. They feel that the well capacity they have may not be adequate to meet their buildout needs, and that Nelson County would need to provide a water source for them to consider any connections outside of the Stoney Creek development properties.

2.3.2 Sewer System

The Stoney Creek sewer system has approximately 7,900 feet of 8-inch gravity sewer, 5,650 feet of 4-inch force main and 1,500 feet of 2-inch force main. There are two (2) suction lift pump stations and one grinder pump station in the system. A third pump station and associated gravity sewer/force main is planned near the entrance of the development.

The WVUC owns and operates a secondary treatment plant permitted for an average flow of 65,000 gpd. According to the utility company personnel, the plant was designed so that it can be upgraded to double the capacity. Since most of the homes in Stoney Creek have septic tanks and drain fields, the average daily flow to the treatment plant is approximately 5,000 gpd which leaves a significant amount of capacity for new customers. WVUC representatives have indicated that they may be willing to sell sewer capacity to the Service Authority.

3.0 EXISTING AND FUTURE DEMANDS

3.1 Existing Demands

3.1.1 Stoney Creek

The current demand for the water system is approximately 25,000-30,000 gpd. The average flow at the wastewater plant is approximately 5,000 gpd.

3.1.2 Rest of corridor

The total population in the corridor is 4,485. Population projections for the Rockfish Valley by the years 2010 and 2025 are approximately 5,300 and 7,000, respectively. However, these projections include the Wintergreen and Stoney Creek resorts, which are already on public utilities. There are approximately 1,950 customers in Wintergreen.

3.2 Projected Future Demands

3.2.1 Basis

The Draft 2001 Nelson County comprehensive plan identifies the projected land use types throughout the corridor area. The uses primarily include village mixed uses, high, medium and low density residential with small patches of commercial and industrial use. Since most of the land is not built out, and there is no record of actual water and sewer usage, it is necessary to make projections of units of flow per acre developed. These unit flows were developed based on our experience with similar land uses and the general neighborhood mixed used development model as proposed in the Draft 2001 comprehensive plan. As defined in the comprehensive plan, appropriate neighborhood mixed use land uses include both single family and multifamily residential, a variety of commercial establishments, professional offices, civic and public uses, and parks or recreational facilities. Some of the preferred uses include a grocery store, restaurants, cultural and entertainment opportunities, a drugstore, doctor and dentist offices, and churches. For Public use, a library, farmers market and space for recreation are desirable.

Figure 1 shows the corridor divided into the five (5) service areas. Within each service area, a primary and secondary service area has been defined based on the topography of the land

and the proximity to the main road corridor. Assumptions were made as to the amount of developable land and land use type within each area that were based on the topography and information in the comprehensive plan. Table 1 lists all of the projected buildout flows within each service area.

Table 1
Rockfish Valley Corridor Water and Sewer Study

Proposed Service Areas and Preliminary Flow Projections

No	Service Area	Development Area (Acres)	Flood Plains (Acres)	Total Potentially Developable Land (Acres)	60% of Developable Land (Acres)	% Village Mixed Use (1,000 gpd/acre)[1]	% High Density Residential, .5 acre lots (600 gpd/acre)	% Med. Density Residential, 1 acre lots (300 gpd/acre)	% Low Density Residential, 2-5 acre lots (100 gpd/acre)	Max Projected Total Flow (gpd, 100% Buildout)	Actual Projected Total Flow (gpd, 50% Buildout)	Total Flow (gpd, 25% Buildout)	ERCs (25% Buildout)[2]	Max Day Projected Total Flow (gpd, Peaking Factor = 2.5, 25% Buildout)[3]	Max Day (gpm, 25% Buildout)	Peak Hour Demand (gpm, 25% Buildout)[4,5]	Peak Hour Demand (gpm, 50% Buildout)[4,6]
1	**Beech Grove (3,574 acres)**																
1P	Beech Grove Primary	693	61	632	379	0.20	0.35	0.35	0.10	199,080	100,000	50,000	125	125,000	87	158	230
1S	Beech Grove Secondary	2,881	618	2,263	1,358	0.20	0.30	0.20	0.30	638,166	319,000	160,000	400	400,000	278	297	432
2	**Nellysford (2,839 acres)**																
2P	Nellysford Primary	2,178	109	2,069	1,241	0.20	0.35	0.35	0.10	651,735	326,000	163,000	408	407,500	283	300	437
2S	Nellysford Secondary	661	466	195	117			0.50	0.50	23,400	12,000	6,000	15	15,000	10	50	73
3	**Rockfish/Central (3,941 acres)**																
3P	Rockfish/Central Primary	1,288	34	1,254	752	0.05	0.10	0.25	0.60	184,338	92,000	46,000	115	115,000	80	151	220
3S	Rockfish/Central Secondary	2,653	512	2,141	1,285			0.20	0.80	179,862	90,000	45,000	113	112,500	78	149	217
4	**Avon (4,207 acres)**																
4P	Avon Primary	1,268	104	1,164	698	0.05	0.10	0.25	0.60	171,108	86,000	43,000	108	107,500	75	145	212
4S	Avon Secondary	2,939	114	2,825	1,695			0.20	0.80	237,300	119,000	59,000	148	147,500	102	172	253
5	**Afton (1,820 acres)**																
5P	Afton Primary	310	26	284	170	0.10	0.10	0.20	0.60	47,712	24,000	12,000	30	30,000	21	73	106
5S	Afton Secondary	1,510	16	1,494	896			0.20	0.80	125,496	63,000	31,000	78	77,500	54	122	179
	Total	16,381	2,060	14,321	8,593					2,458,197 gpd	1,231,000 gpd	615,000 gpd	1,538	1,537,500 gpd	1,068 gpm	1,615 gpm	2,357 gpm

* NOTES:
1) Village Mixed Use = Residential, Commercial, and Retail
2) 1 ERC (Equivalent Residential Connection) = 400 gpd
3) Design for well capacity, WWTP capacity, and storage tank capacity will be based on Max Day Demands at 25% Buildout
4) Peak Hour Demand = 11.4 x no. of connections$^{0.544}$
5) Design of all pump stations will be based on Peak Hour Demands at 25% Buildout
6) Design of all sanitary sewer, water mains, and force mains will be based on Peak Hour Demands at 50% Buildout

3.2.2 Demand Usage

One purpose of this Study is to determine the most cost effective option to solve the short-term (approximately 5-10 years) utility problems that will be incorporated into a long term water and sewer master plan. It seems unlikely that the corridor will be 100% built out before the end of the useful life of the infrastructure. Therefore, we recommend using the 50% buildout projected flows as a basis for designing infrastructure items with a long life (such as underground pipes), and 25% buildout projected flows as a basis for designing infrastructure items with a shorter life (such as pumps or other mechanical equipment). The following list summarizes the proposed basis of design:

- 25% Buildout max day used for water supply, wastewater treatment
- 50% Buildout max day used for storage requirements and water main design (in conjunction with fire flow)
- 25% Buildout Peak Hour used for pump station design
- 50% Buildout Peak Hour used for water main, force main and sanitary main design

4.0 LONG TERM WATER SYSTEM MASTER PLAN

4.1 Description

The Rockfish Valley Corridor is very long, narrow and hilly. This results in several challenges when implementing a water system. Since it is so narrow, it is necessary to have a large amount of pipe for a relatively small number of potential customers. In addition, the pipe needs to be a large diameter to overcome the frictional head loss so that adequate fire flow can be delivered. The topography makes it necessary to have several pressure zones. Otherwise, the pressure would be too high for some customers and too low for others.

All public water systems consist of the following major components:

1. Water Source (groundwater or surface water)
2. Treatment Works (often minimal for groundwater)
3. Pressure Source (tank or pump)
4. Storage
5. Distribution Lines

The concept for the long term water master plan is straightforward; run water lines down Route 151 to serve the primary service areas and divide the areas into pressure zones using tanks, booster pumps and pressure reducing valves. However, determining how to develop the system in phases so that all five of the major components are satisfied becomes more complex.

4.2 Hydrological Investigation

The 1998 " Report of Evaluation and Appraisal for the Wintergreen Stoney Creek Village Water and Sewer Systems" identified five (5) water supply wells within the development and included information regarding ownership, use, and yield. The study did not include a hydrogeologic assessment of the area. The current study conducted by Draper Aden Associates expands the study area, characterizes the hydrogeologic setting, and evaluates available groundwater resources within the Beech Grove, Nellysford, Rockfish, Avon, and Afton service areas. The Groundwater Supply Study (see Appendix II) includes:

- Well database information.
- Limited characterization of groundwater quality.

- A detailed fracture trace (photolineament) analysis.
- Selection and ranking of recommended well locations.

4.2.1 Geology and Hydrogeology

Igneous, metamorphic, and sedimentary rocks including unconsolidated sediments underlie the study area. The Rockfish Valley Fault network has a significant impact on the water-bearing capacity of these geologic units. The highest potential well yields (25 to 50 gallons per minute and locally, perhaps 50 to 100 gallons per minute) exist within the more extensively faulted and fractured bedrock formations. In the absence of such features, low well yields of 1 to 2 gallons per minute (gpm) and even dry wells occur.

4.2.2 Existing Wells

Well records obtained for 49 wells in the study area indicate yields ranging from 1 to 89 gpm at depths of 62 to 675 feet. Yields in excess of 25 gpm occur at depths of 200 to 300 feet in six (6) wells. Five (5) of these wells are part of the Stoney Creek Village water system.

A summary of the well data is presented in Table 1 of the report (Appendix II) and their locations are presented on accompanying figures. The cataclastic rocks and layered granulite gneiss that occur within the limits of the Rockfish Valley Fault network appear to be the most favorable hydrogeologic units for groundwater development.

4.2.3 Well Development Potential

An important aspect of groundwater development is groundwater recharge or replenishment of water removed from the subsurface. The estimated groundwater recharge potential for the 25.5 square mile study area is approximately 7.3 million gallons per day (mgd). The greatest recharge potential occurs in the western portions of the study area and in the area between the proposed service areas and the eastern base of the Blue Ridge Mountains. A groundwater supply of 1.1 to 1.5 mgd is potentially feasible from strategically placed high capacity wells in a system of dense, interconnected networks of highly fractured and faulted groundwater–bearing bedrock.

4.2.4 Groundwater Quality

Limited groundwater quality data was available. Information was obtained from the Virginia Department of Environmental Quality (DEQ) for two (2) of the Stoney Creek Village wells. Both had nitrate/nitrite and volatile organic compounds concentrations that "complied with all primary maximum contamination levels". Elevated concentrations of naturally occurring iron and manganese may occur locally.

4.2.5 Fracture Trace Analysis

The fracture trace (photolineament) analysis identified 351 fracture traces in the study area. A summary of fracture trace orientations is presented in Table 2 of the report (Appendix II). Fracture traces are presented on the four (4) service area figures that follow Table 2. Interconnected fracture zones and faults represent potential subsurface water-bearing intervals within bedrock. The abundance of mapped fractures, their length (generally greater than ½-mile and a number from 1 to 3 miles long), and proximity to the Rockfish Valley Fault network, represent favorable conditions for developing wells yielding from 25 to 50 gpm and potentially from 50 to 100 gpm.

4.2.6 Proposed Well Locations

Based upon the results of reviewing published geologic literature and the fracture trace analysis, 31 proposed wells sites have been identified. Seven (7) recommended well sites were identified for each of the Beech Grove, Nellysford, Rockfish, and Avon service areas. Three (3) were identified for the Afton service area. Proposed well locations are presented on the fracture trace figures in Appendix II. The well sites are numbered in order of preference from 1 to 7 with number 1 being the most preferred. A location ranked 7 is still considered a favorable location. The analysis identified numerous fractures that were not selected, which may also be favorable well development locations.

4.3 Phasing

It is not practical to develop a water system along the entire corridor in the short term. The expense would be prohibitive, and there will not be enough customers to support such a

system for years. Therefore, we recommend dividing the Corridor into five (5) separate service areas that would each be developed independently with the potential to ultimately combine them.

The sequence of phasing presented in this report is based on discussions with Nelson County and NCSA personnel along with our judgment. The actual sequence of the phases may be subject to change depending on the needs of the County and Service Authority. We predict that the phases will be as follows:

1. Nellysford
2. Beech Grove
3. Avon
4. Afton
5. Rockfish Central

The Rockfish Central area is the longest stretch of the corridor, has the most elevation changes, and has the least-dense projected population development. For these reasons, it has the lowest priority for development. We envision that the Nellysford/Beech Grove areas and the Afton/Avon areas will each be connected as two separate systems. The Rockfish Central area will most likely not become significantly developed until it becomes necessary to transfer water from one area of the corridor to another because of groundwater capacity limitations and infrastructure costs.

Cost estimates for each service area are included in Appendix III.

4.4 Long Term Capacity

Although the groundwater study concludes that it may by possible to obtain as much as 1-1.5 mgd of groundwater over the whole corridor, groundwater may not be a practical long term solution for the capacity needs of the corridor. The reason is that although that amount of water may be in the ground, the individual wells will probably yield between 20-50 gpm. At that rate, it could take 15-20 wells just to meet the projected 25% buildout needs of the corridor. It may prove to be difficult to obtain the property for this many well sites. Additionally, the wells would have to be spaced out so that they do not draw down the other wells, which could require a great deal of piping.

The ultimate long term solution may be to build and impoundment on one of the creeks along the corridor to store water for a surface water treatment plant. Plate 1 illustrates several possible impoundment locations.

An analysis of the safe yield of an impoundment was performed for another proposed reservoir in Nelson County with similar topography. By assuming that the yield will be proportional based on the drainage area, we are able to make a very rough estimate of the capacity of the proposed impoundments, which are listed in the following table:

Possible Impoundment Location	Drainage Area (acres)	Approximate Yield (mgd)
A	3300	0.75-1.0
B	1720	0.4-0.6
C	4650	1.0-1.5
D	5000	2.0-2.5
D+E	5700	2.25-3.0

Table 2 – Projected Yield of Potential Impoundments

It is important to note that this analysis is very preliminary. A separate, more detailed investigation will need to be performed if this project is to be pursued. However, it appears that some of the larger impoundment areas could reasonably be expected to meet the needs of the corridor for the 50% buildout total flow of 1.23 mgd.

This venture will be expensive and will only be cost effective if there is a significant amount of potential customers or if other outside revenue sources are obtained. Therefore, the interim solution is to develop groundwater sources until a customer base is built up, and then construct the impoundment to either supplement or replace the groundwater sources. In the meantime, the distribution system should be sized to allow water to be transferred throughout the corridor in anticipation of a central water source.

4.5 Nellysford

4.5.1 Water Source

The water source for the first phase will need to be groundwater. In each of the short term options, NCSA will have to develop additional wells to either operate an independent water system or supplement the existing Stoney Creek wells.

Based on the demand projections for Nellysford, groundwater sources totaling 113 gpm will need to be developed to provide the capacity needed for 25% buildout in the primary development area. Based on empirical information, wells in that area tend to yield 20-40 gpm at most. Therefore, it could easily take five or six wells to meet the projected demand.

4.5.2 Treatment Works

Water quality in this area tends to be good. The only treatment that is anticipated for groundwater (wells) is the addition of chlorine disinfectant. It is possible that a small number of wells would have naturally occurring high levels of iron and/or manganese. Treatment for these wells would be handled on a case-by-case basis.

4.5.3 Pressure Source

The WVUC has indicated that they may be willing to share the existing tank as a fire protection source. A pressure reducing valve will need to be set near the Stoney Creek main entrance which will provide pressure ranging from 40 to 100 psi throughout the Nellysford service area along Route 151.

4.5.4 Storage

The existing Stoney Creek storage tank has a capacity of 400,000 gallons, which gives it a capacity to serve up to 2,000 Equivalent Residential Connections (ERCs) at 400 gpd/ERC (800,000 gpd total). This far exceeds the projected average daily demand. The WVUC has indicated that they may be willing to share the storage capacity of this tank.

4.5.5 Distribution Lines

In order to allow for adequate fire protection and the potential transfer of water throughout the various areas of the corridor, the tie-in to Stoney Creek and the main lines along Route 151 should be at least 12 inches in diameter. The water lines leading to the wells will have to be sized based on the distance of the well from the distribution main and the capacity of the well (typically 6 inch or 8 inch). Figure 2 illustrates both the water and sewer master plan for Nellysford.

Since Nellysford has the most immediate need for water and sewer service, a separate section is included in the report that is devoted to evaluating specific alternatives for providing service in the short term.

4.6 Beech Grove

4.6.1 Water Source

Beech Grove will also initially need to be served by groundwater. To serve the primary area with a projected 25% buildout demand of 50,000 gpd, a total well capacity of 35 gpm will need to be developed. It may be possible to meet this demand with only two wells (the minimum for a public water system). A connection between Beech Grove and Nellysford is recommended so that water can be transferred to either of the systems in the event that the demand in one of them exceeds the well capacity.

4.6.2 Treatment Works

Water quality in this area tends to be good. The only treatment that is anticipated for groundwater (wells) is the addition of chlorine disinfectant. It is possible that a small number of wells would have naturally occurring high levels of iron and/or manganese. Treatment for these wells would be handled on a case-by-case basis.

4.6.3 Pressure Source

Although a connection will be made to Nellysford, the hydraulic grade will be reduced by the pressure reducing valve (PRV) so that the existing tank cannot directly serve the higher

elevation Beech Grove area. Consequently, the connection between the two systems will require a booster pump and PRV.

Figure 2 – Nellysford Service Area Master Plan

STONEY CREEK DEVELOPMENT

EX. 400,000 GAL.
WATER STORAGE TANK

LAKE MONACAN

PHASE 1 - IMMEDIATE SERVICE AREA

EX. 10"
WATER MAIN

MASTER METER &
PRV VAULT

PROP. PUMP STATION
(BY STONEY CREEK)

PHASE 2

PRV

POTENTIAL
BOOSTER PUMP

NEW WELL

NEW WELL

PHASE 3

EXIST.
WWTP

NEW WELL

PUMP
STATION
(FOR GRAVITY)
OPTION

NELLYSFORD

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FIGURE 2 - NELLYSFORD SERVICE AREA MASTER PLAN
ROCKFISH VALLEY CORRIDOR WATER AND SEWER STUDY

SCALE: 1" = 1200'

LEGEND

S	SEWER MAIN
GS	LONG TERM GRAVITY SEWER
FM	FORCE MAIN
W	WATER MAIN
	PRIMARY SERVICE AREA
	SECONDARY SERVICE AREA
	APPROXIMATE FLOOD PLAIN LIMITS

The ultimate pressure source for Beech Grove will be a ground storage tank located at an elevation of 1080'. Since there will not be enough demand initially to support such a tank, a smaller pressure tank could be built to supply storage capacity for interim use.

4.6.4 Storage

In order to supply 2 hours of fire flow at 2,000 gpm and have extra emergency storage, we recommend that the storage tank be at least 400,000 gallons. It is recommended that 240,000 gallons be reserved for fire flow. The additional storage beyond fire flow will help during peak periods, such as weekends during ski season or conventions.

In the interim, each well could have a pressure tank installed until more customers connect to the system. The pressure tanks will continue to be useful even when the bulk storage tank is installed, since they will provide contact time to the disinfectant (probably chlorine).

It should be noted that a pressure tank would significantly limit the number of customers on a system. VDH only gives credit for 1/3 of the capacity of a pressure tank, so a 10,000 gallon pressure tank would only have credit for 3,333 gallons of storage, and only 6,666 gpd of demand would be allowed. The pressure tanks will not provide any significant fire protection. The VDH requires 200 gallons of storage per ERC. Therefore, a 10,000 gallon pressure tank would be able to provide service to approximately 16 equivalent residential customers.

4.6.5 Distribution Lines

In order to allow for adequate fire protection and the potential transfer of water throughout the various areas of the corridor, the main lines along Route 151 and Beech Grove Road up to the proposed water tank will be 12-inches in diameter. The water lines leading to the wells will have to be sized based on the distance of the well from the distribution main and the capacity of the well. Figure 3 illustrates the water and sewer master plan for Beech Grove.

Since Beech Grove is in close proximity to Nellysford and has a strong potential for development, it was included in the section with detailed alternatives for short term service.

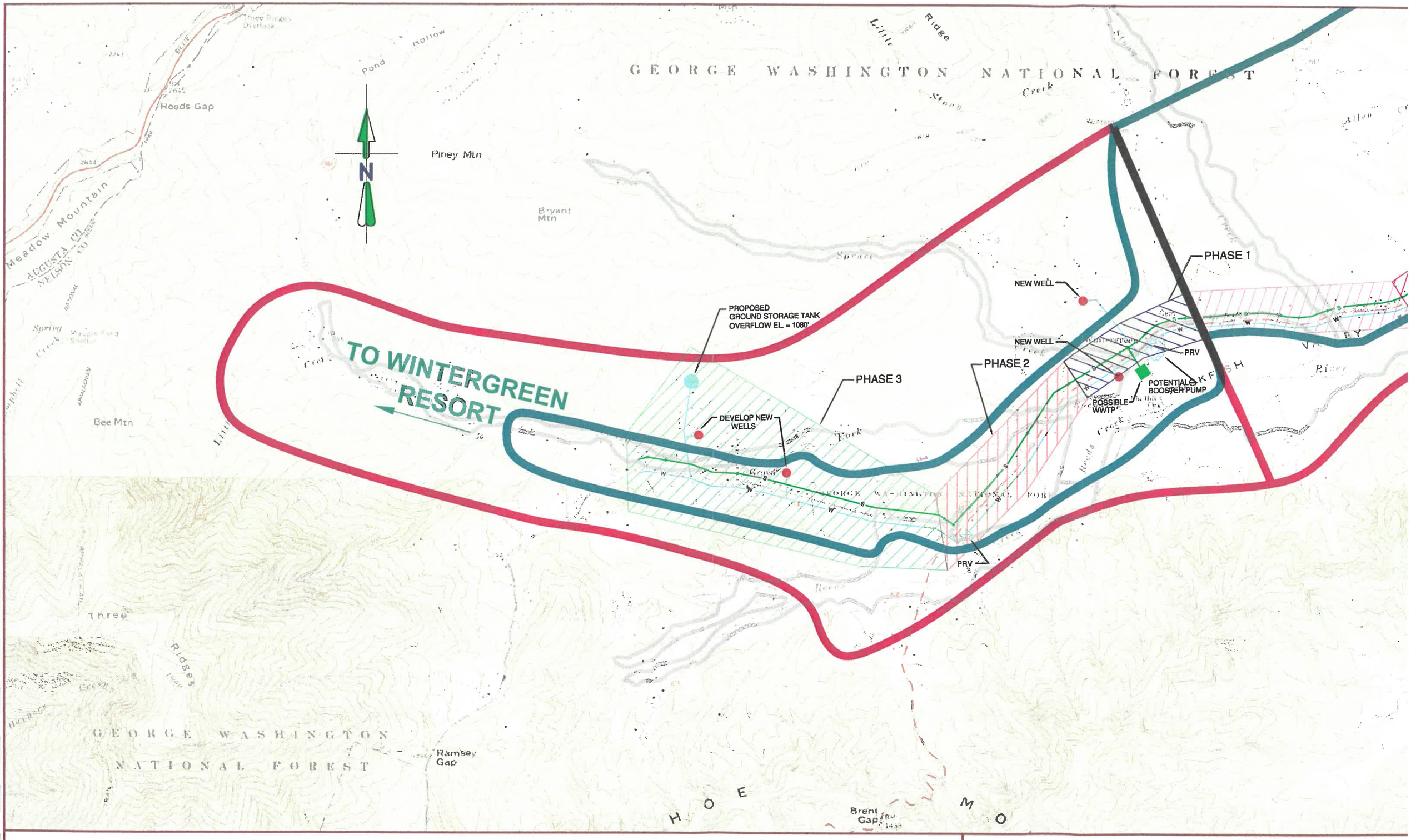

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FIGURE 3 - BEECH GROVE SERVICE AREA MASTER PLAN
ROCKFISH VALLEY CORRIDOR WATER AND SEWER STUDY

SCALE: 1" = 1800'

LEGEND

- W — WATER MAIN
- S — SEWER MAIN
- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- APPROXIMATE FLOOD PLAIN LIMITS

4.7 Avon

4.7.1 Water Source

The water source for Avon will be groundwater, at least in the short term. Based on the demand projections of 86,000 gpd for 25% buildout, a total of 60 gpm of well capacity will need to be developed. It is likely that 3-4 wells will be needed to meet the projected demands.

In order to satisfy the demands for the long term, either more wells will need to be developed or a regional impoundment will need to be built.

4.7.2 Treatment Works

Water quality in this area tends to be good. The only treatment that is anticipated for groundwater (wells) is the addition of chlorine disinfectant. It is possible that a small number of wells would have naturally occurring high levels of iron and/or manganese. Treatment for these wells would be handled on a case-by-case basis.

4.7.3 Pressure Source

The pressure source for Avon will be a ground storage tank located on a knoll just north of the Avon service area, actually in the Afton service area. Most of the Avon service area would consist of a single pressure zone.

4.7.4 Storage

We recommend that the ground storage tank be sized to be at least 500,000 gallons to provide two hours of 2,000 gpm of fire flow plus emergency storage.

4.7.5 Distribution Lines

The initial phase of the Avon water system will be to construct a 12-inch main from the water tank that would follow Route 151. This main will serve as a "spine" that future developments will be able to tap into for good pressure and fire flow. Figure 4 illustrates the water and sewer master plan for Avon and Afton.

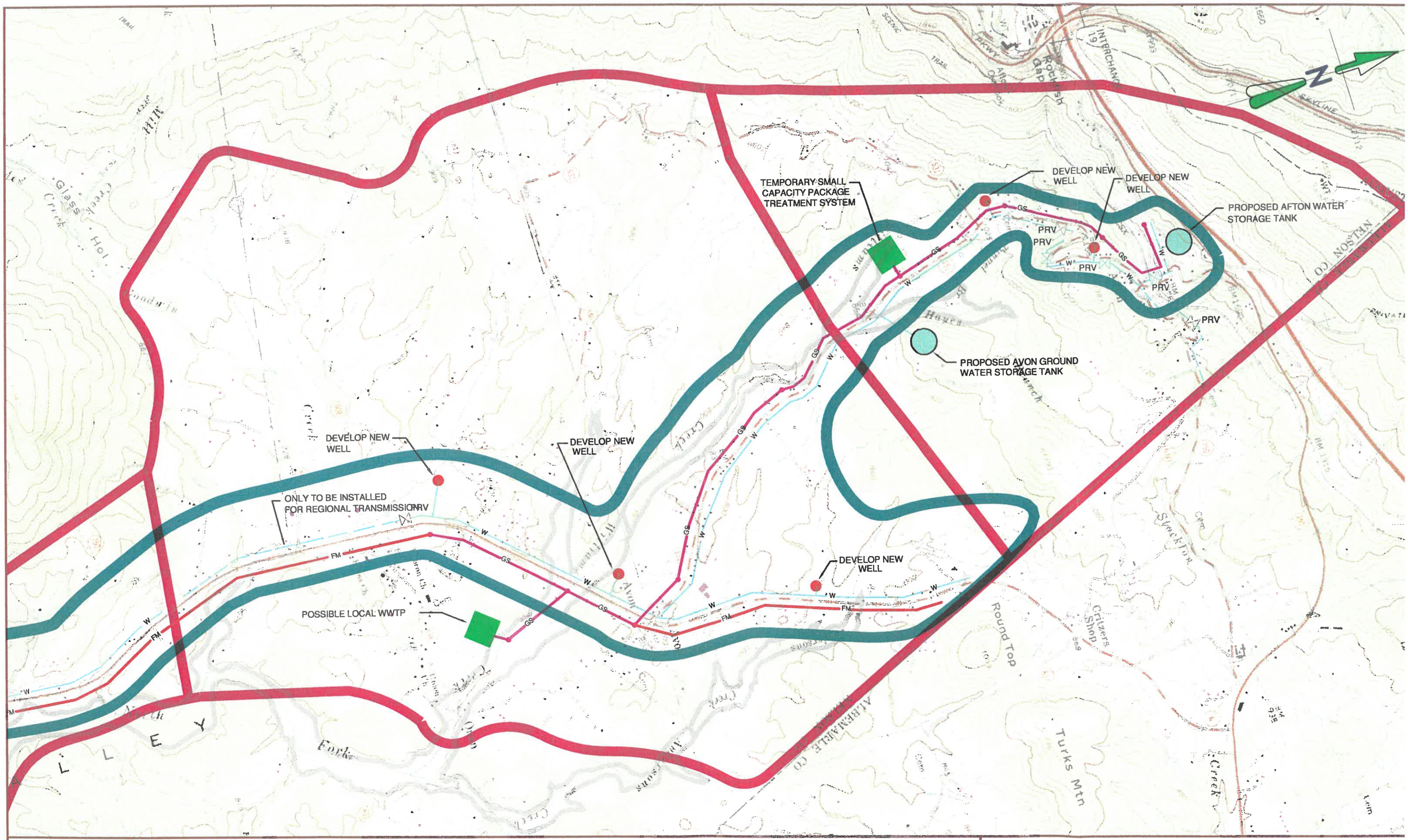

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FIGURE 4 - AFTON / AVON SERVICE AREAS MASTER PLAN
ROCKFISH VALLEY CORRIDOR WATER AND SEWER STUDY

SCALE: 1" = 1800'

LEGEND

- GS — GRAVITY SEWER
- FM — FORCE MAIN
- W — WATER MAIN
- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- APPROXIMATE FLOOD PLAIN LIMI

It is not anticipated that Avon will be connected to anything except for Afton in the near future, however 12-inch water mains will allow for water transfer from a central impoundment if necessary.

4.8 Afton

4.8.1 Water Source

The only practical water source for Afton is groundwater. Based on the demand projections of 12,000 gpd for 25% buildout, a total of 8.3 gpm of well capacity will need to be developed. It is possible that the projected demands can be satisfied with only two wells (the minimum for a public water system). However, the only geologic formation in the vicinity that seems favorable for groundwater is a narrow fault line, which may be difficult to access.

The Afton service area is unique in that it has an elevation range of more than 600 feet. In order to maintain pressure between 40-80 psi, it would be necessary to have at least four pressure zones. In a water system, water is stored in a tank at a high elevation, and the pressure is provided by gravity. The topography of the system complicates the water source component in that water cannot be transferred to a higher pressure zone without a booster pump station. Therefore, either all the water sources need to be in the highest pressure zone, or each lower pressure zone would need to have a booster pump to allow water to be transferred to the higher elevation pressure zone.

Unless an adequate groundwater supply can be developed in the Afton area, it will not be practical to develop a water system.

4.8.2 Treatment Works

Water quality in this area tends to be good. The only treatment that is anticipated for groundwater (wells) is the addition of chlorine disinfectant. It is possible that a small number of wells would have naturally occurring high levels of iron and/or manganese. Treatment for these wells would be handled on a case-by-case basis.

4.8.3 Pressure Source

The Afton area is named for Afton Mountain. Most of the development in Afton is built on the side of the mountain. There is a great deal of elevation change in the area. In order to serve the maximum number of customers and provide ample fire protection, a ground storage tank will need to be built at an elevation of approximately 1,600 feet. In order to keep pressure within a range of 40-90 psi, up to 5 pressure zones will be needed.

4.8.4 Storage

In order to supply 2 hours of fire flow at 1,500 gpm and have extra emergency storage, we recommend that the storage tank be at least 200,000 gallons. Since the projected demand for 50-year buildout is only 24,000 gpd, this will provide adequate emergency storage. If it is decided that fire flow capacity is not needed, a much smaller tank could be used.

4.8.5 Distribution Lines

In order to provide fire flow, the water mains will be sized at 12-inches.

It is possible that the lower Afton area could be connected to the Avon System. However, it will not be practical to transfer water up to the higher pressure zones from Avon. The master plan for both the Afton and Avon area is shown on Figure 4.

4.9 Rockfish Central – Long Term Corridor Water Solution

4.9.1 Water Source

We envision that the Rockfish Central system will not be developed unless there is a need for a regional impoundment. In that case, the water source will be a surface water plant.

If a development occurs within the area that requires water, it may be possible to extend water from the Nellysford or Avon water systems.

4.9.2 Treatment Works

The treatment works for a surface water plant would most likely be a dual-train package conventional water treatment plant. Since the watersheds for the proposed impoundments are

largely undevelopable, the quality of the water in the reservoirs is anticipated to be good. The plant would require at least a Class III operator to man the plant during operation hours.

4.9.3 Pressure Source

Due to the distance and pressure zone differential between the other storage tanks, a ground storage tank would be needed in Rockfish Central to overcome the frictional head loss.

4.9.4 Storage

In order to provide fire flow for 2 hours at 1,500 gpm, we recommend that the tank be sized at least 200,000 gallons. Connecting the system to the other storage areas will allow the water system to take advantage of the additional storage in those areas, which minimizes the needed capacity of this storage tank.

4.9.5 Distribution Lines

A 12-inch main would follow Route 151 and connect to the tank and potential surface water treatment plant. Figure 5 illustrates the water and sewer master plan for Rockfish Central.

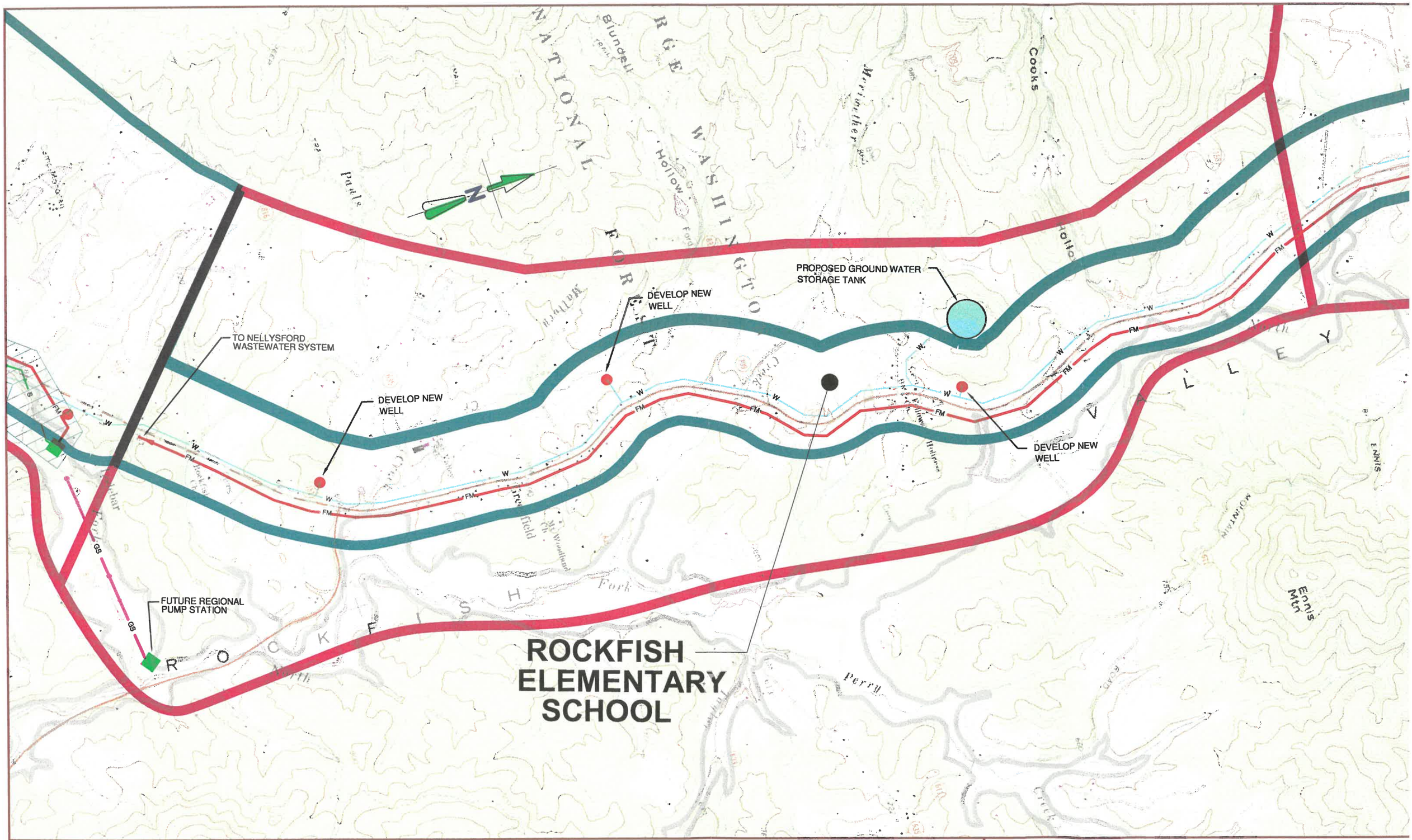

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FIGURE 5 - ROCKFISH/CENTRAL SERVICE AREA MASTER PLAN
ROCKFISH VALLEY CORRIDOR WATER AND SEWER STUDY

SCALE: 1" = 1800'

LEGEND

- GS — GRAVITY SEWER
- FM — FORCE MAIN
- W — WATER MAIN
- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- APPROXIMATE FLOOD PLAIN LIMI

5.0 LONG TERM SEWER SYSTEM MASTER PLAN

5.1 Phasing

The development of the sewage collection system will generally follow the phasing of the service areas of the water system. The main difference will be the treatment plant locations. It is generally more cost effective to construct a single plant with a large capacity than to have several smaller plants. However, a customer base needs to be established before a larger regional plant can be constructed. The interim solution may be to construct small, subsurface package treatment plants until the customer base can support a larger facility.

Cost Estimates for each phase are included in Appendix III.

5.2 Nellysford and Beech Grove

5.2.1 Collection System

The collection system will consist either of a gravity system or low-pressure force main system with grinder pumps. For the grinder pump option, the force main will be sized to convey the peak flows from Nellysford and Beech Grove. Since Nellysford and Beech Grove have the most immediate need for sewer service, detailed alternatives for short term solutions have been developed, and are presented in Section 6.0.

5.2.2 Wastewater Treatment

It was previously stated that the design criteria for wastewater treatment facilities would be the 25% buildout flow in the primary areas. The buildout flow in the Nellysford area is 162,000 gpd, and the projected flow from Beech Grove is 50,000 gpd, totaling 212,000 gpd. The proximity of these service areas would make it far more efficient to consolidate the flow into a single treatment plant than to treat it separately. However, the cost of a new treatment plant with the capacity for 212,000 gpd would be prohibitively high, and it is not expected that the flows will reach that level in the foreseeable future. There are two options for wastewater treatment in the interim for Nellysford and Beech Grove.

5.2.2.1. Nellysford Interim Wastewater Treatment Option 1

The most logical choice for initial wastewater treatment is the Stoney Creek wastewater treatment plant because it is already built, has a discharge permit, currently has approximately 60,000 gpd excess capacity, and is upgradeable to provide another 65,000 gpd. The main issue with this treatment plant is that it is currently owned by the Wintergreen Valley Utility Company (WVUC). Two mechanisms would allow Nelson County/NCSA to use the plant capacity. The first would be to purchase capacity from Stoney Creek. The second would be to purchase the Stoney Creek system. A significant amount of negotiation needs to occur before either of these things can happen.

The ultimate capacity of this plant falls short of the projected buildout flows. However, it is important to note that while the projected buildout flow for Nellysford is 162,000 gpd, the entire Stoney Creek area was included in this projection. Most of Stoney Creek is expected to be residential development, and a large section of the soils within Stoney Creek are at least marginally acceptable for septic tanks and drain fields as shown in Appendix I. Therefore, it is likely that most of the existing residents will continue to use septic tanks, and many of the new residents will build septic systems if the soil conditions are favorable. Based on this, it is reasonable to assume that the Stoney Creek plant will be able to meet the capacity needs of the Nellysford and Beech Grove areas for many years.

Although the Stoney Creek Facility is a good interim solution, ultimately a regional wastewater treatment facility will probably be needed. The existing Stoney Creek facility cannot be readily upgraded beyond 130,000 gpd. A more practical regional facility would be similar to the existing Colleen Regional treatment plant, with an initial design flow of 225,000 gpd, upgradeable to 450,000 gpd.

The location for the regional facility will need to be determined by a future study. It could be constructed at the present site of the Stoney Creek plant, or since the collection system infrastructure will be designed to deliver flow to Stoney Creek, a pump station could be constructed at that location that could transfer wastewater to another location that may be more favorable.

5.2.2.2. Nellysford Interim Wastewater Treatment Option 2

This option is not as desirable as Treatment Option 1, and is presented in case a reasonable agreement between the County/Service Authority and Stoney Creek cannot be reached.

As discussed in the previous section, the cost for providing a regional treatment plant sized for the 25% buildout flow is very high. Therefore, the Nellysford and Beech Grove areas would each develop a small package treatment plant to meet the immediate needs of the areas. A 25,000 gpd plant is proposed for each system because it is a standard size, and will provide a reasonable amount of capacity at an affordable cost. The plant could be either a surface discharge or subsurface type discharge (spray or drip irrigation).

If this option is chosen, capacity for commercial growth will be extremely limited. In addition, the operation and maintenance requirement will be greater for two plants than for a single plant.

5.3 Avon

The Avon area is a wide area of the valley with land that is well suited for residential development. Although a significant portion of the soils in the area are marginally suitable for septic systems, public sewer will be needed if high density subdivisions are planned (<1 acre lots).

5.3.1 Collection System

The collection system will consist mostly of gravity sewer along Route 151 with a force main extension along Route 6. The gravity sewer would begin at a low spot near Williams Creek, extend northwest along Route 151 towards Afton and south along Route 151 to a local high point.

5.3.2 Treatment Works

Ultimately, it would be desirable to serve the entire corridor with as single treatment plant. However, there will not be a need for a regional plant in Nellysford until the capacity

from the Stoney Creek plant is used up. This may not happen for a long time. If the Avon area is going to be developed, it will need its own wastewater treatment plant in the interim.

The Avon area generally drains towards Williams Creek. Avon is also down gradient from Afton, which makes it possible to treat the flow from both areas in a single plant. The total projected 25% buildout flows from both Avon and Afton primary areas is 55,000 gpd. However, based on the topography, Avon has the best potential to provide service to the secondary area as well. For this reason, we recommend that the Avon plant be sized at 100,000 gpd.

The package plant would be factory assembled and consist of coated steel basins, similar to the NCSA plant for Wintergreen Mountain. There would be a small building and minimal sitework. Package plants such as this are less expensive than more permanent plants with concrete basins, but they are not as durable, and may need a significant overhaul in 15 to 20 years. However, by the time the package plant outlives its useful life, the regional treatment plant in Nellysford will probably be in service. The Avon plant could be abandoned and replaced with a pump station. This would allow all the flow from the corridor to be treated in a single place, plus the force main from Avon to Nellysford would open up the Rockfish Central area to grinder pump or local pump station sewer service.

5.4 Afton

The Afton area is small, has a large elevation change, and has very steeps slopes that make the primary service area very narrow. Sewer service to Afton would be gravity along Route 151.

It was previously mentioned that the Avon WWTP would be sized to collect flow from Afton. However, if the sewer service in Afton is required prior to the completion of that plant, or if the extension of sewer main is cost prohibitive, a small package plant similar to those described in the Nellysford/Beech Grove independent options could be built to satisfy the interim needs.

5.5 Rockfish Central

It is not envisioned that sewer service will be provided to Rockfish Central in the near future. The primary area is too narrow for extensive development, and the elevation changes would necessitate many pump stations. For these reasons, we believe that the Rockfish Central would be best served as a force main system with grinder pumps.

It was discussed previously that Avon/Afton may eventually connect to a regional treatment plant in Nellysford. A force main would have to be built through Rockfish Central to accomplish this. This project would open up the area to force main service.

It is possible that force main service would be needed in Rockfish Central prior to the completion of the regional treatment plant. In this case, a partial force main could be extended from either Avon or Nellysford into Rockfish Central. If this is done, it is important to size the force main for projected Avon flows as well as for the projected flows in Rockfish Central.

6.0 NELLYSFORD AND BEECH GROVE ALTERNATIVES

The Rockfish Valley Corridor is a 15 mile strip that is largely undeveloped at this time, and is unlikely to reach full buildout in the near future. Therefore, the majority of the corridor does not have an immediate need for utility service. However, there is an immediate need in the Nellysford area, which is one of the most densely populated areas without water or sewer infrastructure. One goal of this report is to develop a cost effective short term solution to meet the needs of the Nellysford area that will fit into a long term solution for the entire corridor.

6.1 Current Sewer Problems

6.1.1 Failing Drainfields

There is speculative evidence that several of the drainfields in the Nellysford area have failed or are not working optimally. Unfortunately, because of a recent personnel change at the local health department, records of failing drainfields are not available. However, the soil stratum in Nellysford along Route 151 is not favorable for drainfields, and it seems likely that they would fail, especially during wetter times of the year. The topsoil layer is very thin, and bedrock is typically encountered within 4 to 5 feet below the surface. Although some wastewater may percolate through cracks in the bedrock, much of it will have to be dispersed in the topsoil layer. If the soil becomes saturated, the drainfield could easily fail.

It should be noted that a significant portion of soils in the Stoney Creek development area of Nellysford have moderate percolation rates and are usually acceptable for drainfields. This is shown in Appendix I.

6.1.2 No Utility Infrastructure Available for Development

The corridor is identified by the comprehensive plan as having areas that are designated for relatively dense development. However, due to the nature of the soil, development will be limited unless public utilities are provided. Promoting commercial/retail development in the corridor will have positive effects on the tax base, and will provide jobs to local residents.

6.2 Current Water Problems

6.2.1 Capacity

Due to the nature of the geology in the area, groundwater capacity is limited. There has historically been adequate groundwater supply for low-density residential development. However, the supply of groundwater has been a limiting factor for higher density developments. While this is primarily a long-term issue, it does affect the expansion of water to the Nellysford area in the short term. WVUC representatives do not believe that they have enough of a groundwater supply for their own development needs, and are very reluctant to allocate any capacity to the Nelson County Service Authority.

6.2.2 Lack of Fire Protection

The Nellysford area has a relatively high population density, and is not protected by fire hydrants outside the Stoney Creek development. Adding fire protection would enhance the value of the properties, would allow for larger commercial development, and could potentially save lives in the event of an emergency.

6.3 Nellysford Alternative 1 – Enhanced on-site treatment

6.3.1 Description

In this alternative, a mechanical treatment unit sized for a single resident would be installed for each failing drainfield. Mechanical aeration treatment units allow aerobic treatment of wastewater rather than anaerobic (septic) treatment. Aerobic treatment is much more effective than anaerobic treatment, which makes for a higher quality effluent. These units are commercially available from a variety of manufacturers.

All residents would continue to use individual private wells for water service.

6.3.2 Advantages and Disadvantages

The advantage of this alternative is that it has the lowest capital cost to the County and NCSA. Depending on the policy set by the Service Authority, this could also offer the advantage that the Service Authority would not have to maintain the sewer system for each customer.

The disadvantage of this alternative is that it does not fit in well with an overall master plan to provide utility service to the corridor and planning much higher capital and operating costs on the residential/business. The Service Authority would not gain any new customers. In addition, there would be no provisions for developing additional water capacity or fire protection in the Nellysford area.

6.3.3 Cost

Detailed cost estimates are included in Appendix III. For the Nellysford and Beech Grove options, the costs are broken down into the portion assumed paid by NCSA (and/or Nelson County) and the customer. The purpose of this comparison is to provide a true overall project cost so that an informed decision can be made.

The estimated NCSA cost for this alternative is $481,000 and the estimated customer cost is $24,000.

6.4 Nellysford Alternative 2 – Obtain Water and Sewer Capacity from Stoney Creek

6.4.1 Description

This alternative generally consists of designating the potential customers in the Nellysford area as NCSA customers, and having an NCSA-owned distribution and collection system that connects to the Stoney Creek System.

WVUC is currently designing a pump station that will be located near the entrance of Stoney Creek. With this pump station, it will be possible to serve the western portion of the Nellysford area along Route 151 by gravity. Figure 2 shows how the proposed gravity sewer would be extended. The pump station delivers wastewater directly to the Stoney Creek treatment plant. The treatment plant currently has additional capacity to accept up to 60,000 gpd without an upgrade.

Since the topography of the Nellysford area slopes east, a separate pump station would need to be installed to collect the flow from that area.

6.4.2 Distribution System

The connection to the water system would involve laying a line up the main entrance road to Stoney Creek and making a connection near the clubhouse. Since the pressure is very high at that point, a separate pressure zone would need to be created by installing a pressure reducing valve (PRV). The water main would be sized to provide adequate fire flow to the Nellysford area.

As previously mentioned, the WVUC may be willing to negotiate to share emergency fire flow capability and storage capacity, but is very reluctant to give up any water source capacity. It is likely that Nelson County would have to develop a well or possibly several wells that would be capable of producing as much water as would be demanded by the NCSA customers.

A variation of this alternative would be to connect to Stoney Creek for wastewater service, but not for water service. Either the area could continue to use independent wells for water, or a NCSA water system could be developed with an emergency connection to Stoney Creek for fire protection.

6.4.3 Collection System Options

6.4.3.1. Option 1 – Gravity System

One option for developing the collection system is a gravity sanitary sewer. This could be extended from the new pump station in phases as illustrated on Figure 2.

The advantages of a gravity system are that it can be sized to collect flow from other parts of the Corridor, which fits into some of the long-term options, and it will have a minimal operation and maintenance cost. The main disadvantage is the higher capital cost.

The estimated NCSA cost for the first phase of this alternative is $560,000 and the estimated customer cost is $26,400. These costs do not include any fees for capacity to the Stoney Creek plant that need to be negotiated.

6.4.3.2. Option 2 – Grinder Pump/Force Main System

In this option, NCSA would construct a small diameter force main and would require all customers to connect through an individual grinder pump. It is the policy of

NCSA to own and maintain the grinder pump, and to pass the cost of installation directly to the customer through a connection fee. An additional monthly fee is charged to grinder pump customers to cover the added operational and maintenance expense associated with the pumps. The electricity cost would be borne by the customer, however that is comparable to operating a 100-watt light bulb for 4-5 hours per day.

The advantage of this option is it has a low capital cost for NCSA. NCSA currently has several hundred grinder pumps in the Wintergreen Mountain system, which allows efficiency with regards to maintenance. The disadvantages are that the customers would have a connection fee that is 4-6 times greater than a standard gravity lateral, and since the force main would be so small, it would not have the capacity to accept flow from other areas in the Rockfish Valley.

The estimated NCSA cost for the first phase of this alternative is $376,000 and the estimated customer cost is $168,000. These costs do not include any fees for capacity to the Stoney Creek plant that need to be negotiated.

6.5 Nellysford Alternative 3 – Develop independent wastewater collection and treatment system

6.5.1 Description

This alternative would consist of the Service Authority constructing a gravity sewer system first in the Nellysford area with future extensions to Beech Grove and Rockfish Central. The gravity sewer would flow to the eastern corner of the Nellysford area, where it would be treated by an Authority-owned treatment plant that would discharge to the Rockfish River. If a treatment plant cannot be located in this area, a pump station would be installed that would collect the gravity flow and pump it to an alternate location.

6.5.2 Collection System

The sewer collection system would essentially be the same as the two options presented in Alternative 2. The main difference is that it would have to be extended further east to the proposed treatment plant, which increases the amount of pipe needed for the initial phase.

6.5.3 Distribution System

The water distribution system would generally follow Route 151 except to make connections to wells and to the storage tank. Based on discussions with NCSA personnel, a water distribution system that does not provide fire protection will not be considered.

6.5.4 Advantages and Disadvantages

The advantages of developing an independent water sewer system are that the Service Authority would not have to rely on WVUC to supply capacity, and the system could be laid out to meet the long term needs of the corridor.

The disadvantages of this alternative is that it has a very high capital cost, and the operation and maintenance (O/M) costs for the wastewater plant would be very high relative to the flow that it will experience during the first several years of existence. Also, in order to fit in with the master plan for providing utility service to the corridor while relieving the failing drainfields in the Nellysford area, the sewer would have to be installed all the way down Route 151, allowing less flexibility for phasing.

6.5.5 Cost

The estimated cost for the first phase of this alternative with the gravity option is $1,367,000 for NCSA, and $26,400 for the customers.

The estimated cost for the first phase of this alternative with the force main option is $1,125,000 for NCSA, and $168,000 for the customers.

6.6 Nellysford Alternative 4 – Allow Stoney Creek to Provide Water and Sewer Service to Nellysford

6.6.1 Description

In this alternative, the residents of Nellysford would become private customers of the Stoney Creek system. NCSA would not be involved in their service, or in the design of the water and sewer extensions. However, in order to make the project cost effective from the perspective of Stoney Creek, a contribution from the County would likely be required.

6.6.2 Advantages and Disadvantages

The main advantage to this alternative is that it would involve a minimal effort and financial contribution on the part of the county. It will also avoid any political issues associated with water system capacity.

The disadvantages of this alternative are that the county and NCSA will have very little control as to how the area is served, which may not fit into the long term plan for the corridor, and NCSA will not gain any new customer revenue.

6.6.3 Cost

The cost to the alternative cannot be estimated since no official negotiations between the County/Service Authority and Stoney Creek have occurred. The total cost would be similar to the costs presented in Alternative 2, but it is impossible to determine how the cost would be divided.

6.7 Nellysford Alternative 5 – NCSA Purchase Stoney Creek Water and Sewer Systems

6.7.1 Description

In 1998 Draper Aden Associates prepared an Evaluation and Appraisal of the Stoney Creek Water and Sewer System. In this alternative, Nelson County and NCSA would purchase the system and extend the utilities as described in Alternative 2. In order for this to occur, Nelson County and NCSA would have to guarantee enough capacity to Stoney Creek for their projected future needs.

In order for the transaction to be feasible, a County contribution would probably be required. An agreement could be implemented to have the County and NCSA share in the revenue collected by future connection fees. It is possible that a USDA/Farmers Home loan could be obtained for the system purchase, which would result in a favorable interest rate and a long loan term (30 or 40 years).

6.7.2 Advantages and Disadvantages

The main advantage of this option is that it would give Nelson County and NCSA the most control over how the utilities in the corridor are developed.

The disadvantage of this alternative is that it is the most complex from a legal and administrative standpoint, so it would take a longer amount of time to implement. This alternative may be more practical from a long term standpoint instead of a short term alternative.

6.7.3 Cost

The estimated NCSA cost for the first phase of this alternative is $560,000 and the estimated customer cost is $26,400.

The estimated NCSA cost for the first phase of this alternative is $376,000 and the estimated customer cost is $168,000.

These costs do not include the cost to purchase the Stoney Creek System, which still needs to be negotiated.

6.8 Beech Grove Alternative 1 – Connect to Nellysford Water and Sewer System

6.8.1 Description

In this alternative, Beech Grove essentially becomes an extension of the Nellysford water and sewer system. For the water system, a new storage tank and well would be built, and a connection would be made to Nellysford with a PRV and booster pump. This will allow water to be transferred from either service area to either service area.

The sewer system would consist of gravity sewer along the main roads flowing to a pump station. Wastewater would then be pumped to the Nellysford System.

6.8.2 Advantages and Disadvantages

The advantage of this alternative is that the capital cost for the first phase is lower, and the capacity will not be as limited because of the connection to Nellysford.

The disadvantage of this alternative is that it requires that Phase 2 and 3 of the Nellysford system be constructed first.

6.8.3 Cost

The NCSA total cost for the initial phase is $737,000, and the customer cost is $84,000.

6.9 Beech Grove Alternative 2 – Develop Independent Water and Sewer Systems

6.9.1 Description

In this alternative, no connection would be made to Nellysford in the initial phase. The water system would consist of a 50,000 gallon tank that would only be sufficient for domestic flows (no fire protection), new wells, and 12-inch water main along the main road. The system would be designed so that a connection to Nellysford could be made in the future.

The sewer system would consist of gravity sewer that flows to a small package treatment plant with a capacity of 25,000 gpd. Eventually, this plant could be replaced with a pump station to transfer flow back to Nellysford.

6.9.2 Advantages and Disadvantages

The main advantage to this option is that it would allow public utilities to be installed in Beech Grove without having to install the Phase 2 and 3 water and sewer in Nellysford.

The disadvantages of this alternative is that capacity will be limited below the projected buildout flows, and there will be no fire protection. Also, the operation and maintenance expense for the wastewater plant will be high compared to pumping the sewage to Nellysford.

6.9.3 Cost

The NCSA total cost for the initial phase is $1,355,000, and the customer cost is $13,200.

7.0 FUNDING SOLUTIONS

7.1 Funding Options

In order to provide affordable user fees to the customers of the proposed systems and to establish rates that recover the costs of funding and operating the systems, low interest loans and grants or significant contributions from Nelson County or private developers will be required. The following sources are potential funding options for the financing of the Rockfish Valley Corridor water and sewer systems:

- Virginia Community Development Block Grants for Community Facilities
- Rural Development Administration
- Virginia Water Facilities Revolving Fund
- Virginia Water Supply Revolving Loan Fund
- Southeast Rural Community Assistance Project
- Virginia Resources Authority
- Revenue Bonds
- Connection Fees
- County Contributions

Competition for funding in today's market is competitive. Projects of this nature usually require several sources of funding. The following is a brief description of the sources listed above:

7.1.1 Virginia Community Development Block Grants for Community Facilities (VCBG)

Block grants are awarded on an annual basis through the Virginia Department of Housing and Community Development. Applications are submitted in March and selections are usually announced in June each year. A maximum grant of $1,000,000 is available for community facilities projects. Community facilities projects include water services, wastewater services, drainage improvements, and street improvements. VCDBG assistance under this option is generally targeted to projects involving water and wastewater improvements, particularly those involving new services to low- and moderate-income persons.

Low- and moderate-income persons cannot be charged a connection fee for facilities using VCDBG funding and connection fees are not VCDBG-eligible expenses. However, the

cost of making the physical connection is eligible for VCDBG funding. To the extent feasible, public water service proposals must include a project design that accommodates appropriate fire protection measures in the project area.

The project must address the needs of low- and moderate-income (LMI) households. At least 51% of the households served by a project must benefit LMIs. To be competitive in the grant process, the percentage of LMI households benefiting from the project should be much higher. In addition, addressing housing needs along with water or wastewater needs help in receiving grants.

7.1.2 Rural Development Administration (RD)

The Rural Development Administration provides financial assistance for water and wastewater projects to rural areas and towns across the State.

Water and Waste Disposal Direct Loans may be made to develop water and wastewater systems in rural areas and to cities and towns with a population of 10,000 or less. Priority is given to areas with less than 5,500 people, to restore a deteriorating water supply, or to improve, enlarge, or modify a water facility or an inadequate waste facility. This is a loan program with interest ranging between 4.5% and 5.53%; the loan period is not to exceed forty (40) years.

Water and Wastewater Disposal Grants can be made to reduce water and waste disposal costs to a reasonable level for the users of the system. Grants can be made for up to 75% of the eligible project costs.

While RD accepts funding applications at any time, the fiscal year for this Federally funded program begins on October 1st. It is therefore advisable to submit a funding application prior to October 1st.

7.1.3 Virginia Water Facilities Revolving Fund (VWFRF)

The Virginia Water Facilities Revolving Fund program is jointly funded by the USEPA and the State of Virginia. The Virginia Department of Environmental Quality administers this sewer program. The funds can be used for new facilities or upgrades to existing facilities. Funding is provided on an annual basis with applications being submitted to VDEQ in the

summer of each year. Application deadlines are announced annually. The program seeks to address existing environmental problems.

Interest rates on the loans from the VWFRF can range from 0% to the "ceiling rate" which is one percentage point below market rates (the ceiling has recently been 4.5% or less, but varies from year to year). The term of a loan from the VWFRF cannot exceed twenty years.

7.1.4 Virginia Water Supply Revolving Fund (VWSRF)

The Virginia Water Supply Revolving Fund program is also jointly funded by the USEPA and the State of Virginia. This water program is administered by the Virginia Department of Health. The funds can be used for new facilities or upgrades to existing facilities. Funding is provided on an annual basis with applications being submitted to VDH in the spring of each year. Applications deadlines are announced annually. The program seeks to address existing drinking water quality or water quantity problems.

Interest rates on the loans from the VWSRF can range from 0% to the "ceiling rate" which one percentage point below market rates (the ceiling is usually 4.5% or less, but varies from year to year). The term of a loan from the VWSRF can be twenty or thirty years. The VWSRF also provides some grant funds.

7.1.5 Southeast Rural Community Assistance Project (SE/R-CAP)

SE/R-CAP's Loan Fund serves rural communities with less than 25,000 residents. Low-interest loans are available for water and wastewater projects as well as housing and community economic development projects. The project population must be 10,000 or less and at least 30% of the project population must be low-to-moderate income. With a maximum loan of $250,000 and an interest rate from 4% to 7%, communities can use these funds to extend new service, construct community facilities, or leverage the funds in order to seek larger grants and loans from state, federal and private sources.

Additionally SE/R-CAP provides grants for preliminary engineering studies and a maximum of $400 per hookup is available for connection fees.

7.1.6 Virginia Resources Authority (VRA)

The Virginia Resources Authority provides funds through the sale of bonds for financing projects for water, wastewater, and solid waste. The loan period is usually twenty to thirty years with interest based on market trends. Based on recent VRA bond issues, the interest rate for a loan for a term of 20 – 30 years would have an interest rate of less than 5% to 5.0%. The VRA's Pooled Loan Bond Program offers borrowers the opportunity to issue bonds with other communities and reduce the issuance costs associated with the bond sale.

7.1.7 Revenue Bonds

Revenue bonds can be issued to provide funding for water and sewer improvements. Typically, revenue bonds would be issued for a term of 20 to 30 years. Revenues from the facilities constructed with the bond proceeds would typically be used to secure the bonds. Bonds can also be supported by the moral obligation of the County.

7.1.8 Connection Fees

Connection fees are an important part of funding a new project as well as establishing a reserve fund for future system improvements. Connection fees relate to the value of the service, including treatment systems, transmission lines, storage facilities, pumping stations, etc. Connection fees collected from the initial customers to the system can be used to offset or reduce the original debt while future customers will assist in paying annual debt service.

7.1.9 County Contributions

In many cases until an adequate customer base has been established, the County may have to make annual contributions from the General Fund to assist in the payment of operations and maintenance cost and debt service. These contributions are made to keep the cost of service to the customers at a fair and reasonable rate. As the customer base increases, contributions may decrease or be eliminated.

In the Rockfish Valley Corridor, it appears it will be necessary to pursue grant money as well as the lowest-rate and longest-term financing available for the proposed improvements. Even with optimal funding, the systems may need subsidy from the other Nelson County Service

Authority systems or from County funds until the customer base increases enough to pay the operating expenses and debt service of the projects. A blending of the above funding sources listed above may be necessary to make these projects feasible.

7.2 Cost Feasibility Analysis

There are several options for providing water and sewer in the Rockfish Valley Corridor. The costs for each option have been estimated and the initial number of connections for each has been estimated. The following evaluates the revenues generated in two particular service areas and provides a comparison of the revenues to "best case" and "worse case" funding scenarios for each. Also, a calculation of the number of connections required to pay debt service on the long-term options of a regional water impoundment and regional wastewater treatment facility are evaluated.

7.2.1 Obtain Water and Sewer from Stoney Creek

The Nellysford alternative of obtaining water and sewer from Stoney Creek (Alternative 2, Phase 1, Option A – Gravity Sewer) is estimated to cost $560,000. Of that, $241,000 is related to water improvements and $319,000 is sewer-related.

Eleven scenarios of funding using terms ranging from 20 to 40 years and rates ranging from 0% to 4.5% were calculated. Grant funding of amounts ranging from 25% - 50% of the water costs and 25% - 50% of the water and sewer costs were calculated. The assumptions are based on funding the entire project with Rural Development funds or using a combination of VWSRF and WWFRF funds. The best option is using all Rural Development funds, with 50% being grant funds. The term of 40 years is key to keeping the annual debt service low, especially if little or no grant money is obtained. The proposed funding scenarios are as follows:

Funding Source	Amount of Loan	Amount of Grant	Term (Years)	Interest Rate	Annual Debt Service
Water and Sewer					
RD – All Loan	$560,000	-	38	4.5%	$30,786
RD – 25% Grant	$420,000	$140,000	38	4.5%	$23,089
RD – 50% Grant	$280,000	$280,000	38	4.5%	$15,393
Water					
VWSRF – all Loan	$241,000	-	20	4.5%	$18,695
VWSRF – all Loan	$241,000	-	20	3.0%	$16,414
VWSRF – all Loan	$241,000	-	30	0.0%	$8,169
VWSRF – 25% Grant	$180,750	$60,250	30	0.0%	$6,127
VWSRF – 50% Grant	$120,500	$120,500	30	0.0%	$4,085
Sewer					
VWFRF – All Loan	$319,000	-	20	4.5%	$24,745
VWFRF – All Loan	$319,000	-	20	3.0%	$21,727
VWFRF – All Loan	$319,000	-	20	0.0%	$16,359

The scenario with the highest annual debt service is using VWFRF loan money with an interest rate of 4.5% for the sewer project and the VWSRF loan funds with a rate of 4.5% for 20 years. The combined annual debt service is approximately $43,400.

The scenario with the lowest debt service is a RD grant/loan combination with 50% of the funds being grant funds. With a rate of 4.5% and a term of 38 years, the annual debt service is $15,393.

It is estimated that the service area served by this infrastructure would initially have approximately 20 water and 20 sewer customers. The following compares the revenues generated by these customers to the debt service required under the best and worse case scenarios. It is assumed that the customers in this area pay the Wintergreen rates; $25.25 for water and $38.10 for sewer, based on usage of 5,000 gallons per month.

Annual Operating Revenues:	
Water	6,060
Sewer	9,144
Total	15,204
Best Case Scenario:	
Annual Debt Service	$15,000
Annual Revenue Per Customer	$760
Number of Customers Required for Breakeven	20
Worse Case Scenario:	
Annual Debt Service	$43,000
Annual Revenue Per Customer	$760
Number of Customers Required for Breakeven	57

These calculations indicate that with 20 customers, the systems would generate enough revenue *under the best funding scenario* to pay debt service. However, this calculation does not include the cost of operation and maintenance and overhead expenses of the system. So, under the best funding scenario, the system would need to be supplemented from some other source, a significant amount of additional customers will need to be obtained, or rates would have to be increased.

7.2.2 Beech Grove Service Area (Phase1 – Option B – Independent Water/Sewer System)

The option of the development of an independent water and sewer system in the Beech Grove Service Area is estimated to cost $1,356,000. Of that, $604,000 is related to water improvements and $752,000 is sewer-related.

Eleven scenarios of funding using terms ranging from 20 to 40 years and rates ranging from 0% to 4.5% were calculated. Grant funding of amounts ranging from 25% - 50% of the water costs and 25% - 50% of the water and sewer costs were calculated. The assumptions are based on funding the entire project with Rural Development funds or using a combination of VWSRF and WWFRF funds. The best option is using all Rural Development funds, with 50% being grant funds. The term of 40 years is key to keeping the annual debt service low, especially if little or no grant money is obtained. The proposed funding scenarios are as follows:

Funding Source	Amount of Loan	Amount of Grant	Term (Years)	Interest Rate	Annual Debt Service
Water and Sewer					
RD – All Loan	$1,356,000	-	38	4.5%	$74,546
RD – 25% Grant	$1,017,000	$339,000	38	4.5%	$55,910
RD – 50% Grant	$678,000	$678,000	38	4.5%	$37,273
Water					
VWSRF – all Loan	$604,000	-	20	4.5%	$46,853
VWSRF – all Loan	$604,000	-	20	3.0%	$41,138
VWSRF – all Loan	$604,000	-	30	0.0%	$20,475
VWSRF – 25% Grant	$453,000	$151,000	30	0.0%	$15,356
VWSRF – 50% Grant	$302,000	$302,000	30	0.0%	$10,237
Sewer					
VWFRF – All Loan	$752,000	-	20	4.5%	$58,333
VWFRF – All Loan	$752,000	-	20	3.0%	$51,218
VWFRF – All Loan	$752,000	-	20	0.0%	$38,564

The scenario with the highest annual debt service is using VWFRF loan money with an interest rate of 4.5% for the sewer project and the VWSRF loan funds with a rate of 4.5% for 20 years. The combined annual debt service is approximately $105,000.

The scenario with the lowest debt service is a RD grant/loan combination with 50% of the funds being grant funds. With a rate of 4.5% and a term of 38 years, the annual debt service is $37,273.

It is estimated that the service area served by this infrastructure would initially have 10 water and 10 sewer customers. The following compares the revenues generated by these customers to the debt service required under the best and worse case scenarios. It is assumed that the customers in this area pay the Wintergreen rates; $25.25 for water each month and $38.10 for sewer, based on usage of 5,000 gallons per month.

Annual Operating Revenues:	
Water	3,030
Sewer	4,572
Total	7,602
Best Case Scenario:	
Annual Debt Service	$37,000
Annual Revenue Per Customer	$760
Number of Customers Required for Breakeven	49
Worse Case Scenario:	
Annual Debt Service	$105,000
Annual Revenue Per Customer	$760
Number of Customers Required for Breakeven	138

These calculations indicate that with 10 customers, the systems would *not* generate enough revenue *under the best funding scenario* to pay debt service. In fact, nearly 50 customers would be needed to pay the debt service alone. This calculation does not include the cost of operation and maintenance and overhead expenses of the system. So, under the best funding scenario, the system would need significantly more connections, supplement from some other source, or rates would have to be increased significantly.

7.2.3 Impoundment for Regional Water Service and Regional Wastewater Treatment Plant in Nellysford Area

The final scenario analyzed is the cost of providing regional water and sewer service in the Corridor. The total cost is estimated to be $10,730,000. Of that, $4,930,000 is related to water improvements and $5,800,000 is sewer-related.

Eleven scenarios of funding using terms ranging from 20 to 40 years and rates ranging from 0% to 4.5% were calculated. Grant funding of amounts ranging from 25% - 50% of the water costs and 25% - 50% of the water and sewer costs were calculated. The assumptions are based on funding the entire project with Rural Development funds or using a combination of VWSRF and WWFRF funds. The best option is using all Rural Development funds, with 50% being grant funds. The term of 40 years is key to keeping the annual debt service low, especially if little or no grant money is obtained. The proposed funding scenarios are as follows:

Funding Source	Amount of Loan	Amount of Grant	Term (Years)	Interest Rate	Annual Debt Service
Water and Sewer					
RD – All Loan	$10,730,000	-	38	4.5%	$589,881
RD – 25% Grant	8,047,500	2,682,500	38	4.5%	$442,411
RD – 50% Grant	5,365,000	5,365,000	38	4.5%	$294,941
Water					
VWSRF – all Loan	$4,930,000	-	20	4.5%	$382,424
VWSRF – all Loan	$4,930,000	-	20	3.0%	$335,779
VWSRF – all Loan	$4,930,000	-	30	0.0%	$167,119
VWSRF – 25% Grant	$3,697,500	$1,232,500	30	0.0%	$125,339
VWSRF – 50% Grant	$2,533,500	$2,465,000	30	0.0%	$83,559
Sewer					
VWFRF – All Loan	$5,800,000	-	20	4.5%	$449,911
VWFRF – All Loan	$5,800,000	-	20	3.0%	$395,034
VWFRF – All Loan	$5,800,000	-	20	0.0%	$297,436

The scenario with the highest annual debt service is using VWFRF loan money with an interest rate of 4.5% for the sewer project and the VWSRF loan funds with a rate of 4.5% for 20 years. The combined annual debt service is approximately $832,000.

The scenario with the lowest debt service is a Rural Development grant/loan combination with 50% of the funds being grant funds. With a rate of 4.5% and a term of 38 years, the annual debt service is $294,941.

The following calculates the number of customers required to simply pay debt service on the project under the best and worse case scenarios. It is assumed that the customers in this area pay the Wintergreen rates; $25.25 for water and $38.10 for sewer, based on usage of 5,000 gallons per month.

Best Case Scenario:	
Annual Debt Service	$295,000
Annual Revenue Per Customer	$760
Number of Customers Required for Breakeven	388
Worse Case Scenario:	
Annual Debt Service	$832,000
Annual Revenue Per Customer	$760
Number of Customers Required for Breakeven	1,095

These calculations indicate that with the system would need 388 customers just to pay the debt service on the long-term solutions *under the best funding scenario.* However, this calculation does not include the cost of operation and maintenance and overhead expenses of the system nor does it include any debt on the remainder of the infrastructure in the Corridor.

This analysis indicates the cost of providing infrastructure in the Rockfish Valley Corridor with the proposed customer base initially will not generate enough revenue to be self-sufficient, even with significant grant funds contributed to the construction costs.

8.0 ENVIRONMENTAL ISSUES

An environmental assessment was performed for the corridor, which is included in Appendix IV. This assessment is general in nature, and will need to be refined once a specific alignment is chosen before any permits can be obtained.

The assessment identifies several environmental and cultural issues. There are three trout streams in the area. There is a nesting ground for the Loggerhead Shrike (a predatory bird). There is a portion of Route 151 south of Nellysford that is in the floodplain of the Rockfish River. Additionally, there are several locations of historical/cultural significance along the Route 151 corridor.

While these issues are important, careful design of the proposed infrastructure system should not create a problem with any of them. With the general alignment shown, wetland impacts are expected to be limited to temporary impacts for utility stream crossings.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The Rockfish Valley Corridor is a long, narrow area with topography that makes it difficult to provide public water and sewer utilities. The only existing utility system is the private Stoney Creek development in Nellysford. Although the area is sparsely populated, it has a high growth rate that is expected to continue into the future with residential and neighborhood mixed used types of development.

The main objectives of this report were to:

1. Develop a long term master plan for water and sewer service.
2. Evaluate short term solutions for solving the problem of failing drainfields in Nellysford with respect to the long term master plan.

The corridor is too large to consider installing utilities throughout the entire length at one time. Therefore, the corridor was broken down into five service areas. The master plan for the corridor is to develop each of the areas in phases until they can ultimately be combined to a single system.

For water, we recommend that negotiations be made with Stoney Creek to the Nellysford area to the Stoney Creek water system. The Nellysford system would be extended in phases, and eventually would be connected to Beech Grove. The Afton and Avon water systems would be developed from scratch. Due to the elevation difference, it is not anticipated that Afton will be connected to any system. Eventually Avon could be connected to Nellysford, which would open up the Rockfish Central area for water service.

The water source for the corridor will initially need to be groundwater. A groundwater supply study was performed (Appendix II) that indicated that there may be up to 1-1.5 mgd of groundwater available in the corridor. However, it may not be practical to tap into that entire source. Therefore, the long term solution for the corridor may be to construct an impoundment and construct a surface water treatment plant.

The master plan for sewer should also begin with Nellysford. We recommend that negotiations be made to purchase capacity in the existing Stoney Creek WWTP. While this plant will not meet the projected buildout flows of the service area, it should satisfy the flows for many

years. Beech Grove would connect to Nellysford, and eventually the Stoney Creek WWTP would be replaced with a larger regional facility.

A sewer system in Avon would also be developed with a package WWTP (flows up to 25,000 gpd). The flow from Afton would be treated at this plant. Eventually when the regional facility is constructed in Nellysford, the Avon plant would be replaced with a pump station that would transfer waste to the new facility. This would also open up the Rockfish Central area as a force main system.

There are two major options for a sewer collection system. The gravity option has a higher initial cost to the NCSA, and a relatively low cost to the customer. It also has a much lower operation and maintenance cost, and would result in a lower monthly bill to the customers. The force main option has a significantly lower capital cost to NCSA, but a much higher cost to the customer because of the grinder pump station that they would have to purchase, plus the higher monthly service fees.

The Nellysford area has the highest priority because of several failing drainfields along Route 151. Several options were presented along with the proposed phasing of the options. The recommended option is to negotiate with the WVUC to allow NCSA to connect to their water and sewer systems.

The total (water and sewer) NCSA estimated cost for the initial phase is $560,000 for a gravity system, and $376,000 for force main system. The total estimated cost to the customers is $26,400 for a gravity system and $168,000 for a force main system. This does not include any costs that the WVUC may charge to allow the connection.

If this cannot be negotiated, then the only option would be to develop an independent water and sewer system. The cost would probably be much higher for NCSA, $1,367,000 for a gravity system and $1,125,000 for a force main system, the capacity would be far less than connecting to Stoney Creek, and there would probably not be fire protection.

This water and sewer master study is intended to layout the initial framework for providing utility services to the areas along the Rockfish Valley Corridor. Some of the tasks we believe are important for the NCSA and the County to consider in the near future are:

1. Proceed with Nellysford Area - Phase 1 – Gravity Sewer and Water Main and negotiate to purchase entire system or some capacity.

2. Perform pilot test well study to define if ample wells exist in possible growth areas.

3. Perform a more detailed surface water impoundment study in the near future as environmental permitting and property acquisition can be a major obstacle to overcome if not acted upon in a timely manner.

4. Perform detailed Preliminary Engineering Reports for options developed in the study as service areas develop.

5. Encourage developer participation towards long-term water and sewer master plan in each of the service corridors.

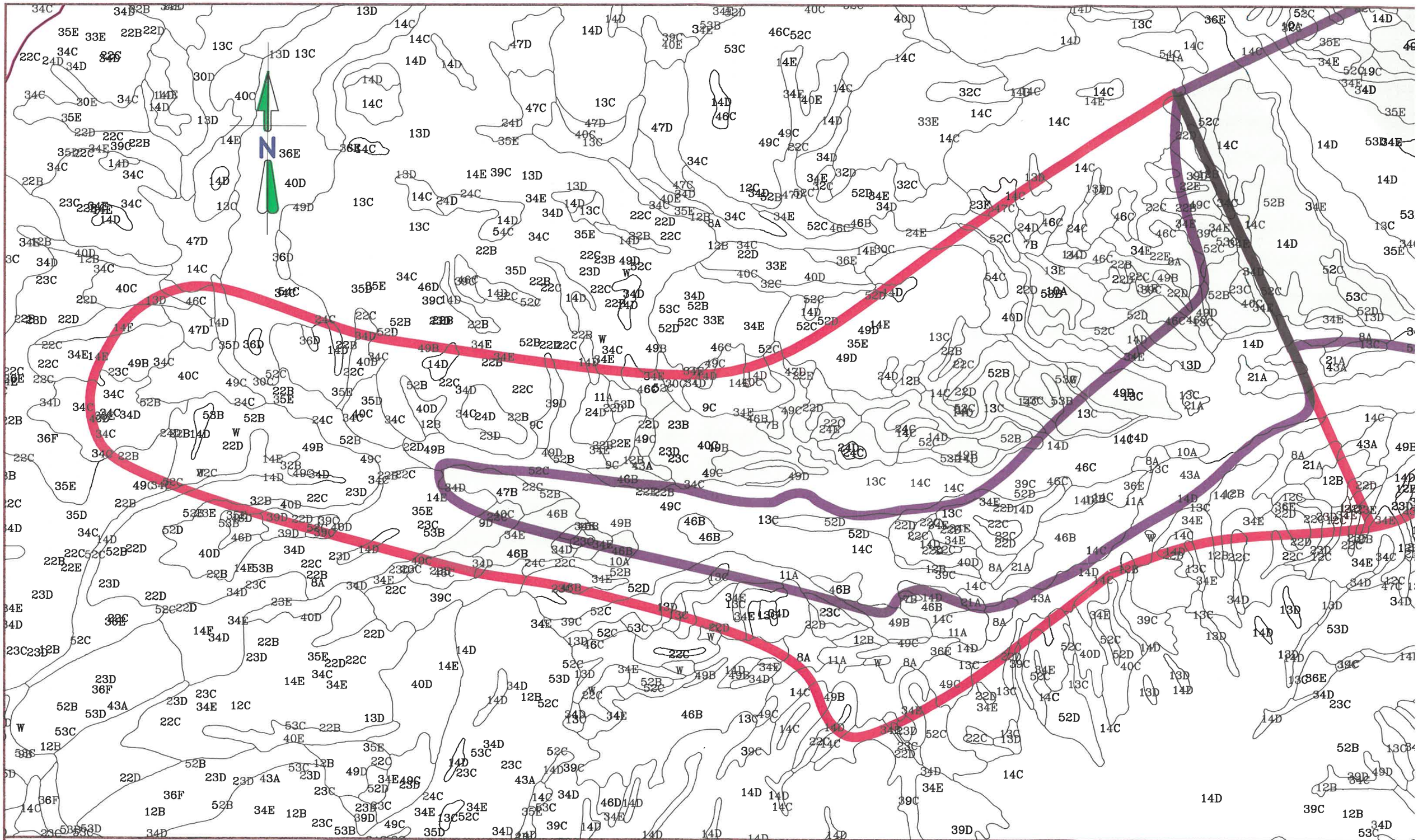
6. Update this initial water and sewer master plan at reasonable time frames (at least every 5 years) as County planning/zoning and development potential evolve.

Appendix I

Soil Study Maps

LEGEND OF SOIL TYPES

1D "ARCOLA GRAVELLY SILT LOAM, 15 TO 25 PERCENT SLOPES"
1E "ARCOLA GRAVELLY SILT LOAM, 25 TO 50 PERCENT SLOPES"
2A "BATTEAU LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
3B "BELVOIR SANDY LOAM, 2 TO 7 PERCENT SLOPES"
4B "BUFFSTAT SILT LOAM, 2 TO 7 PERCENT SLOPES"
4C "BUFFSTAT SILT LOAM, 7 TO 15 PERCENT SLOPES"
4D "BUFFSTAT SILT LOAM, 15 TO 25 PERCENT SLOPES"
5C "BUGLEY CHANNERY SILT LOAM, 7 TO 15 PERCENT SLOPES"
5D "BUGLEY CHANNERY SILT LOAM, 15 TO 25 PERCENT SLOPES"
5E "BUGLEY CHANNERY SILT LOAM, 25 TO 50 PERCENT SLOPES"
6E "CATOCTIN-ROCK OUTCROP COMPLEX, 25 TO 75 PERCENT SLOPES, EXTREMELY STONY"
7B "CHATUGE LOAM, 1 TO 4 PERCENT SLOPES"
8A "CODORUS SILT LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
9B "COLLEEN GRAVELLY LOAM, 2 TO 7 PERCENT SLOPES"
9C "COLLEEN GRAVELLY LOAM, 7 TO 15 PERCENT SLOPES"
9D "COLLEEN GRAVELLY LOAM, 15 TO 25 PERCENT SLOPES"
10A "COLVARD FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
11A "CRAIGSVILLE VERY COBBLY LOAM, 0 TO 2 PERCENT SLOPES, FREQUENTLY FLOODED"
12B "DELANCO LOAM, 2 TO 7 PERCENT SLOPES"
12C "DELANCO LOAM, 7 TO 15 PERCENT SLOPES"
13C "EDNEYTOWN LOAM, 7 TO 15 PERCENT SLOPES"
13D "EDNEYTOWN LOAM, 15 TO 25 PERCENT SLOPES"
13E "EDNEYTOWN LOAM, 25 TO 50 PERCENT SLOPES"
14C "EDNEYTOWN-PEAKS COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
14D "EDNEYTOWN-PEAKS COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
14E "EDNEYTOWN-PEAKS COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
14F "EDNEYTOWN-PEAKS COMPLEX, 55 TO 75 PERCENT SLOPES, EXTREMELY STONY"
15B "ELIOAK LOAM, 2 TO 7 PERCENT SLOPES"
15C "ELIOAK LOAM, 7 TO 15 PERCENT SLOPES"
15D "ELIOAK LOAM, 15 TO 25 PERCENT SLOPES"
16C "ELIOAK CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED"
16D "ELIOAK CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED"
17B "ELSINBORO LOAM, 2 TO 7 PERCENT SLOPES, RARELY FLOODED"
18C "FAUQUIER LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
18D "FAUQUIER LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
18E "FAUQUIER LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
19A "GALTSMILL FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
20D "GLENELG SILT LOAM, 15 TO 25 PERCENT SLOPES"
21A "HATBORO LOAM, 0 TO 2 PERCENT SLOPES, FREQUENTLY FLOODED"
22B "HAYESVILLE LOAM, 2 TO 7 PERCENT SLOPES"
22C "HAYESVILLE LOAM, 7 TO 15 PERCENT SLOPES"
22D "HAYESVILLE LOAM, 15 TO 25 PERCENT SLOPES"
22E "HAYESVILLE LOAM, 25 TO 50 PERCENT SLOPES"
23B "HAYESVILLE CLAY LOAM, 2 TO 7 PERCENT SLOPES, SEVERELY ERODED"
23C "HAYESVILLE CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED"
23D "HAYESVILLE CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED"
23E "HAYESVILLE CLAY LOAM, 25 TO 50 PERCENT SLOPES, SEVERELY ERODED"
24C "HAYESVILLE LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
24D "HAYESVILLE LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
24E "HAYESVILLE LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
25C "HAZEL CHANNERY LOAM, 7 TO 15 PERCENT SLOPES"
25D "HAZEL CHANNERY LOAM, 15 TO 25 PERCENT SLOPES"
25E "HAZEL CHANNERY LOAM, 25 TO 50 PERCENT SLOPES"
26D "HAZEL LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
26E "HAZEL LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
27B "JACKLAND GRAVELLY SILT LOAM, 2 TO 7 PERCENT SLOPES"
27C "JACKLAND GRAVELLY SILT LOAM, 7 TO 15 PERCENT SLOPES"
28B "LEW SILT LOAM, 2 TO 7 PERCENT SLOPES"
29B "LEW SILT LOAM, 2 TO 7 PERCENT SLOPES, EXTREMELY STONY"
30C "LEW CHANNERY SILT LOAM, 7 TO 15 PERCENT SLOPES, EXTREMELY BOULDERY"
30D "LEW CHANNERY SILT LOAM, 15 TO 25 PERCENT SLOPES, EXTREMELY BOULDERY"
30E "LEW CHANNERY SILT LOAM, 25 TO 75 PERCENT SLOPES, EXTREMELY BOULDERY"
31B "LITTLEJOE SILT LOAM, 2 TO 7 PERCENT SLOPES"
31C "LITTLEJOE SILT LOAM, 7 TO 15 PERCENT SLOPES"
32B "MINNIEVILLE LOAM, 2 TO 7 PERCENT SLOPES"
32C "MINNIEVILLE LOAM, 7 TO 15 PERCENT SLOPES"
32D "MINNIEVILLE LOAM, 15 TO 25 PERCENT SLOPES"
32E "MINNIEVILLE LOAM, 25 TO 50 PERCENT SLOPES"
33C "MYERSVILLE-CATOCTIN COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
33D "MYERSVILLE-CATOCTIN COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
33E "MYERSVILLE-CATOCTIN COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
34C "OCCOQUAN LOAM, 7 TO 15 PERCENT SLOPES"
34D "OCCOQUAN LOAM, 15 TO 25 PERCENT SLOPES"
34E "OCCOQUAN LOAM, 25 TO 50 PERCENT SLOPES"
35D "OCCOQUAN LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
35E "OCCOQUAN LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
36D "PEAKS-ROCK OUTCROP COMPLEX, 15 TO 35 PERCENT SLOPES"
36E "PEAKS-ROCK OUTCROP COMPLEX, 35 TO 55 PERCENT SLOPES"
36F "PEAKS-ROCK OUTCROP COMPLEX, 55 TO 75 PERCENT SLOPES"
37A "PINEYWOODS SILT LOAM, 0 TO 2 PERCENT SLOPES"
38 "PITS, QUARRY"
39C "SAUNOOK LOAM, 7 TO 15 PERCENT SLOPES"
39D "SAUNOOK LOAM, 15 TO 25 PERCENT SLOPES"
40C "SAUNOOK LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
40D "SAUNOOK LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
40E "SAUNOOK LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
41B "SKETERVILLE SILT LOAM, 2 TO 7 PERCENT SLOPES"
42C "SPRIGGS LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
42D "SPRIGGS LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
42E "SPRIGGS LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
43A "SUCHES LOAM, 0 TO 2 PERCENT SLOPES, FREQUENTLY FLOODED"
44C "SYLCO-SYLVATUS COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
44D "SYLCO-SYLVATUS COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
44E "SYLCO-SYLVATUS COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
45E "SYLVATUS-ROCK OUTCROP COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
45F "SYLVATUS-ROCK OUTCROP COMPLEX, 55 TO 70 PERCENT SLOPES, EXTREMELY STONY"
46B "THURMONT LOAM, 2 TO 7 PERCENT SLOPES"
46C "THURMONT LOAM, 7 TO 15 PERCENT SLOPES"
46D "THURMONT LOAM, 15 TO 25 PERCENT SLOPES"
47B "THURMONT LOAM, 2 TO 7 PERCENT SLOPES, VERY STONY"
47C "THURMONT LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
47D "THURMONT LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
48 "UDORTHENTS, SMOOTHED"
49B "UNISON LOAM, 2 TO 7 PERCENT SLOPES"
49C "UNISON LOAM, 7 TO 15 PERCENT SLOPES"
49D "UNISON LOAM, 15 TO 25 PERCENT SLOPES"
50B "WARMINSTER CLAY LOAM, 2 TO 7 PERCENT SLOPES"
50C "WARMINSTER CLAY LOAM, 7 TO 15 PERCENT SLOPES"
50D "WARMINSTER CLAY LOAM, 15 TO 25 PERCENT SLOPES"
51A "WINGINA LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
52B "WINTERGREEN LOAM, 2 TO 7 PERCENT SLOPES"
52C "WINTERGREEN LOAM, 7 TO 15 PERCENT SLOPES"
52D "WINTERGREEN LOAM, 15 TO 25 PERCENT SLOPES"
53B "WINTERGREEN CLAY LOAM, 2 TO 7 PERCENT SLOPES, SEVERELY ERODED"
53C "WINTERGREEN CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED"
53D "WINTERGREEN CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED"
54C "WINTERGREEN LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
55A "YOGAVILLE LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
W WATER



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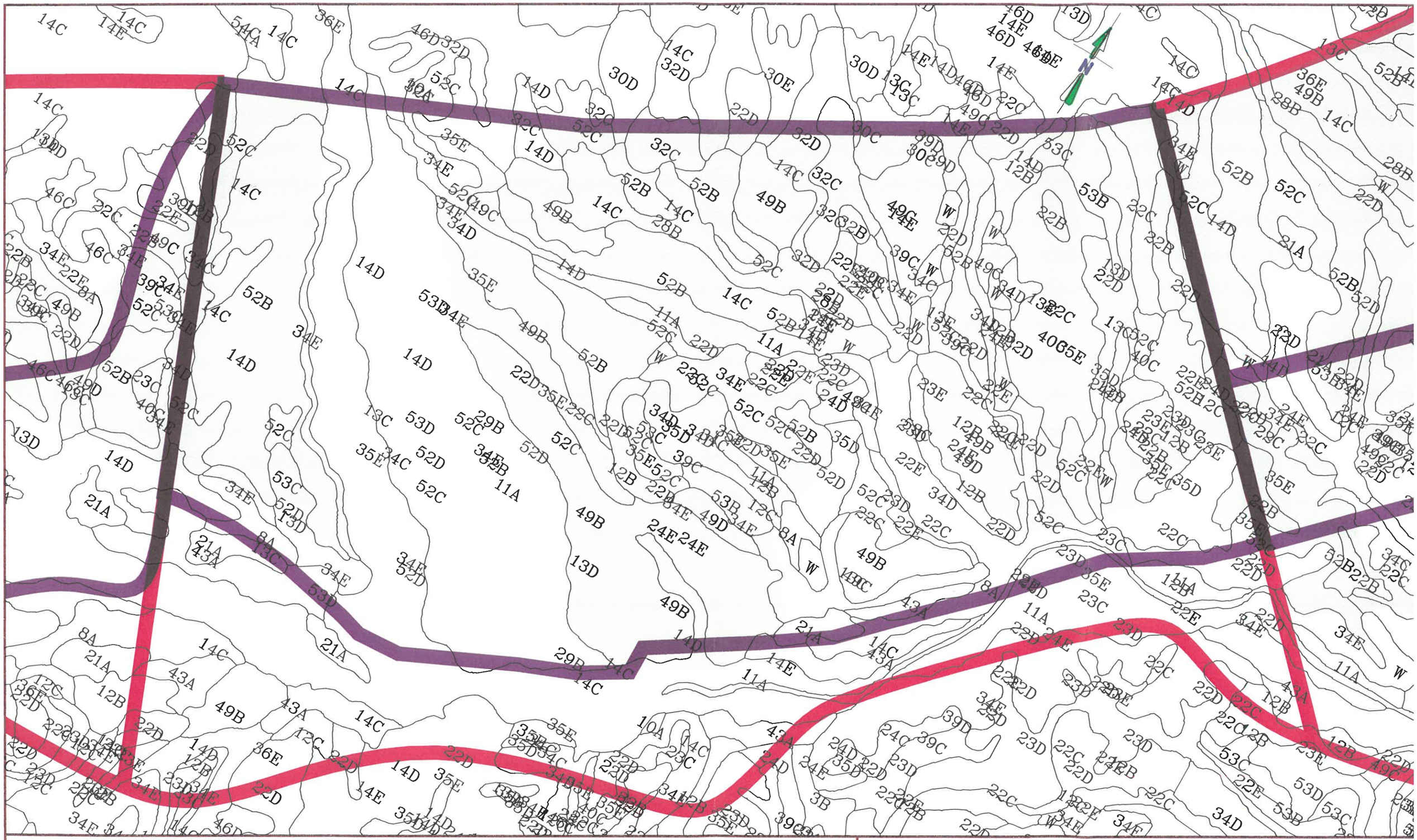
SOILS SURVEY MAP
BEECH GROVE SERVICE AREA

SCALE: 1" = 1800'

* NOTE - INFORMATION TAKEN FROM SOILS SURVEY OF NELSON COUNTY, VA. PREPARED BY THE US DEPARTMENT OF AGRICULTURE

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- 46B — SOIL TYPE, SEE TABLE FOR DESCRIPTION
- SOIL TYPES THAT MAY BE SUITABLE FOR CONVENTIONAL SANITARY DRAINFIELDS
- SOIL TYPES NOT SUITABLE FOR CONVENTIONAL SANITARY DRAINFIELDS



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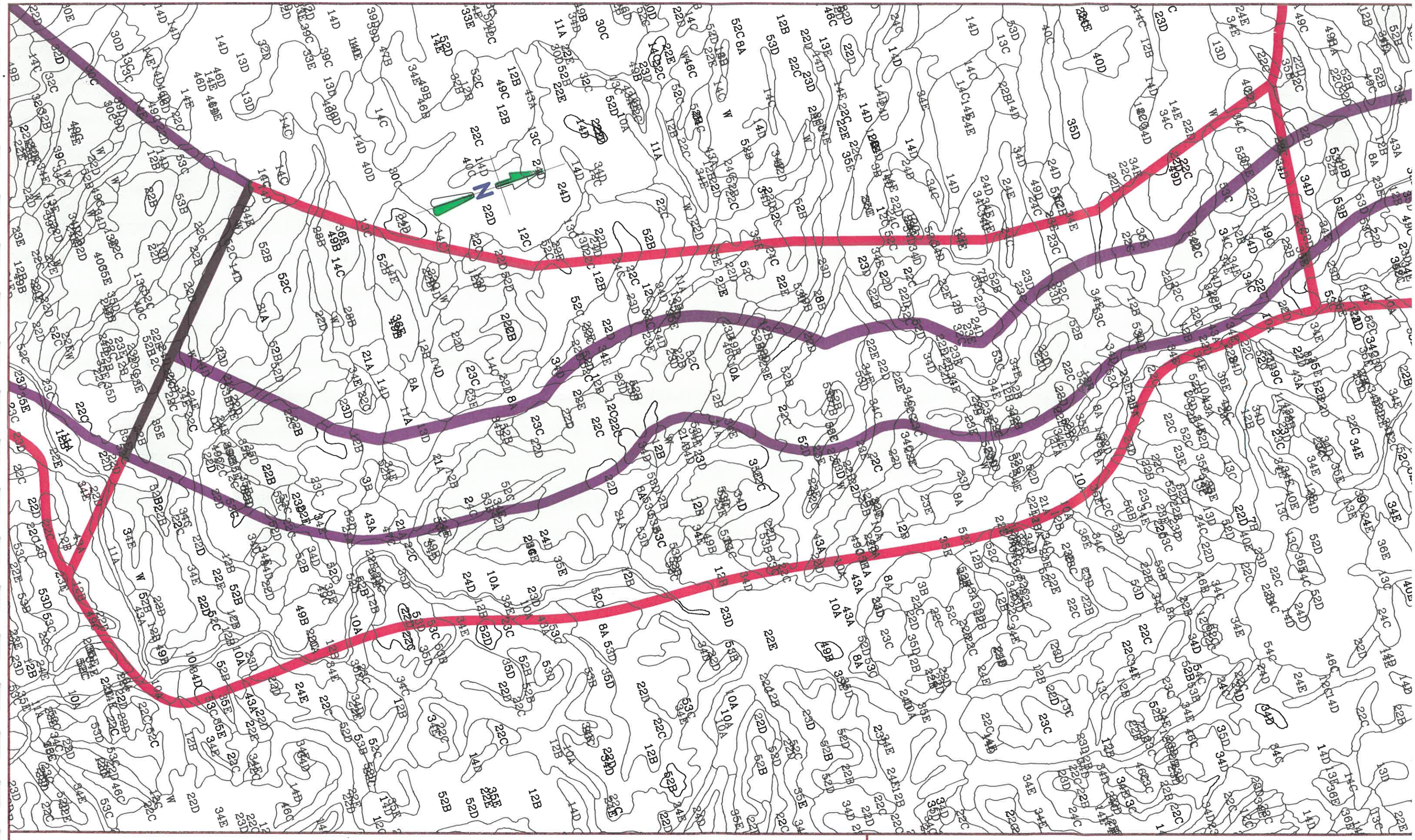
SOILS SURVEY MAP
NELLYSFORD SERVICE AREA

SCALE: 1" = 1200'

* NOTE - INFORMATION TAKEN FROM SOILS SURVEY OF NELSON COUNTY, VA. PREPARED BY THE US DEPARTMENT OF AGRICULTURE

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- 46B — SOIL TYPE, SEE TABLE FOR DESCRIPTION
- SOIL TYPES THAT MAY BE SUITABLE FOR CONVENTIONAL SANITARY DRAINFIELDS
- SOIL TYPES NOT SUITABLE FOR CONVENTIONAL SANITARY DRAINFIELDS



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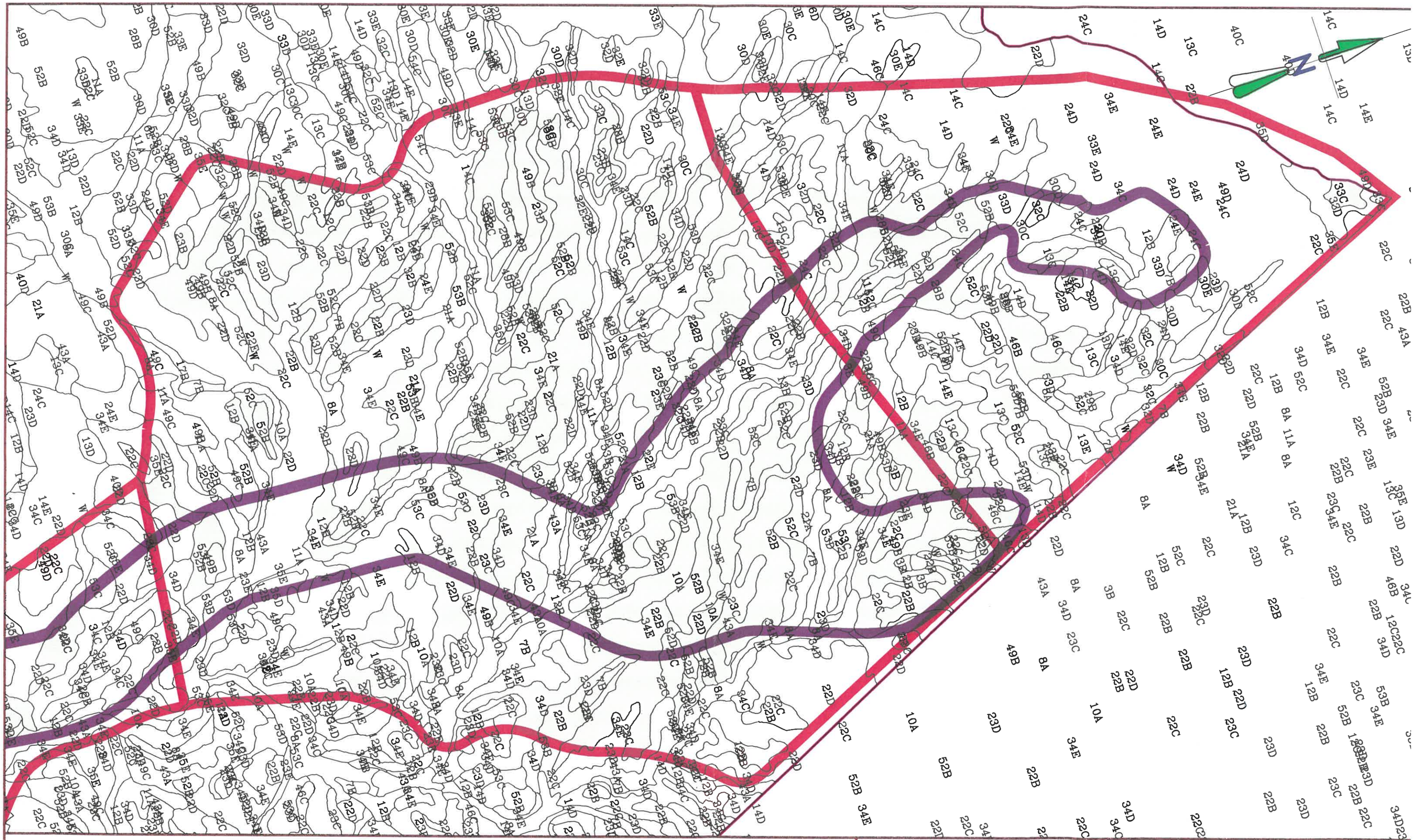
SOILS SURVEY MAP
ROCKFISH / CENTRAL SERVICE AREA

SCALE: 1" = 1800'

* NOTE - INFORMATION TAKEN FROM SOILS SURVEY OF NELSON COUNTY, VA. PREPARED BY THE US DEPARTMENT OF AGRICULTURE

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- 46B — SOIL TYPE, SEE TABLE FOR DESCRIPTION
- SOIL TYPES THAT MAY BE SUITABLE FO CONVENTIONAL SANITARY DRAINFIELD
- SOIL TYPES NOT SUITABLE FOR CONVENTIONAL SANITARY DRAINFIELD



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SOILS SURVEY MAP
AVON / AFTON SERVICE AREAS

SCALE: 1" = 1800'

* NOTE - INFORMATION TAKEN FROM SOILS SURVEY OF NELSON COUNTY, VA. PREPARED BY THE US DEPARTMENT OF AGRICULTURE

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- 46B — SOIL TYPE, SEE TABLE FOR DESCRIPTION
- SOIL TYPES THAT MAY BE SUITABLE FOR CONVENTIONAL SANITARY DRAINFIELDS
- SOIL TYPES NOT SUITABLE FOR CONVENTIONAL SANITARY DRAINFIELDS

Appendix II

Groundwater Supply Study

GROUNDWATER SUPPLY STUDY
ROCKFISH VALLEY CORRIDOR
NELSON COUNTY, VIRGINIA

Prepared for:

Nelson County Service Authority
&
Nelson County, Virginia

Prepared by:

Draper Aden Associates
8090 Villa Park Drive
Richmond, Virginia 23228

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Executive Summary

The 1998 " Report of Evaluation and Appraisal for the Wintergreen Stoney Creek Village Water and Sewer Systems" identified water supply wells within the development, but did not include a hydrogeologic assessment. The current study expands the study area, characterizes the hydrogeologic setting, and evaluates available groundwater resources within five (5) service areas. It includes well database information, limited characterization of groundwater quality, a detailed fracture trace (photolineament) analysis, and selection and ranking of recommended well locations.

Igneous, metamorphic, and sedimentary rocks underlie the study area. The Rockfish Valley Fault network impacts the bedrock water-bearing capacity significantly. The highest potential well yields (25 to 50 gpm and locally, exceeding 50 gpm) likely occur within extensively faulted and fractured bedrock. In the absence of such features, low well yields of 1 to 2 gallons per minute (gpm) and even dry wells occur.

Well records obtained for 49 wells indicate yields ranging from 1 to 89 gpm at depths of 62 to 675 feet. Yields exceeding 25 gpm occur at depths of 200 to 300 feet in six (6) wells. Five (5) of these wells are part of the Stoney Creek Village water system. The cataclastic rocks and layered granulite gneiss that occur within the Rockfish Valley Fault network appear to be the most favorable formations for groundwater development.

Important to groundwater development is replenishment of water removed from the subsurface. The estimated groundwater recharge potential for the 25.5 square mile study area is approximately 7.4 mgd. It may be possible to capture 15 to 20 percent of this annual recharge, or 1.1 to 1.5 mgd; however, this would have to be confirmed through a test well drilling and aquifer test program.

Limited groundwater quality data was available. Information obtained for two (2) of the Stoney Creek Village wells reported nitrate/nitrite and volatile organic compounds concentrations that "complied with all primary maximum contamination levels". Elevated concentrations of naturally occurring iron and manganese may occur locally.

The fracture trace (photolineament) analysis identified 351 fracture traces in the study area. Interconnected fracture zones and faults represent potential subsurface water-bearing intervals within bedrock. The abundance of mapped fractures, their length and proximity to the Rockfish Valley Fault network, represent favorable conditions for developing wells yielding from 25 to 50 gpm and potentially from 50 to 100 gpm.

Based upon published geologic literature and the fracture trace analysis, 31 proposed wells sites have been identified. Seven (7) sites each were identified in Beech Grove, Nellysford, Rockfish, and Avon service areas and three (3) in the Afton service area. The well sites are numbered in order of preference in each service area.

1.0 INTRODUCTION

1.1 Purpose and Scope of Study

In conjunction with the water systems engineering study conducted for the Rockfish Valley Corridor, Draper Aden Associates (DAA) also performed a hydrogeologic study to evaluate available groundwater resources within the proposed water system development areas.

In May 1998, Draper Aden Associates submitted to the Nelson County Service Authority a report entitled, "Report of Evaluation and Appraisal for the Wintergreen Stoney Creek Village Water and Sewer Systems". The study addressed the existing ground water supply system in this specific area, which consisted of five (5) wells. Although not included in the May 1998 study, the current study characterizes the area hydrogeology (geology and groundwater conditions), groundwater development potential, availability of groundwater resources along the corridor, and predicts which areas have the greatest potential for developing favorable well yields. The current study consists of a more detailed hydrogeologic study and addresses a much larger geographic area.

Services for the current study consisted of the following:

- A review of readily available geologic literature addressing the geology and groundwater conditions in the study area using . Information was obtained from the Virginia Division of Mineral Resources and the Nelson County Health Department.

- Contacting a number of local well drilling contractors concerning their knowledge of local geologic / hydrogeologic conditions, typical well yields, and general groundwater quality.

- Performance of a fracture trace analysis using aerial photographs and topographic maps of the study area.

- Selection of at least three potential well sites per proposed water service area with well sites ranked in order of preference with respect to potential yields.

- A geologic field reconnaissance of the study area to verify the findings and recommended well sites.

The following services were not included in the study:

- The performance of an electromagnetic (EM) survey to more accurately locate specific well sites, if deemed necessary.

- The drilling of test wells into bedrock and performance of pumping tests to define well yields and potential impact of well pumping on neighboring wells.

- A water balance analysis to evaluate ground water recharge (infiltration rates) vs. groundwater pumping and the hydraulic capacity of the Bedrock Aquifer.

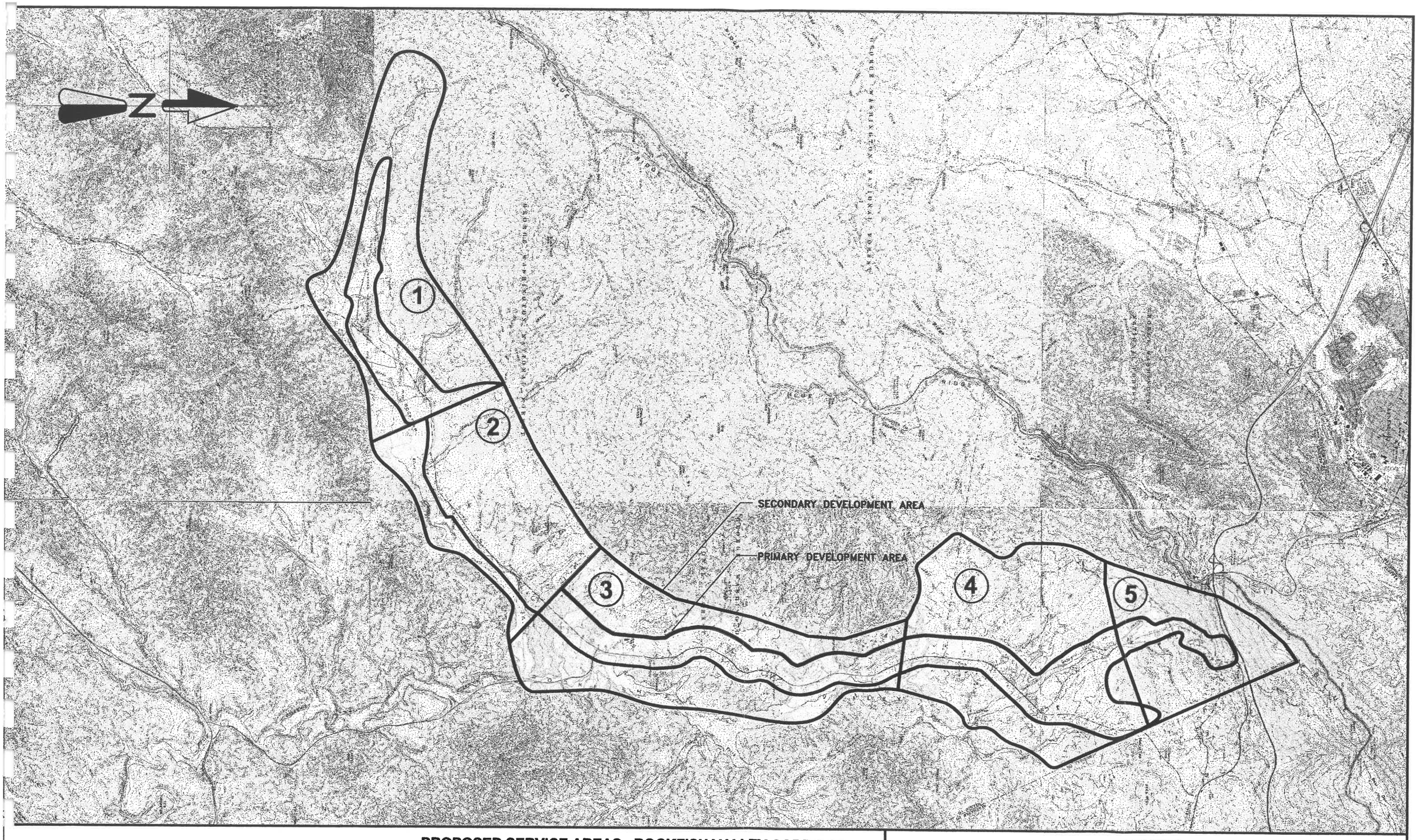
- Water quality assessments, other than general statements, as to typical groundwater quality in the area.

1.2 Description of Study Area

The study area encompasses the Route 151/Route 6 (or Rockfish Valley) Corridor from the Albemarle County – Nelson County line, southward to the intersection of Route 151 and Route 664. It continues west along Route 664 for approximately 3.5 miles. It does not include the Route 6 corridor south of the confluence of the South Fork of the Rockfish River and the Rockfish River (the actual area ends approximately 0.6 miles south of this confluence). The general location of the study area is shown on the accompanying figure.

The designated area included in this study consisits of approximately 25.5 square miles. Farms and orchards occupy much of the area and includes the communities of Afton, Avon, Greenfield, Nellysford, and Wintergreen. There is a large residential development near Nellysford, Stoney Creek at Wintergreen. Commercial and small lot residential properties are scattered along Routes 151, 6 and 664 and adjacent roads.

The study area lies within the western portion of Virginia's Piedmont Physiographic Province and in the Blue Ridge Physiographic Province. The Western Piedmont is characterized by gently to steeply rolling topography. The Blue Ridge is characterized by steeply rolling topography. The maximum elevation is 2,259 feet above mean sea level (amsl) in the northern most tip of the study area and the minimum elevation is less than 580 feet amsl along the Rockfish River, south of Greenfield near the intersection of State Route 151 and 6.



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PROPOSED SERVICE AREAS - ROCKFISH VALLEY CORRIDOR

SCALE: 1" = 6000'

1. BEECH GROVE
2. NELLYSFORD
3. ROCKFISH/CENTRAL
4. AVON
5. AFTON

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- APPROXIMATE FLOOD PLAIN LIMITS

2.0 LOCAL GEOLOGY AND HYDROGEOLOGY

2.1 General Geology

The study area is located along the contact between the Western Piedmont and Blue Ridge Physiographic Provinces of Virginia. Igneous, metamorphic and sedimentary rocks underlie the area. Igneous and metamorphic rocks are generally of Precambrian to Cambrian geologic age with the exception of the diabase dikes, which are of Triassic geologic age. The sedimentary deposits are of Quaternary geologic age. The following Virginia Division of Mineral Resources (VDMR), publications describe in detail the geology of the study area:

- Geology of the Waynesboro East and Waynesboro West Quadrangles, Virginia by Gathright II, Henika, and Sullivan III.
- Geology of the Greenfield and Shenandoah Quadrangles, Virginia Bartholomew.

The geology of the area is diverse and complex reflecting the multiple phases of compressional and extensional deformation. There are two distinctively different rock types that occur in the study area. These include igneous (diabase dikes) and metamorphic (gneiss, schist, and quartzose sandstone) rocks, which resulted from high heat and stress in Precambrian and Cambrian geologic time. There are also unconsolidated sediments (gravel, sand, silt, clay), which were deposited over the igneous and metamorphic rocks as the result of differential weathering of these rocks.

One major fault, the Rockfish Valley Fault, extends from south of the split of State Routes 151 and 664 near the southern edge of the study area through the northern portion of the study area and beyond to the east. There is also an unnamed thrust fault which trends along south-north along the eastern portion of the study area from slightly north of Nellysford to the Nelson County, Albemarle County line and beyond to the northeast.

Nine geologic formations are found within the study area. They are Alluvium and Terrace and Alluvial Fan deposits of Quaternary geologic age, Diabase dikes of Triassic geologic age, the Swift Creek Formation and Catoctin Formation of Cambrian Geologic age, and the Pedlar Formation, Lovingston Formation, a layered granulite gneiss and cataclastic rocks of the Precambrian geologic age.

Alluvium consists of floodplain and low-level terrace deposits of sand and silt overlying silty clay and gravel. Large cobbles can also occur in these deposits. Alluvium is generally found adjacent to creeks and rivers.

Terrace and Alluvial Fan deposits consist of gravel and sand in a clay matrix. Terrace deposits are generally found adjacent to and near creeks and within drainages. Alluvial fan deposits are also found near creeks and in drainages. They commonly result

from upland erosion, which results in deposition of recent sediments in and adjacent to drainage areas.

Diabase dikes consist of medium to coarse grained, dark grayish green to black diabase. Diabase dikes are found throughout the study area.

The Catoctin Formation consists of fine-grained, dark greenish-gray chlorite, epidote, albite schist and actinolite chlorite albite schist; amygdaloidal metabasalt, epidosite, epidote quartz breccia and greenish-gray metatuff.

The Swift Run Formation consists of medium to coarse grained, light to greenish gray, tan weathering quartz sericite schist and quartz sericite chlorite schist with some schistose metamorphosed lithic sandstone. Both the Catoctin and Swift Creek Formations generally occur in the western portion study area west of the Rockfish Valley Fault. The Catoctin and Swift Creek Formations are found north of the Rockfish Valley Fault in the northern portion of the study area.

The Pedlar Formation consists of dark bluish to greenish gray coarse grained, massive to sheared granodiorite gneiss. The Pedlar Formation generally occurs in the western portion of the study area and is also found west of the Rockfish Valley Fault. There is an isolated occurrence of the Pedlar Formation in the northern portion of the study area. This occurrence is found in an upthrusted area adjacent to a portion of the Rockfish Valley Fault, which appears to have splayed off the main portion of the fault.

Cataclastic rocks found in the study area have reportedly been altered from Precambrian geologic age rocks in the Paleozoic geologic age. They consist of dark to light gray medium to coarse-grained protomylonite, mylonite, phylonite, blastomylonite and mylonite gneiss derived from the Lovingston Formation of Precambrian geologic age. Cataclastic rocks are found to occur between the Rockfish Valley Fault (western edge) and the unnamed thrust fault (eastern edge) throughout the length of the study area.

2.2 Groundwater Occurrence

Throughout the Western Piedmont and Eastern Blue Ridge Physiographic Provinces of Virginia, groundwater occurs within two basic horizons, in the soils or "overburden materials" overlying the bedrock and also within the fractures present within the bedrock. These two water-bearing horizons are typically termed the Water Table Aquifer and the Bedrock Aquifer, respectively. In many instances the Water Table Aquifer and the shallow fractures in the Bedrock Aquifer, when hydraulically interconnected, behave as a single aquifer under water table (unconfined) to slightly artesian conditions (confined and under pressure). With increasing fracture depths in the Bedrock Aquifer, the likelihood of hydraulic interconnection with the Water Table Aquifer decreases.

Groundwater flow in the Water Table Aquifer usually conforms to the slope of the ground surface in a subdued manner. Groundwater gradients are typically much less

than those of the ground surface. Flow in the Bedrock Aquifer is controlled by the frequency and orientation of the fractures, which provide permeability to the bedrock. Since groundwater is confined essentially to the fractures, it is possible to drill dry wells in this system as the result of not penetrating any water-bearing fractures.

Recharge to the Water Table Aquifer is by infiltration of precipitation and runoff through the overlying soils. The underlying Bedrock Aquifer is recharged slowly by the vertical migration of infiltrating waters through the overburden and into the bedrock fractures. More rapid recharge occurs when fractured bedrock is exposed in stream or riverbeds, drainage ways, or surface water bodies such as ponds and lakes.

Based on a review of well completion information from the Virginia Division of Mines, Minerals, and Energy (VDMME), the Nelson County Department of Health and from area water well drillers, the majority of the water wells in the study area, which support residential and small commercial establishments, are deep wells drilled into the fractured bedrock. Casing diameters for these wells range from 6 – 8 inches. Aquifer well yields reported in the fractured bedrock wells ranged from 1 gallon per minute to 89 gallons per minute (gpm).

The majority of the high yielding wells occur in and around the Stoney Creek development. Yields from wells in this area generally range from 15 – 89 gpm. These higher yields are related to local intense bedrock fracturing resulting from the proximity of the development to Rockfish Valley Fault and associated faults in the area.

A detailed discussion of area groundwater usage is presented in Section 3.0, Local Groundwater Conditions.

2.3 Groundwater Recharge

Groundwater is continually replenished by recharge from infiltrating precipitation (rainfall and melting snow). Most of the precipitation returns to the atmosphere by evaporation and transpiration from plants. The remainder flows overland to nearby streams or recharges the groundwater system. The amount of water that recharges a groundwater system can be estimated by examining stream flow hydrographs and separating out the contribution from groundwater called base flow. Over long periods of time, groundwater discharge in a groundwater basin equals groundwater recharge. Draper Aden estimates the average infiltration from precipitation in the study area is at least 6 inches per year.

The study area encompasses approximately 25.5 square miles and therefore, receives an estimated 7.3 million gallons per day (mgd) of recharge on an average annual basis. Not all of this water can be captured by water wells. However, it is may be feasible to develop up to 15 to 20 percent of this annual recharge, 1.1 to 1.5 mgd, based on the locally favorable water-producing characteristics of bedrock within the study area and the abundance of fracture traces identified. This, however, would have to be confirmed through a test well drilling and aquifer test program. This estimate does not take into

account the additional recharge to the local groundwater regime that occurs to the west between the study area and the east slopes of the Blue Ridge Mountains.

Actual recharge rates may vary substantially locally due to hydrogeologic factors such as thickness and permeability of the overburden, watershed drainage density, and the slope of the land surface. Effective recharge rates are expected to be higher in areas underlain by more permeable soils such as the areas underlain by granitic rocks, floodplain and terrace deposits. Effective recharge rates may likely be less in areas underlain by more clayey soils and dense, unfractured bedrock.

The geomorphic and hydrologic characteristics of the drainage basins present within the study area have an impact on groundwater recharge. Areas with greater topographic relief will have increased storm runoff and locally, decreased groundwater recharge rates. Areas with a higher drainage density (total length of streams divided by watershed area) reflect increased storm water run off, and less infiltration of water into the subsurface. In general, there is greater topographic relief in the western portion of the study area (Blue Ridge Physiographic Province). Although some ground recharge is expected in the exposed fractured bedrock, the majority of the runoff will infiltrate in the lowlands of Rockfish Valley near the intersection (base) of the uplands with the lowlands (Western Piedmont Physiographic Province).

3.0 LOCAL GROUNDWATER CONDITIONS

3.1 Previous Information

The May 1998 "Report of Evaluation and Appraisal for the Wintergreen Stoney Creek Village Water and Sewer Systems" presented an inventory of reported water supply wells within Stoney Creek Village including well ownership, use and yield. Well construction details were not available. The well inventory was gathered from the Nelson County Service Authority. It is noted that the reported well yield is both a function of hydrogeologic conditions and intended use, and therefore may not necessarily reflect maximum well yield potential. In addition, the reported yield is often based on driller's observations from short yield tests and may not accurately reflect the actual yield as established by a controlled 48-hour draw down test.

Five (5) wells were identified in Stoney Creek Village. Well yields in the five wells completed in the Stoney Creek Village development; Well 22, 23, 24, 25 and 26, had reported yields of 52, 28, 89, 45 and 68 gpm, respectively.

3.2 Updated Information

The Virginia Department of Mines, Minerals and Energy (VDMME), Nelson County Health Department and several area water well drillers (only Burner Well Drilling responded) were contacted to obtain updated information regarding area wells and groundwater quality. The information gathered was for bedrock wells only, since they provide the highest sustained yields in the area.

Well construction information and approximate locations were obtained for forty-nine (49) wells located in the study area. Five (5) wells were identified in the May 1998 study and forty-four (44) wells were identified in the current study. A summary of the water well data collected is presented in Table 1. Approximate locations for these wells are presented on the four (4) accompanying figures. Most of the information collected was obtained from public regulatory agencies. Unfortunately, the information obtained is limited in content and much of the desired well information was not available.

Well depth and well yield data were available for 37 wells. The following information was compiled:

- Well depths ranged from 62 to 675 feet
- Well yields ranged from 1 to 89 gallons per minute (gpm)
- 10 wells had yields from 0 – 5 gpm
- 12 wells had yields from 6 – 10 gpm
- 5 wells had yields from 11 – 25 gpm
- 7 wells had yields from 26 – 50 gpm

- 3 wells had yields greater than 50 gpm
- Yields greater than 25 gpm occurred at depths of 200-300 feet

TABLE 1
SUMMARY OF WATER WELL DATA
ROUTE 151/ROUTE 664 CORRIDOR
NELSON COUNTY, VA

LOCATION DESIGNATION	LOCATION	DRILLER	DRILLING METHOD	DATE STARTED	DATE COMPLETED	TOTAL DEPTH ft	DEPTH TO BEDRX ft	CASING				WATER					
								ID INCHES	TYPE	FROM ft	TO ft	STATIC UNPUMPED ft	STABILIZED YIELD gpm	TIME hrs	USE	TYPE OF FACILITY	WATER ZONES TO/FROM ft
VDMME - 9	Afton	C. R. Moore				230					52	195	5				
VDMME - 16	Wintergreen	Buckingham Well Drlg			6/12/1948	63				0	44	15	1.5				
VDMME - 17	Wiginia	Buckingham Well Drlg			1/8/1947	62				0	44					Domestic	??-48
VDMME - 21	Afton	Sydnor				500											
VDMME - 26	Afton	C. R. Moore			10/49	77				0	23	59.5	3				
VDMME - 31	Afton	C. R. Moore			12/55	163				0	32	28	7				
VDMME - 60	Nellysford	Aquamasters	Air Rotary	2/4/1971	2/12/1971	372		6		0	97	70	8				150-272
VDMME - 77	Nellysford - Wintergreen #1	Burner Well Drlg	Air Rotary	9/3/1974	9/7/1974	675						180	Abandoned		Drinking	Restaurant	
VDMME -78	Nellysford - Wintergreen #2	Burner Well Drlg	Air Rotary	9/7/1974	9/17/1974	350		6		+1	69	70	3.5	1	Drinking	Restaurant	Intake - 340
VDMME - 83	Nellysford - Wintergreen #3	Burner Well Drlg	Air Rotary	9/10/1974	9/16/1974	96		6		+1	57	10	5		Drinking	Store	
VDMME - 90	Wintergreen	Burner Well Drlg	Air Rotary	10/28/1975	11/1/1975	319		6		+1.5	79	20	4.5	10	Supply	Golf Course Maintenance Shop	
VDMME - 93	Lovingston	Falwell Well Corp.	Air Rotary	11/3/1975	11/6/1975	280							Abandoned				
VDMME - 94	Lovingston	Falwell Well Corp.	Air Rotary	11/7/1975	11/17/1975	240		6		0	52	2	8			Bank	160-200
VDMME - 110	Wintergreen - #16	Burner Well Drlg	Air Rotary	10/28/1980	11/6/1980	345	43	8	Steel	+1.5	64	15	47.1	48	Drinking		69-75
																	84-85
																	90-91
																	130-133
																	190-190.5
																	212-218
VDMME - 111	Wintergreen - #17	Burner Well Drlg	Air Rotary	11/7/1980	11/12/1980	218	20	8	Steel	+1.3	50.75		31.1	48	Drinking	Ski Maintenance Shop	191-198
VDMME - 112		Fred Jones Well Co.	Air Rotary	2/84/87	3/5/1987	305	96	6	Steel	0	96		15 - natural				Intake - 295
NCHD 162-98-0198 Tax Parcel #4-A-27	Rt. 6 - See Map					180							6-8		Domestic		
NCHD 162-93-0046 Tax Parcel #4-A-49	See Map														Domestic		
NCDH 162-00-0323 Tax Parcel #4-A-57	Off Rt 151 - See Map					200							6		Domestic		
NCDH *** Tax Parcel #4-A-58	Off Rt 151 - See Map														Domestic		
NCDH 162-00-0071 Tax Parcel #4-A-60	Off Rt 151 - See Map														Domestic		
NCDH 162-95-0012 Tax Parcel #6-A-46C	Off Rt 639 - See Map					70							10-12		Domestic		
NCDH 162-92-0229 Tax Parcel #6-A-93	Off Rt 151 - See Map					100							10		Domestic		

NOTES:

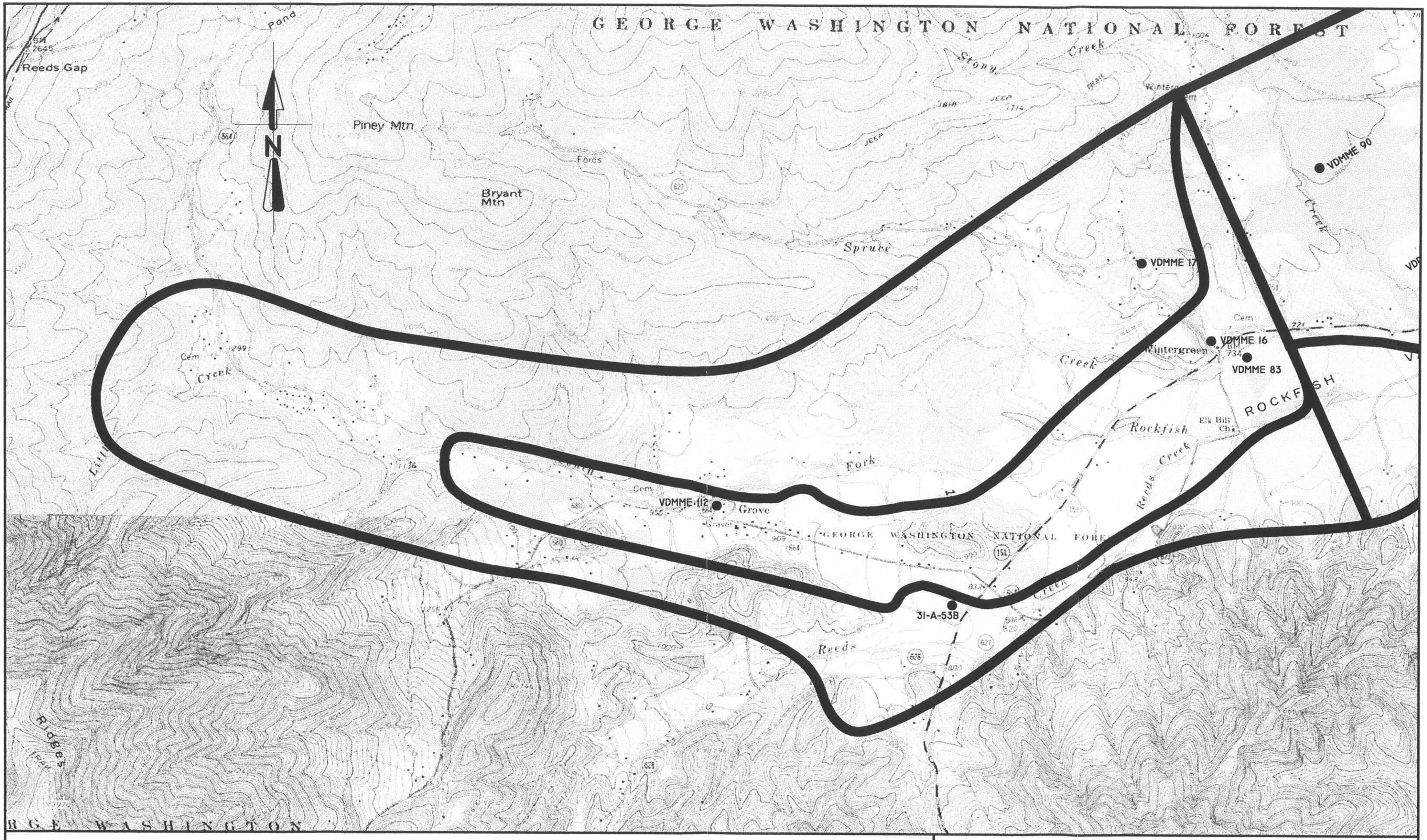
VDMME - Virginia Department of Mines, Minerals and Energy
NCDH - Nelson County Health Department

TABLE 1, CONTINUED
SUMMARY OF WATER WELL DATA
ROUTE 151/ROUTE 664 CORRIDOR
NELSON COUNTY, VA

								CASING				WATER					
LOCATION DESIGNATION	LOCATION	DRILLER	DRILLING METHOD	DATE STARTED	DATE COMPLETED	TOTAL DEPTH ft	DEPTH TO BEDRX ft	ID INCHES	TYPE	FROM ft	TO ft	STATIC UNPUMPED ft	STABILIZED YIELD gpm	TIME hrs	USE	TYPE OF FACILITY	WATER ZONES TO/FROM ft
NCDH 162-98-0155 Tax Parcel #6-A-93B	See Map					120							10		Domestic		
NCDH 162-94-0184 Tax Parcel #6-A-158	See Map					155							20		Domestic		
NCDH 162-97-0193 Tax Parcel #6-A-163	Off Rt 151 - See Map					305							15		Cemetary		
NCDH 162-92-100 Tax Parcel #7-A-2	Off Rt 151 - See Map					305							1		Domestic		
NCDH 162-99-0201 Tax Parcel #12-A-79	See Map					400							2		Domestic		
NCDH 162-97-106 Tax Parcel #12-A-106	See Map					180							8		Bank		
NCDH 162-96-0027 Tax Parcel #12-A-129A	Off Rt 151 - See Map														Domestic		
NCDH C162-99-0127 Tax Parcel #12-A-131B	See Map					285							5		Domestic		
NCDH 162-95-0093 Tax Parcel #12-A-132	Off Rt 151 - See Map														Domestic		
NCDH 162-97-0028 Tax Parcel #12-A-134	See Map					230							5		Domestic		
NCDH 162--95-0181 Tax Parcel #12-A-149	See Map												Spring		Domestic		
NCDH 162-96-0048 Tax Parcel #12-7-1	See Map					125							12-15		Domestic		
NCDH 162-00-0162 Tax Parcel #21-7-2A	Off Rt 151 - See Map					105							30		Domestic		
NCDH 162-95-0235 Tax Parcel #21-11-D	See Map					205							6		Domestic		
NCDH 162-93-0288 Tax Parcel #22-A-6C	See Map					231							8		Domestic		
NCDH 162-94-0212 Tax Parcel #22-A-33	Off Rt. 612 - See Map														Domestic		
NCDH 162-*** Tax Parcel #22-A-41-A	Off Rt. 613 - See Map														Domestic		
NCDH 162-*** Tax Parcel #22-A-44C	See Map					305							10		Domestic		
NCDH 162-99-?? Tax Parcel #31-A-53B	Off Rt 151 - See Map					230							40		Domestic		
SCV - 22	Stoney Creek Village		Air Rotary	5-86	5-86	297		8	Steel	0	70		52	48	Public	Resiential Water Supply	
SCV - 23	Stoney Creek Village		Air Rotary	5-86	5-86	297		6	Steel	0	49.5		28	48	Public	Resiential Water Supply	
SCV - 24	Stoney Creek Village		Air Rotary	5-86	5-86	297		8	Steel	0	50		89	48	Public	Resiential Water Supply	
SCV - 25	Stoney Creek Village		Air Rotary	5-86	5-86	220		8	Steel	0	58		45	48	Public	Resiential Water Supply	
SCV - 26	Stoney Creek Village		Air Rotary	5-86	5-86	93		8	Steel	0	56		68	48	Public	Resiential Water Supply	
RRES - 1	Rockfish River Elementary School		Air Rotary	9-96	9-96	405			Steel	0	64		30	48	Public	School	
RRES - 3	Rockfish River Elementary School		Air Rotary	9-96	9-96	405			Steel	0	60		10	48	Public	School	

NOTES:

NCDH - Nelson County Health Department
SCV - Stoney Creek Village
RRES - Rockfish River Elementary School



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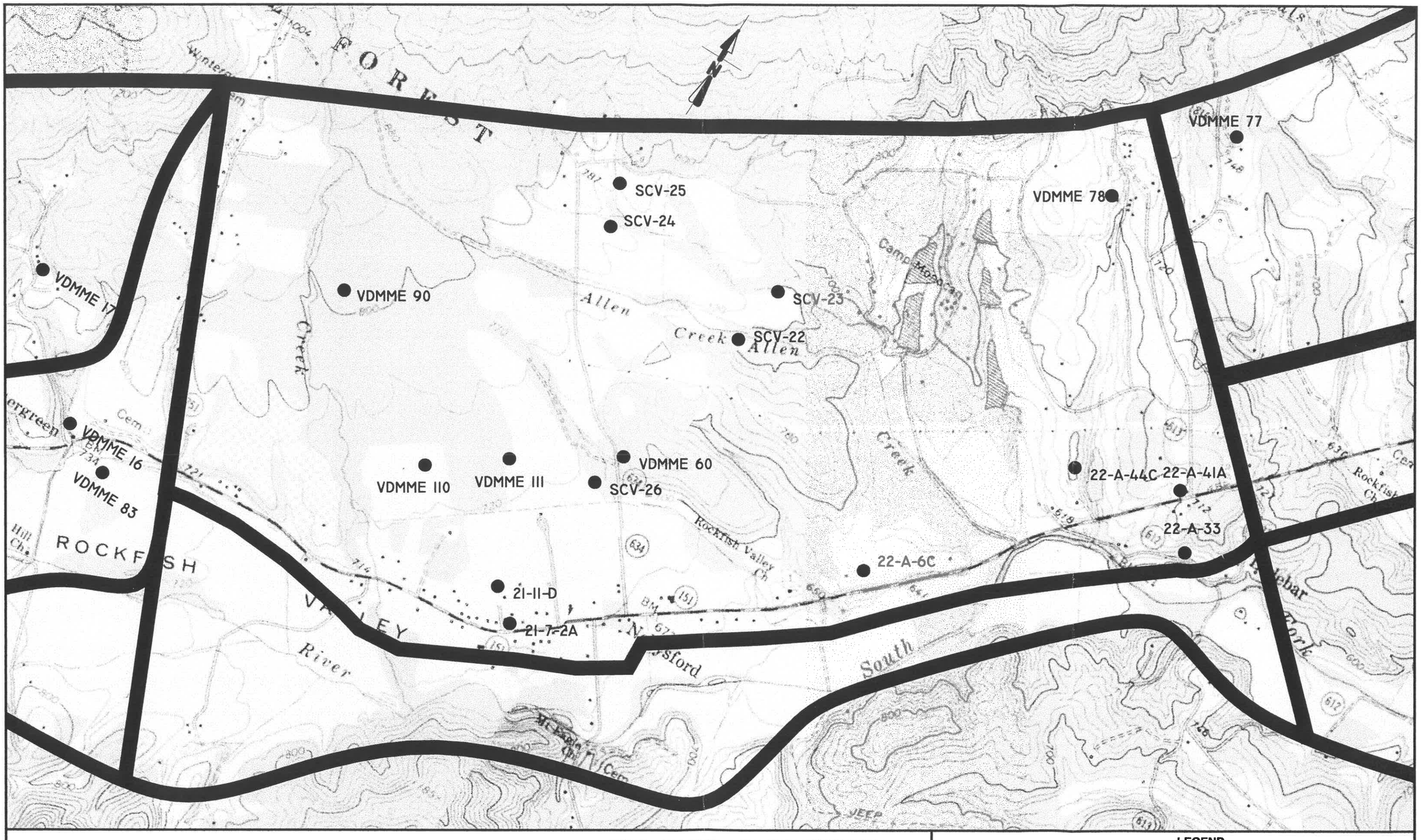
EXISTING WELLS LOCATION MAP
BEECH GROVE SERVICE AREA

SCALE: 1" = 1800'

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- VDMME 90 / 31-A-53B — EXISTING WELL



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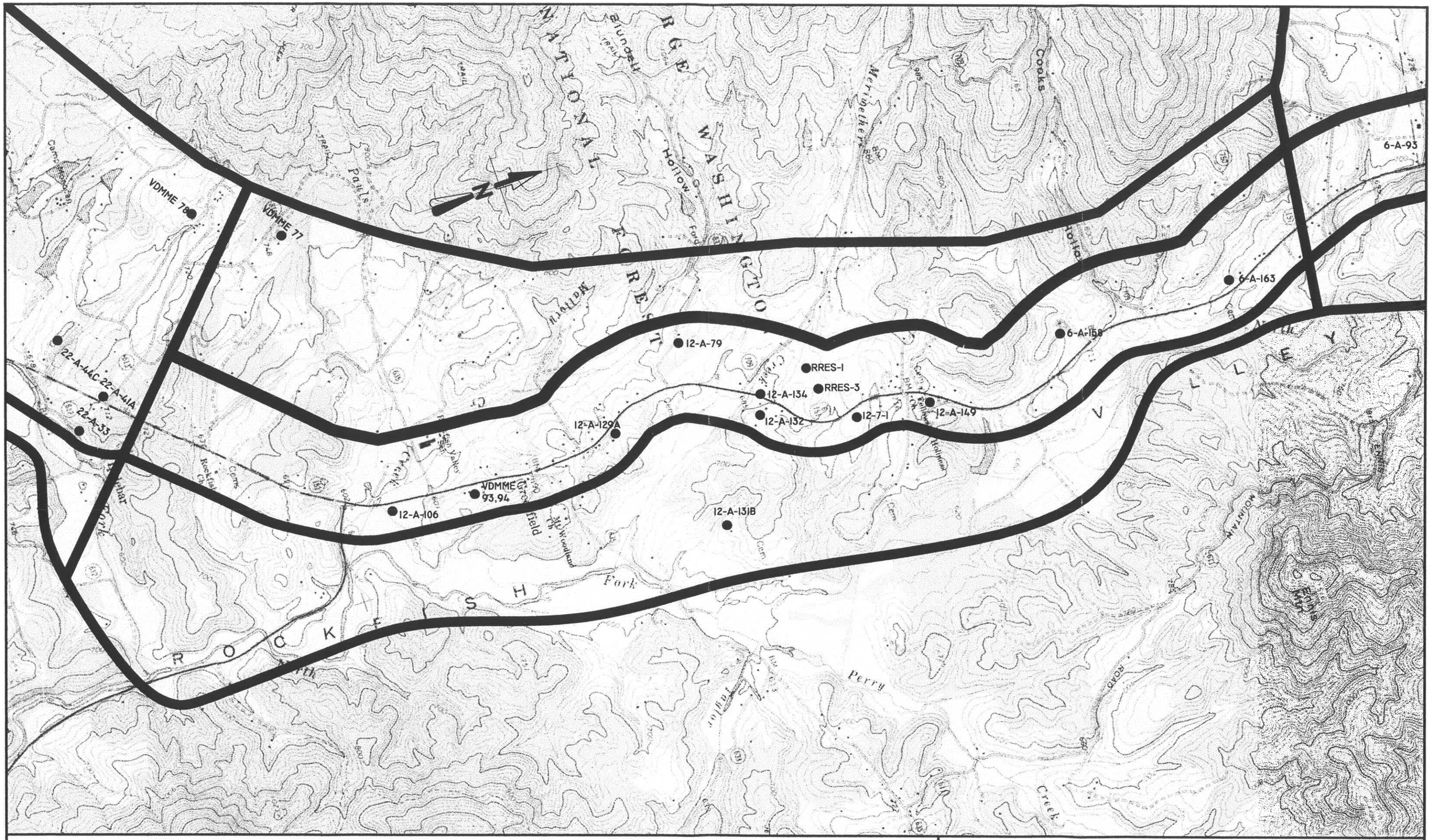
EXISTING WELLS LOCATION MAP
NELLYSFORD SERVICE AREA

SCALE: 1" = 1200'

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- VDMME 90 / 31-A-53B — EXISTING WELL



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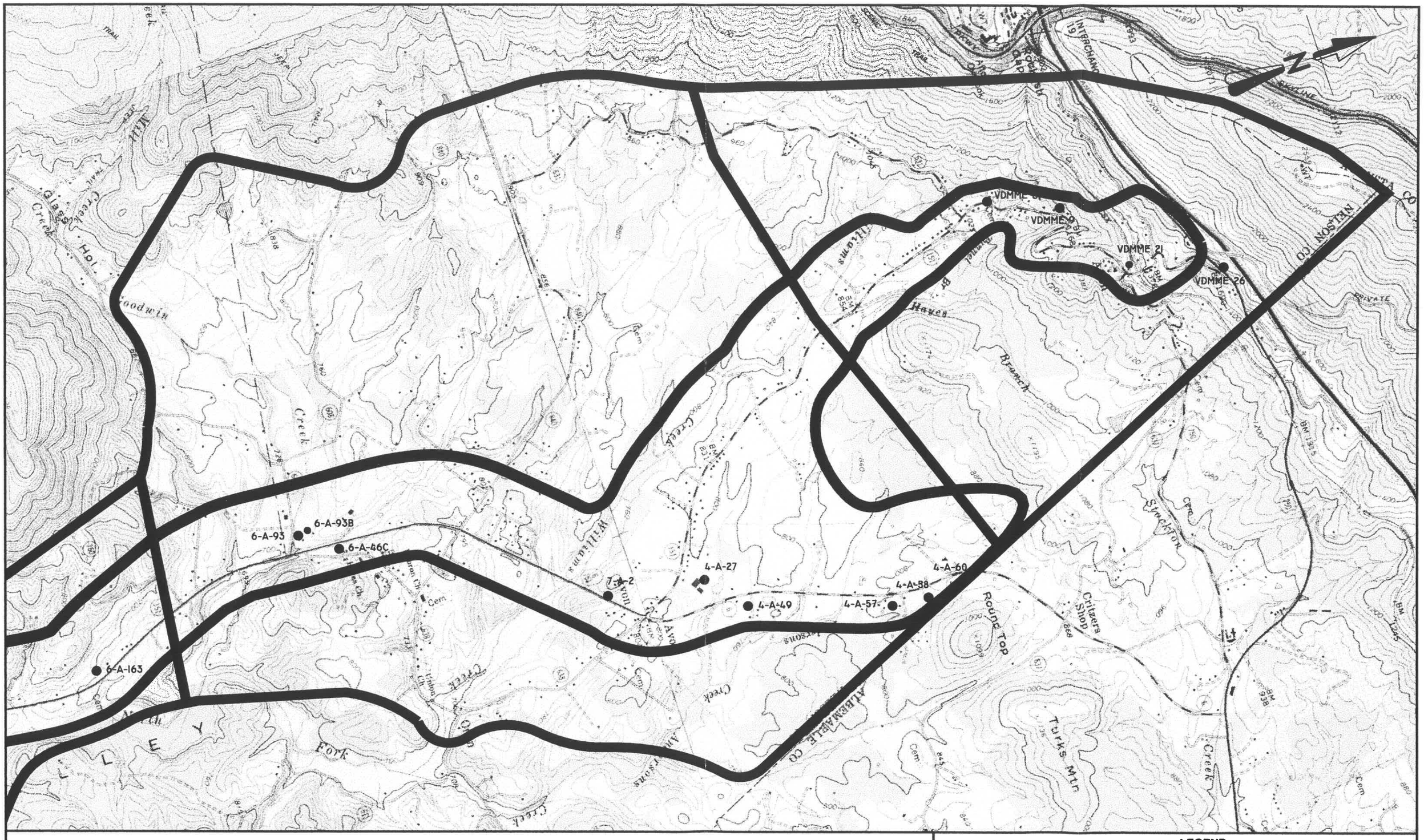
EXISTING WELLS LOCATION MAP
ROCKFISH / CENTRAL SERVICE AREA
SCALE: 1" = 1800'

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- VDMME 90 / 31-A-53B — EXISTING WELL



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EXISTING WELLS LOCATION MAP
AVON / AFTON SERVICE AREA
SCALE: 1" = 1800'

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- VDMME 90 / 31-A-53B — EXISTING WELL

3.3 Groundwater Quality

Very limited water quality information could be obtained. Two ground water quality reports were available for Wells 24 and 25. Nitrate/nitrite (as nitrogen) sampling and analyses were performed in May 1996 and April 1997. Volatile organic compound (VOC) sampling was also performed in May 1996. The ground water sample was collected from a tap on a water storage tank that received water from Wells 24 and 25. Nitrate/nitrate was reported at concentrations of 0.25 and 0.36 (no units were recorded, nor were certificates of analyses included) from the May 1996 and April 1997 sampling events, respectively. No VOCs were detected in the May 1996 sampling event. Based on correspondence from the Virginia Department of Environmental Quality (VDEQ), analytical results from both sampling events indicated "compliance with all primary maximum contamination levels".

Based upon previous experience in the eastern Blue Ridge – western Piedmont Physiographic Provinces, naturally occurring elevated iron and manganese levels may occur in the Bedrock Aquifer. Coliform bacteria may occur locally in the Water Table Aquifer in residential and commercial areas served by septic systems and livestock areas, but is less likely to occur in the Bedrock Aquifer.

4.0 FRACTURE TRACE ANALYSIS

The highest yielding wells in the Blue Ridge and Western Piedmont regions of Virginia are typically those that penetrate extensive, water-saturated fracture zones present within the bedrock. A fracture trace analysis utilizes aerial photographs to detect linear stream segments, tonal changes in soils and the occurrence of certain types of vegetation which can be attributed to extensive fracturing in the bedrock. Once these features are detected, well sites are selected with respect to fracture trace frequency, intersection of fractures, potential for surface water recharge, and local geologic conditions.

A fracture trace analysis was performed using a series of aerial photographs obtained from the Virginia Department of Transportation (VDOT). A composite of 15 different aerial photographs from a November 8, 1999 flight, enlarged to a 1 inch = 500 feet scale, was used in the analysis. VDOT aerial photographs were not available for the areas north of Avon or west of Wintergreen. Consequently, only a limited number of fracture traces were identified in these areas using topographic maps.

As shown in Table 1, fracture trends are predominantly oriented in a northwest direction. Fracture locations are shown on the four (4) accompanying figures. The greatest number of fractures were identified in the Beech Grove area, where northwest trends are significantly greater in number. Fracture trends for the entire study area appear to occur in the following perpendicular to sub-perpendicular sets:

- North 0 – 20 degrees East / North 70 – 90 degrees West (76 fractures)
- North 40 – 60 degrees East / North 30 –60 degrees West (127 fractures)
- North 70 – 90 degree East / North 10 – 30 degrees West (102 fractures)

Many of the mapped fractures are greater than ½ -mile in length, and in fact some range from approximately 1 to 3 miles in length. The large number of fractures identified and their greater than typical lengths are likely to result in increased well yields. Increased well yields are also likely where the fracture intensity (number of fractures) increases significantly.

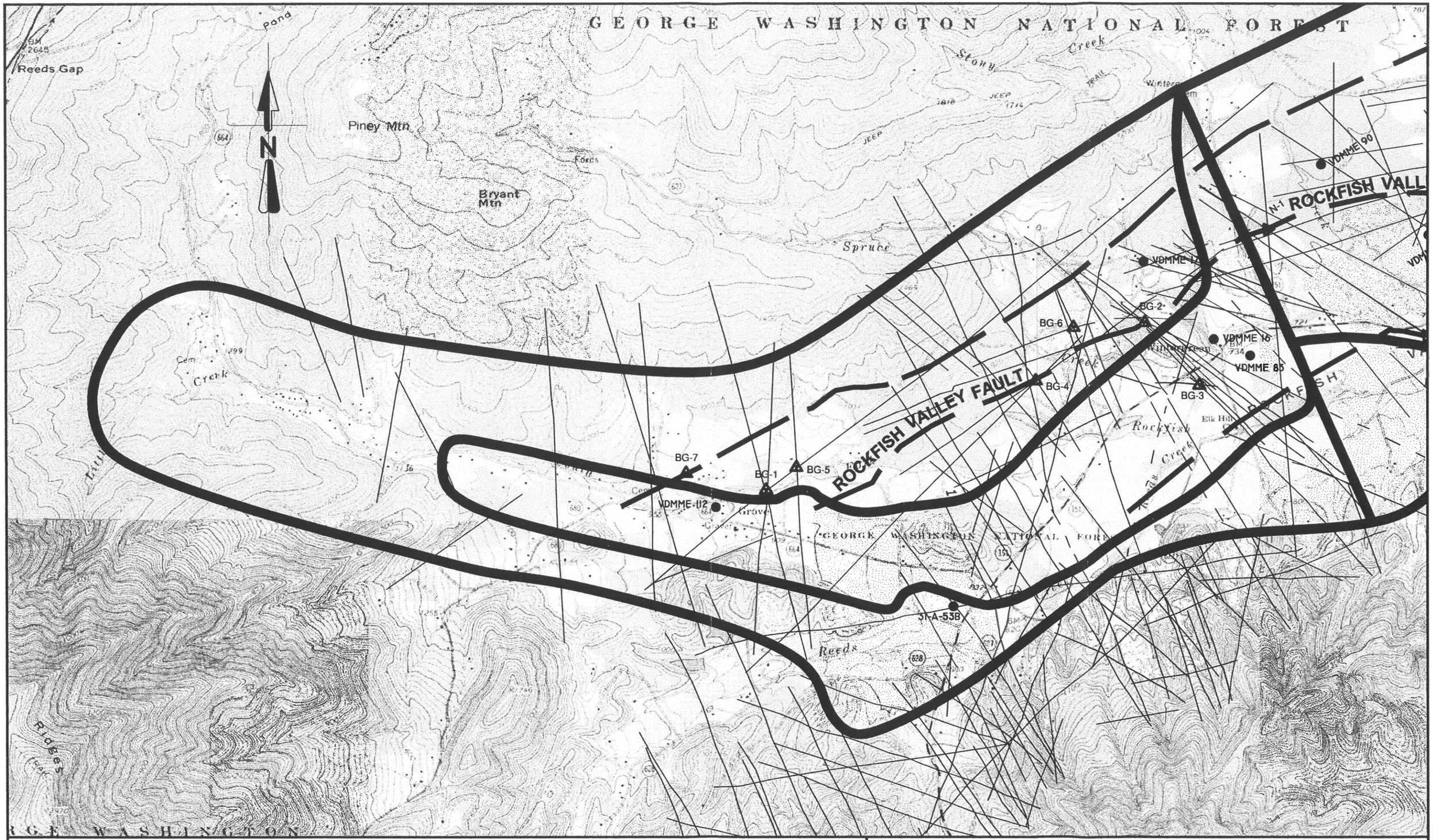
Fracture traces were field confirmed to eliminate possible mapping of gas and power line easements, fence lines, roads or large animal paths. The local geology was field verified and found to be consistent with the geologic maps prepared by Bartholomew and Gathright, Heinka, Sullivan.

TABLE 2
FRACTURE TRACE SUMMARY
ROCKFISH VALLEY CORRIDOR
NELSON COUNTY, VIRGINIA

TREND	SERVICE AREA				
	Beech Grove	**Nellysford**	**Rockfish**	**Avon/Afton**	
N 0-10 E	5	1	8	4	18
N 11-20 E	6	2	0	7	15
N 21-30E	1	1	0	1	3
N 31-40 E	1	0	3	0	4
N 41-50E	2	0	8	1	11
N 51-60E	4	0	10	5	19
N 61-70E	2	0	2	4	8
N 71-80 E	2	4	5	4	15
N 81-90 E	5	10	13	8	36
Subtotal	28	18	49	34	129
N 0-10 W	8	4	2	3	17
N 11-20 W	15	4	2	0	21
N 21-30 W	26	2	2	0	30
N 31-40 W	6	2	2	4	14
N 41-50 W	14	5	7	5	31
N 51-60 W	5	7	13	4	29
N 61-70 W	10	6	12	9	37
N 71-80 W	12	2	6	2	22
N 81-90 W	3	2	12	4	21
Subtotal	99	34	58	31	222
Total	127	52	107	65	351

Notes:

* N 0-10 E = 0 to 10 degrees to the northeast
* There was no VDOT aerial photography coverage to the west of Wintergreen along Route 644 nor to the north and west of Avon.



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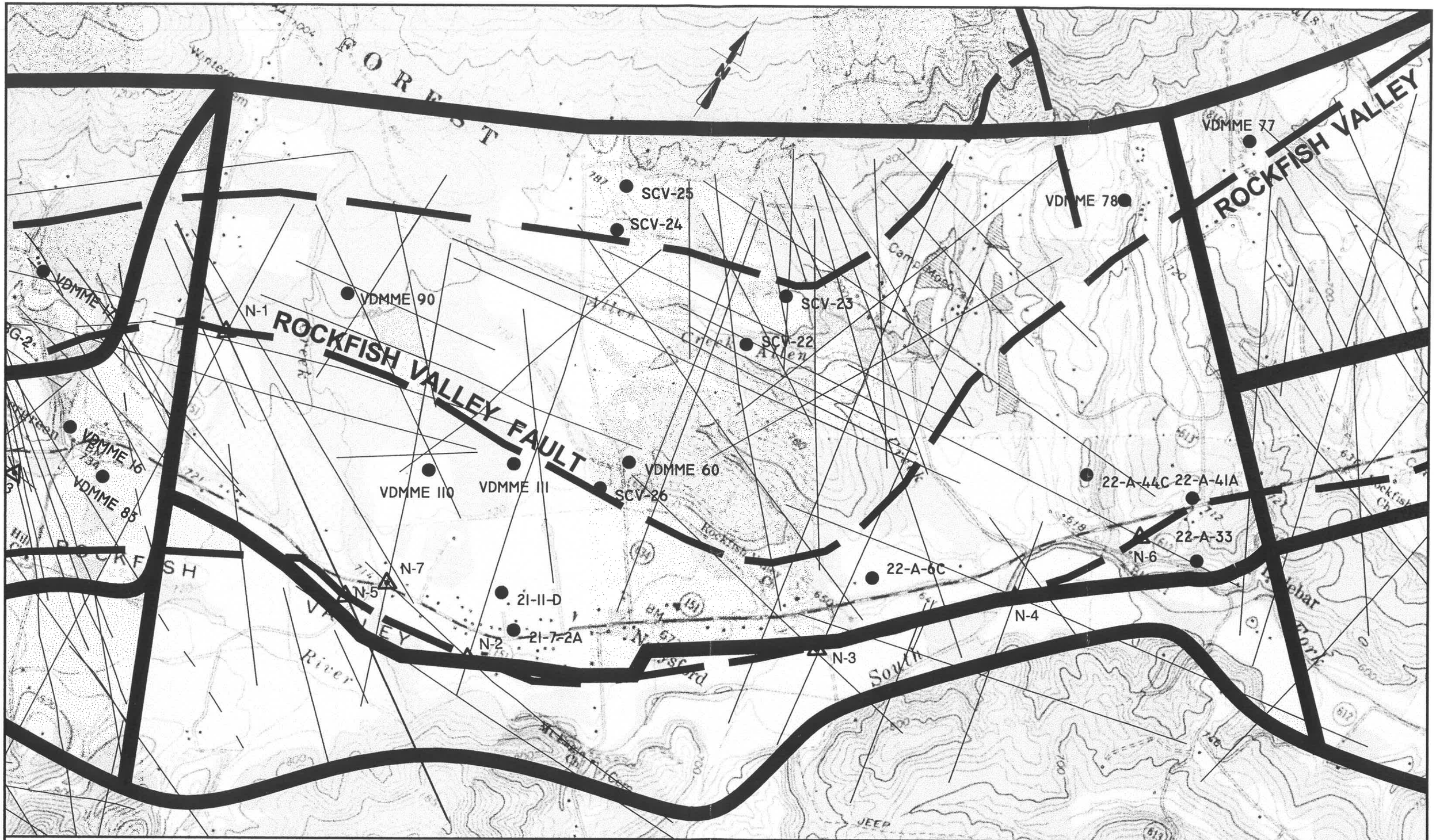
FRACTURE TRACES - PROPOSED WELL LOCATIONS
BEECH GROVE SERVICE AREA

SCALE: 1" = 1800'

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- BG-1 PROPOSED WELL LOCATION BEECH GROVE SERVICE AREA
- ROCKFISH VALLEY FAULT
- MAPPED FRACTURE TRACES



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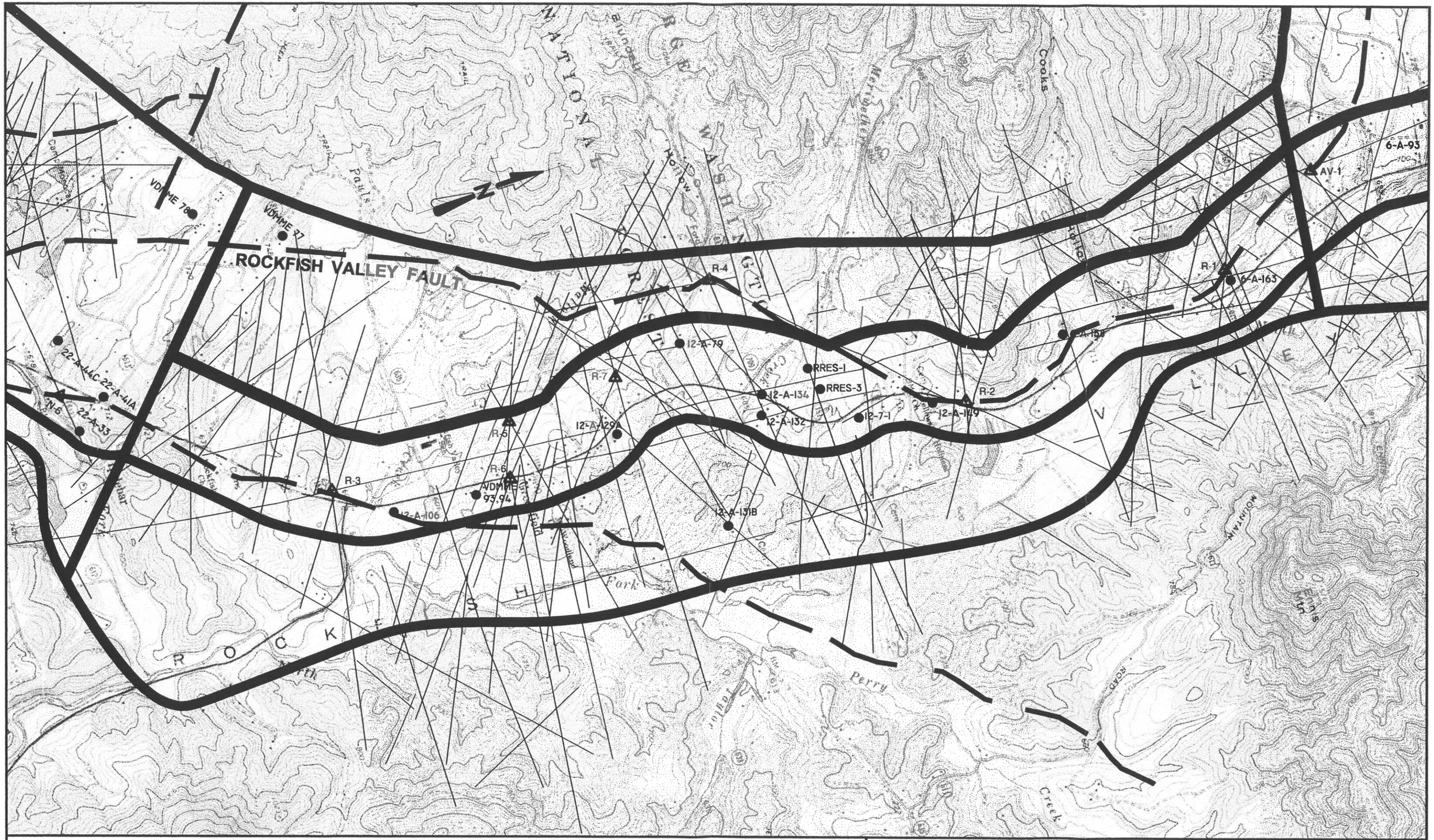
FRACTURE TRACES - PROPOSED WELL LOCATIONS
NELLYSFORD SERVICE AREA

SCALE: 1" = 1200'

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- N-1 PROPOSED WELL LOCATION NELLYSFORD SERVICE AREA
- ROCKFISH VALLEY FAULT
- MAPPED FRACTURE TRACES



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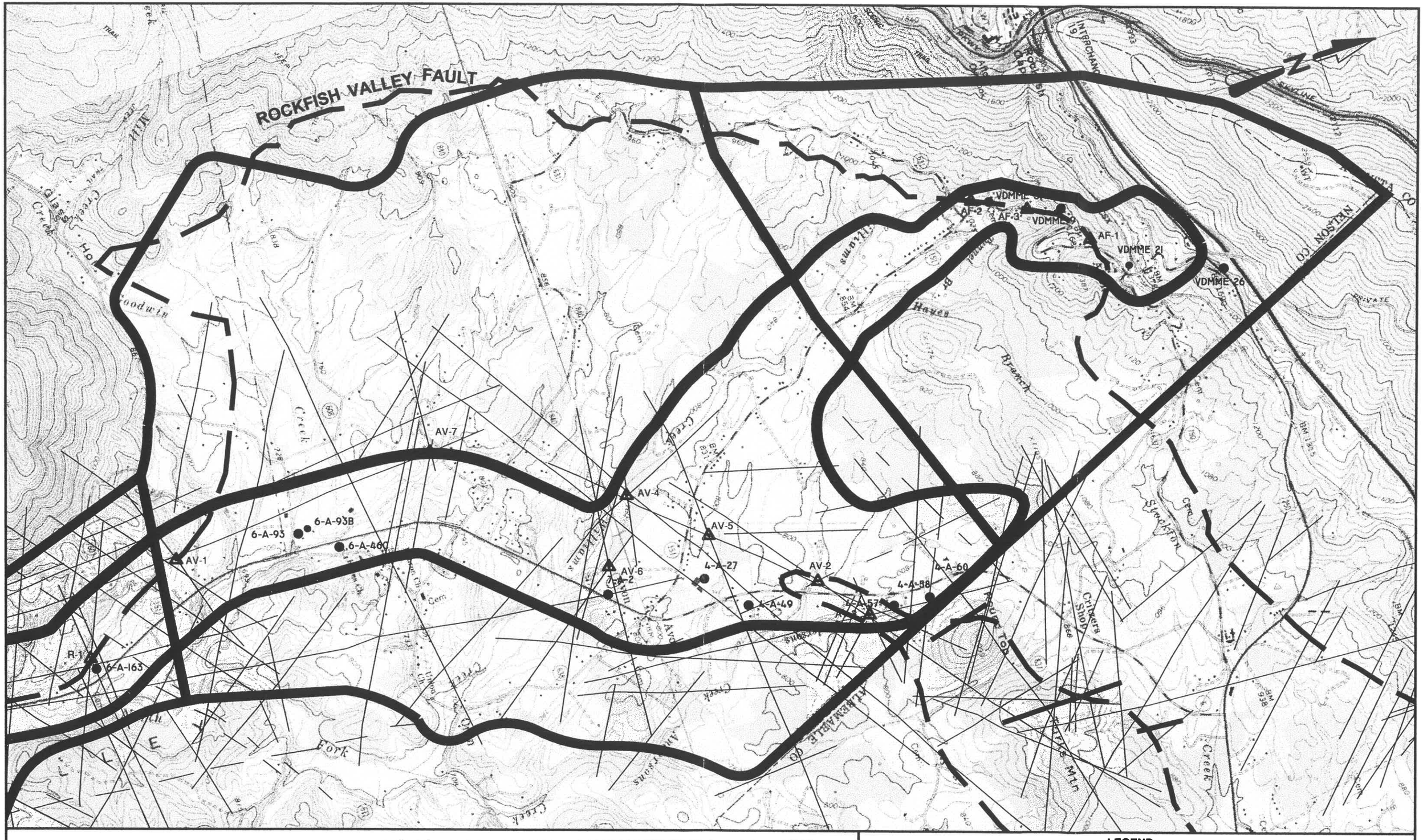
FRACTURE TRACES - PROPOSED WELL LOCATIONS
ROCKFISH / CENTRAL SERVICE AREA

SCALE: 1" = 1800'

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- R-1 PROPOSED WELL LOCATION ROCKFISH / CENTRAL SERVICE AREA
- ROCKFISH VALLEY FAULT
- MAPPED FRACTURE TRACES



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FRACTURE TRACES - PROPOSED WELL LOCATIONS
AVON / AFTON SERVICE AREA

SCALE: 1" = 1800'

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- AV-1 — PROPOSED WELL LOCATION AVON SERVICE AREA
- AF-1 — PROPOSED WELL LOCATION AFTON SERVICE AREA
- ROCKFISH VALLEY FAULT
- MAPPED FRACTURE TRACES

5.0 RECOMMENDED WELL LOCATIONS

5.1 Proposed Sites for Drilling

Based upon the results of the fracture trace analysis and the subsequent field reconnaissance, 31 proposed well sites have been identified. These sites are located throughout the study area. The sites have been selected based upon the abundance of intersecting fracture traces and the presence of faults. The underlying bedrock is suspected to be fractured and more permeable than areas "outside" the fault network. Locations with respect to proposed or future water line routes were also considered. Many of the well sites are located in undeveloped areas, which allows for appropriate wellhead protection as development increases along the Rockfish Valley Corridor. Only a limited number of sites are near commercial development and residences, where detrimental environmental impacts from surface activities are potentially possible.

The proposed well sites are numbered in order of preference with Site 1 being the most favorable location and Site 7 being the least favorable location. Based upon the abundance of fractures mapped in the study area, a low number such as 7 is still considered favorable for well development. The proposed well sites, which are shown on the figures after Table 2 (Section 4.0), have been grouped into the four service areas identified below.

- Beech Grove Service Area - Seven (7) well locations (BG-1 through BG-7) are proposed.
- Nellysford Service Area – Seven (7) proposed well locations (N-1 through N-7) are identified.
- Rockfish Service Area – Seven (7) well locations (R-1 through R-7) are proposed.
- Avon / Afton Service Areas – Seven (7) well locations (AV-1 through AV-7) have been identified for the Avon area. Only three (3) have been identified for the Afton area. Based upon the mountainous topography and a much smaller groundwater recharge area than the other service areas, it may be difficult to obtain favorable well yields in the Afton service area.

5.2 Well Development Potential in Other Areas

The proposed well sites were selected based upon fracture frequency, fault locations, and general site conditions. The fracture trace analysis has identified numerous fractures, which were not selected, but may also be favorable for possible well construction, especially if development is proposed in an area where fractures exist and a proposed well site was not identified. In such an instance, it is recommended that a

qualified hydrogeologist evaluate the local hydrogeologic conditions and select a specific well site.

There are a limited number of high yielding wells (20 to 40 gpm) in the area and an alternative to drilling a new well, may be to consider purchasing and upgrading an existing well to meet VDH public water supply well requirements. If considering an existing well, it is important that the well meet the VDH casing and grouting requirements. If retrofitting is required to meet VDH standards, a cost-benefit analysis is recommended. It may prove more cost effective to drill and properly construct a new well near an existing high capacity well, than to retrofit the existing well.

5.3 Limitations of Drilling Fracture Traces

While attempting to successfully locate wells in rock formations similar to those in the study area, it is imperative that the wells be drilled within the limits of the mapped fracture traces and faults. This is especially true in areas where fracturing is limited and local in occurrence. In such a setting, wells offset as little as 50 feet from the desired locations can result in much lower yields and even "dry holes". This is usually not a problem when the water bearing fractures extend vertically into the bedrock (i.e., 45 degrees from horizontal), it is possible to drill a mapped fracture trend and not penetrate the water bearing portion of the fracture.

Based upon the geologic data for the area and also the results of the fracture trace analysis, much of the study area appears to be fractured. This geologic condition increases the potential for higher than average well yields, even if wells are not drilled directly into a fracture trace. However, the potential for highest yields, still exists when wells are drilled on fracture traces, especially intersecting fracture traces.

5.4 Well Considerations

When drilling water supply wells, there are a number of factors, which should be considered.

a. All well sites must be approved by the Virginia Department of Health prior to drilling.

b. To avoid potential groundwater contamination, public water supply wells should not be located near fueling facilities, landfills, or facilities whose activities have the potential for releasing materials which might impact groundwater quality.

c. Wells should be drilled by a reputable well drilling contractor with experience in the area. It is advisable to request well construction bids prior to entering into a contract.

d. Wells should be drilled initially as test wells in order to minimize costs, should undesirable yields or water quality be encountered. Most well drilling contractors drill a minimum 6-inch diameter well, which is generally acceptable for the well yields normally encountered. However, the VDH has indicated that at least a Class II B well is required by the Health Department for a central water system. As such, the borehole will have to be reamed to a larger diameter in order to set and grout the outer casing.

e. A hydrogeologic consultant should be either on site during drilling or available for consultation with respect to the conditions encountered and well termination depths. Based upon the local hydrogeologic setting, the most favorable well yields at the site are anticipated at depths of 200 to 500 feet. If favorable quantities of water are not encountered at these depths. Deeper drilling may not increase the potential of developing the desired yields.

f. Once favorable yields are encountered, an aquifer pump test should be performed in accordance with Department of Health requirements. A minimum 48 hour test is required for central water systems and it is advised to extend the pumping test to a longer time period if drawdowns are not approaching equilibrium. This provides assurance that an extensive, saturated fracture network has been encountered rather than an isolated pocket of water.

g. Water quality tests must be performed in accordance with Department of Health regulations. Such samples are typically obtained during aquifer pump testing.

h. Design of an efficient well includes the selection of a properly sized pump and setting of pump bowls or intake in the well.

i. The study area is not located in a Commonwealth of Virginia Ground Water Management Area. Consequently, ground water withdrawal permits are not required.

j. It is recommended that public water supply wells be constructed, so that groundwater level measurements can be taken on a scheduled basis. These measurements can be used to evaluate the long term yield of the fractured bedrock aquifer and whether groundwater management policies need to be implemented, as groundwater demands increase in the future.

6.0 SUMMARY OF FINDINGS AND CONCLUSIONS

The May 1998 "Report of Evaluation and Appraisal for the Wintergreen Stoney Creek Village Water and Sewer Systems" addressed the existing groundwater supply system (5 wells) in that area. The current groundwater supply study addresses a much larger area. It characterizes the area hydrogeology, updates the existing well database information, characterizes groundwater quality, includes a detailed fracture trace (photolineament) analysis, and identifies and ranks recommended well locations. A summary of the study findings and conclusions are presented below.

1. The study area is underlain by igneous, metamorphic, and sedimentary rocks including unconsolidated sediments.

2. Local geologic structure, the Rockfish Valley Fault network, has a significant impact on the water-bearing capacity of these units. The highest potential well yields (25 to 50 gpm and perhaps up to 100 gpm locally) exist within the more extensively fractured and faulted bedrock formations. In the absence of such features, low well yields of 1 to 2 gpm and even dry wells occur. Well records obtained for 49 wells indicate yields ranging from 1 to 89 gpm for wells constructed to depths of 69 to 675 feet.

3. Well yields greater than 25 gpm occurred in six (6) wells at depths of 200 to 300 feet. Five (5) of these wells are part of the Stoney Creek Development water system.

4. An important aspect of groundwater development is groundwater recharge or replenishment of water removed from the subsurface. The estimated groundwater recharge potential for the 25.5 square mile study area is approximately 7.3 million gallons per day (mgd). It is estimated that approximately 15 to 20 percent of this recharge, or approximately 1.1 to 1.4 mgd, may be available for groundwater development. However, this can only be confirmed through a test well drilling and aquifer test program.

5. Very little groundwater quality data was available. Groundwater from bedrock wells in areas not densely populated is expected to be suitable for public water supply use. Naturally occurring iron and manganese concentrations may be elevated locally.

6. The fracture trace analysis identified approximately 351 fracture traces in the study area. Interconnected faults and fracture zones represent potential subsurface water-bearing intervals within bedrock. The abundance of mapped fractures and their length (many greater than ½ - mile and a number from 1-3 miles long) represent favorable conditions for developing high yielding wells, generally from 25 to 50 gpm and potentially in the range of 50 to 100 gpm.

7. Based upon the results of the fracture trace analysis, 31 proposed well sites were identified; seven (7) each in the Beech Grove, Nellysford, Rockfish, and Avon service areas and three (3) in the Afton service area. They are ranked numerically in order of preference with Site 1 most preferred and Site 7 least preferred. Based on the abundance of the fractures mapped, a site ranking of 7 is still a favorable location. The analysis identified numerous fractures that were not selected, but may also be favorable for possible well construction.

8. Anticipated depths for proposed wells range from 200 to 500 feet.

9. The potential for developing favorable yielding well in the Afton service area is considered very limited due to the mountainous topography and the small groundwater recharge area.

7.0 LIMITATIONS

This report has been prepared in accordance with generally accepted hydrogeologic practices. No other warranty, either expressed or implied, is made. Our conclusions and recommendations are based on information provided to us, the review of published data, and our site observations. We cannot be responsible for information provided by others. The conclusions and recommendations presented have taken into consideration possible variations in hydrogeologic conditions, however, unanticipated variations may still exist. In performing this well location study, no guarantees with respect to well yields or water quality are made. However, scientific technology acceptable to the ground water industry and hydrogeologic profession has been used in selecting potentially favorable locations for developing satisfactory well yields and water quality.

Appendix III

Cost Estimates

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
Nellysford Cost Estimate Summary

Prepared by: MAL

Project	Phase/Option	NCSA Total	Customer Total	Total Project Estimate *
Nellysford Alternative 1: Enhanced On-Site Treatment	(Sewer Only)	$ 481,000	$ 24,000	**$ 505,000**
Nellysford Alternative 2: Obtain Water and Sewer from Stoney Creek	Phase 1, Option A (Gravity)	$ 560,000	$ 26,400	**$ 586,000**
	Phase 2, Option A (Gravity)	$ 813,000	$ 30,360	**$ 843,000**
	Phase 3, Option A (Gravity)	$ 1,928,000	**	**$ 1,928,000**
	Subtotals for Gravity Option:	*$ 3,301,000*	*$ 56,760*	***$ 3,357,760***
	Phase 1, Option B (Force Main)	$ 376,000	$ 168,000	**$ 544,000**
	Phase 2, Option B (Force Main)	$ 572,000	$ 193,200	**$ 765,000**
	Phase 3, Option B (Force Main)	$ 1,002,000	**	**$ 1,002,000**
	Subtotals for Force Main Option:	*$ 1,950,000*	*$ 361,200*	***$ 2,311,200***
Nellysford Alternative 3: Develop Independent Water and Sewer Systems in Nellysford	Phase 1, Option A (Gravity)	$ 1,367,000	$ 26,400	**$ 1,393,000**
	Phase 2, Option A (Gravity)	$ 979,000	$ 30,360	**$ 1,009,000**
	Phase 3, Option A (Gravity)	$ 2,017,000	**	
	Subtotals for Gravity Option:	*$ 4,363,000*	*$ 56,760*	***$ 2,402,000***
	Phase 1, Option B (Force Main)	$ 1,125,000	$ 168,000	**$ 1,293,000**
	Phase 2, Option B (Force Main)	$ 738,000	$ 193,200	**$ 931,000**
	Phase 3, Option A (Gravity)	$ 1,264,000	**	
	Subtotals for Force Main Option:	*$ 3,127,000*	*$ 361,200*	***$ 3,488,200***
Nellysford Alternative 4: Nellysford Residents with Problem Drainfields Become Stoney Creek Customers	*Assumption is that capital cost for expansion would be shared by County and Stoney Creek. However, this has not yet been negotiated.*			
Nellysford Alternative 5: Purchase the Stoney Creek Water and Sewer System and Expand to Nellysford	Phase 1, Option A (Gravity)	$ 560,000	$ 26,400	**$ 586,000**
	Phase 2, Option A (Gravity	$ 813,000	$ 30,360	**$ 843,000**
	Phase 3, Option A (Gravity)	$ 1,928,000	**	**$ 1,928,000**
	Subtotals for Gravity Option:	*$ 3,301,000*	*$ 56,760*	***$ 3,357,760***
	Phase 1, Option B (Force Main)	$ 376,000	$ 168,000	**$ 544,000**
	Phase 2, Option B (Force Main)	$ 572,000	$ 193,200	**$ 765,000**
	Phase 3, Option B (Force Main)	$ 1,002,000	**	**$ 1,002,000**
	Subtotals for Force Main Option:	*$ 1,950,000*	*$ 361,200*	***$ 2,311,200***
	The water and sewer cost would be the same as Nellysford Alternative 2. The system purchase price would have to be negotiated, and would likely involve the assumption of Debt Service on the part of Nelson County and/or NCSA.			

Note 1: Legal, Administration, and Easement Costs are not included
****Note 2: Total Customer Cost for Phase 3 cannot be determined at this time. See breakdowns for typical unit costs for force main and gravity systems.***

Nelson County Service Authority
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1/28/01

Nellysford Alternative 1 - Enhanced On-Site Treatment

	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	Pump Tank for Dosing	20	EA	$ 1,800.00	$ 36,000
3	Pretreatment Unit (Mechanical aeration)	20	EA	$ 12,000.00	$ 240,000
4	Misc. Piping per dwelling	20	EA	$ 500.00	$ 10,000
5	Electrical Hookup	20	EA	$ 800.00	$ 16,000
6	Subsurface Distribution System per home	20	EA	$ 3,000.00	$ 60,000
Water					
	Customers Continue to use private wells				$ -
				NCSA Subtotal:	$ 362,000
				20% Contingency:	$ *72,400*
				8% Engineering:	$ *28,960*
				3% Inspection:	$ *10,860*
				2% Mobilization/Demobilization:	$ *7,240*
				NCSA TOTAL:	**$ 481,000**
Sewer					
7	4-inch PVC Lateral	1000	LF	$ 20	$ 20,000
Water					
	N/A				$ -
				CUSTOMER Subtotal:	$ 20,000
				20% Contingency:	$ *4,000*
				CUSTOMER Total:	**$ 24,000**
				Total (NCSA + Customer) Project Cost:	**$ 505,000**

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
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Prepared By: MAL/BLJ
1/28/01

Nellysford Alternative 2 - Obtain Water and Sewer from Stoney Creek Phase 1 (Option A - Gravity Sewer)

	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	12-inch Gravity Sewer	3000	LF	$ 45	$ 135,000
2	Standard Manholes	11	EA	$ 4,000	$ 44,000
3	6-inch PVC lateral stubs	20	EA	$ 800	$ 16,000
4	Road Boring	10	EA	$ 3,000	$ 30,000
Water					
1	12-inch PVC Water Main	3000	LF	$ 35	$ 105,000
2	PRV and Master Meter Vault	1	LS	$ 30,000	$ 30,000
3	Fire Hydrants	5	EA	$ 2,500	$ 12,500
4	12" Valves	3	EA	$ 1,500	$ 4,500
5	Install Water Service by Jacking	10	EA	$ 800	$ 8,000
6	Water Meter Assembly	20	EA	$ 300	$ 6,000
Misc					
1	Erosion Control/Restoration	3000	LF	$ 10.00	$ 30,000
				NCSA Subtotal:	$ 421,000
				20% Contingency:	$ *84,200*
				8% Engineering:	$ *33,680*
				3% Inspection:	$ *12,630*
				2% Mobilization/Demobilization:	$ *8,420*
				NCSA TOTAL:	**$ 560,000**
Sewer					
5	4-inch PVC Lateral	1000	LF	$ 12	$ 12,000
Water					
7	3/4-inch PE Service Pipe	1000	LF	$ 6	$ 6,000
8	Locate and Connect to Existing Well Service Line	20	EA	$ 200	$ 4,000
				CUSTOMER Subtotal:	$ 22,000
				20% Contingency:	$ *4,400*
				CUSTOMER Total:	**$ 26,400**
				Total (NCSA + Customer) Project Cost:	**$ 586,000**

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Nellysford Alternative 2 - Obtain Water and Sewer from Stoney Creek
Phase 1 (Option B - Force Main)

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	6-inch Force Main	3000	LF	$ 25	$ 75,000
2	Locate and Connect to Existing House Connection	20	EA	$ 200	$ 4,000
3	Jack Service Across Road	10	EA	$ 800	$ 8,000
Water					
1	12-inch PVC Water Main	3000	LF	$ 35	$ 105,000
2	PRV and Master Meter Vault	1	LS	$ 30,000	$ 30,000
3	Fire Hydrants	5	EA	$ 2,500	$ 12,500
4	12" Valves	3	EA	$ 1,500	$ 4,500
5	Install Water Service by Jacking	10	EA	$ 800	$ 8,000
6	Water Meter Assembly	20	EA	$ 300	$ 6,000
Misc					
1	Erosion Control/Restoration	3000	LF	$ 10.00	$ 30,000
				NCSA Subtotal:	$ 283,000
				20% Contingency:	$ *56,600*
				8% Engineering:	$ *22,640*
				3% Inspection:	$ *8,490*
				2% Mobilization/Demobilization:	$ *5,660*
				NCSA TOTAL:	**$ 376,000**
Sewer					
4	1 1/4-inch PE Service Pipe	1000	LF	$ 10	$ 10,000
5	Grinder Pump	20	EA	$ 6,000	$ 120,000
Water					
7	3/4-inch PE Service Pipe	1000	LF	$ 6	$ 6,000
8	Locate and Connect to Existing Well Service Line	20	EA	$ 200	$ 4,000
				CUSTOMER Subtotal:	$ 140,000
				20% Contingency:	$ *28,000*
				CUSTOMER Total:	**$ 168,000**
				Total (NCSA + Customer) Project Cost:	**$ 544,000**

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1/28/01

Nellysford Alternative 2 - Obtain Water and Sewer from Stoney Creek Phase 2 (Option A - Gravity Sewer)

	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	12-inch Gravity Sewer	5000	LF	$ 45	$ 225,000
2	Standard Manholes	17	EA	$ 4,000	$ 68,000
3	6-inch PVC lateral stubs	23	EA	$ 800	$ 18,400
4	Road Boring	11	EA	$ 3,000	$ 33,000
Water					
1	12-inch PVC Water Main	5000	LF	$ 35	$ 175,000
2	Fire Hydrants	8	EA	$ 2,500	$ 20,000
3	12" Valves	4	EA	$ 1,500	$ 6,000
4	Install Water Service by Jacking	11	EA	$ 800	$ 8,800
5	Water Meter Assembly	23	EA	$ 300	$ 6,900
Misc					
1	Erosion Control/Restoration	5000	LF	$ 10.00	$ 50,000
				NCSA Subtotal:	$ 611,100
				20% Contingency:	$ *122,220*
				8% Engineering:	$ *48,888*
				3% Inspection:	$ *18,333*
				2% Mobilization/Demobilization:	$ *12,222*
				NCSA TOTAL:	**$ 813,000**
Sewer					
5	4-inch PVC Lateral	1150	LF	$ 12	$ 13,800
Water					
6	3/4-inch PE Service Pipe	1150	LF	$ 6	$ 6,900
7	Locate and Connect to Existing Well Service Line	23	EA	$ 200	$ 4,600
				CUSTOMER Subtotal:	$ 25,300
				20% Contingency:	$ *5,060*
				CUSTOMER Total:	**$ 30,360**
				Total (NCSA + Customer) Project Cost:	**$ 843,000**

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Nellysford Alternative 2 - Obtain Water and Sewer from Stoney Creek Phase 2 (Option B - Force Main)

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	8-inch Force Main	5000	LF	$ 30	$ 150,000
2	Locate and Connect to Existing House Connection	23	EA	$ 200	$ 4,600
3	Jack Service Across Road	11	EA	$ 800	$ 8,800
Water					
1	12-inch PVC Water Main	5000	LF	$ 35	$ 175,000
2	Fire Hydrants	8	EA	$ 2,500	$ 20,000
3	12" Valves	4	EA	$ 1,500	$ 6,000
4	Install Water Service by Jacking	11	EA	$ 800	$ 8,800
5	Water Meter Assembly	23	EA	$ 300	$ 6,900
Misc					
1	Erosion Control/Restoration	5000	LF	$ 10.00	$ 50,000
				NCSA Subtotal:	$ 430,100
				20% Contingency:	$ *86,020*
				8% Engineering:	$ *34,408*
				3% Inspection:	$ *12,903*
				2% Mobilization/Demobilization:	$ *8,602*
				NCSA TOTAL:	**$ 572,000**
Sewer					
4	1 1/4-inch PE Service Pipe	1150	LF	$ 10	$ 11,500
5	Grinder Pump	23	EA	$ 6,000	$ 138,000
Water					
6	3/4-inch PE Service Pipe	1150	LF	$ 6	$ 6,900
7	Locate and Connect to Existing Well Service Line	23	EA	$ 200	$ 4,600
				CUSTOMER Subtotal:	$ 161,000
				20% Contingency:	$ *32,200*
				CUSTOMER Total:	**$ 193,200**
				Total (NCSA + Customer) Project Cost:	**$ 765,000**

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Nellysford Alternative 2 - Obtain Water and Sewer from Stoney Creek Phase 3 - Serve North of Nellysford (Option A - Gravity)

Item	Description	Quantity	Unit	Unit Price	Total
Water					
1	12-inch PVC Water Main	5700	LF	$ 54	$ 307,800
Sewer					
1	12-inch Sanitary Sewer	5700	LF	$ 58	$ 330,600
2	Standard Manholes	19	EA	$ 4,000	$ 76,000
3	8-inch Force Main	2700	LF	$ 49	$ 132,300
4	1 mgd Suction Lift Pump Station	1	LS	$ 300,000	$ 300,000
5	Upgrade Stoney Creek WWTP	65000	Gal	$ 5	$ 325,000
				Subtotal:	**$ 1,471,700**
				20% Contingency:	*$ 294,340*
				8% Engineering:	*$ 117,736*
				3% Inspection:	*$ 44,151*
				Total Project Cost:	**$ 1,928,000**

Nellysford Alternative 2 - Obtain Water and Sewer from Stoney Creek Phase 3 - Serve North of Nellysford (Option B - Force Main)

Item	Description	Quantity	Unit	Unit Price	Total
Water					
1	12-inch PVC Water Main	5700	LF	$ 54	$ 307,800
Sewer					
1	8-inch Force Main	2700	LF	$ 49	$ 132,300
5	Upgrade Stoney Creek WWTP	65000	Gal	$ 5	$ 325,000
				Subtotal:	**$ 765,100**
				20% Contingency:	*$ 153,020*
				8% Engineering:	*$ 61,208*
				3% Inspection:	*$ 22,953*
				Total Project Cost:	**$ 1,002,000**

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1/28/01

Nellysford Alternative 3 - Independent Nellysford System
Phase 1 (Option A - Gravity Sewer)

	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	12-inch Gravity Sewer	3000	LF	$ 45	$ 135,000
2	Standard Manholes	11	EA	$ 4,000	$ 44,000
3	6-inch PVC lateral stubs	20	EA	$ 800	$ 16,000
4	Road Boring	10	EA	$ 3,000	$ 30,000
5	Package WWTP (25,000 gpd)	1	LS	$ 300,000	$ 300,000
Water					
1	12-inch PVC Water Main	3000	LF	$ 35	$ 105,000
2	Fire Hydrants	5	EA	$ 2,500	$ 12,500
3	12" Valves	3	EA	$ 1,500	$ 4,500
4	Install Water Service by Jacking	10	EA	$ 800	$ 8,000
5	Water Meter Assembly	20	EA	$ 300	$ 6,000
6	Develop new wells	2	EA	$ 100,000	$ 200,000
7	6-inch Water Line to Wells	2000	LF	$ 25	$ 50,000
8	10,000 gallon pressure tanks	2	EA	$ 15,000	$ 30,000
Misc					
1	Erosion Control/Restoration	8700	LF	$ 10.00	$ 87,000
				NCSA Subtotal:	$ 1,028,000
				20% Contingency:	$ *205,600*
				8% Engineering:	$ *82,240*
				3% Inspection:	$ *30,840*
				2% Mobilization/Demobilization:	$ *20,560*
				NCSA TOTAL:	**$ 1,367,000**
Sewer					
6	4-inch PVC Lateral	1000	LF	$ 12	$ 12,000
Water					
9	3/4-inch PE Service Pipe	1000	LF	$ 6	$ 6,000
10	Locate and Connect to Existing Well Service Line	20	EA	$ 200	$ 4,000
				CUSTOMER Subtotal:	$ 22,000
				20% Contingency:	$ *4,400*
				CUSTOMER Total:	**$ 26,400**
				Total (NCSA + Customer) Project Cost:	**$ 1,393,000**

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Nellysford Alternative 3 - Independent Nellysford System
Phase 1 (Option B - Force Main)

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	6-inch Force Main	3000	LF	$ 25	$ 75,000
2	Locate and Connect to Existing House Connection	20	EA	$ 200	$ 4,000
3	Jack Service Across Road	10	EA	$ 800	$ 8,000
4	Package WWTP (25,000 gpd)	1	LS	$ 300,000	$ 300,000
Water					
1	12-inch PVC Water Main	3000	LF	$ 35	$ 105,000
2	Fire Hydrants	9	EA	$ 2,500	$ 22,500
3	12" Valves	5	EA	$ 1,500	$ 7,500
4	Install Water Service by Jacking	10	EA	$ 800	$ 8,000
5	Water Meter Assembly	20	EA	$ 300	$ 6,000
6	Develop new wells	2	EA	$ 100,000	$ 200,000
7	6-inch Water Line to Wells	2000	LF	$ 25	$ 50,000
8	10,000 gallon pressure tanks	2	EA	$ 15,000	$ 30,000
Misc					
1	Erosion Control/Restoration	3000	LF	$ 10.00	$ 30,000
				NCSA Subtotal:	$ 846,000
				20% Contingency:	*$ 169,200*
				8% Engineering:	*$ 67,680*
				3% Inspection:	*$ 25,380*
				2% Mobilization/Demobilization:	*$ 16,920*
				NCSA TOTAL:	**$ 1,125,000**
Sewer					
4	1 1/4-inch PE Service Pipe	1000	LF	$ 10	$ 10,000
5	Grinder Pump	20	EA	$ 6,000	$ 120,000
Water					
9	3/4-inch PE Service Pipe	1000	LF	$ 6	$ 6,000
10	Locate and Connect to Existing Well Service Line	20	EA	$ 200	$ 4,000
				CUSTOMER Subtotal:	$ 140,000
				20% Contingency:	*$ 28,000*
				CUSTOMER Total:	**$ 168,000**
				Total (NCSA + Customer) Project Cost:	**$ 1,293,000**

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Nellysford Alternative 3 - Independent Nellysford System
Phase 2 (Option A - Gravity Sewer)

	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	12-inch Gravity Sewer	5000	LF	$ 45	$ 225,000
2	Standard Manholes	17	EA	$ 4,000	$ 68,000
3	6-inch PVC lateral stubs	23	EA	$ 800	$ 18,400
4	Road Boring	11	EA	$ 3,000	$ 33,000
Water					
1	12-inch PVC Water Main	5000	LF	$ 35	$ 175,000
2	Fire Hydrants	8	EA	$ 2,500	$ 20,000
3	12" Valves	4	EA	$ 1,500	$ 6,000
4	Develop New Well	1	LS	$ 100,000	$ 100,000
5	6-inch Well Piping	1000	LF	$ 25	$ 25,000
6	Install Water Service by Jacking	11	EA	$ 800	$ 8,800
7	Water Meter Assembly	23	EA	$ 300	$ 6,900
Misc					
1	Erosion Control/Restoration	5000	LF	$ 10.00	$ 50,000
				NCSA Subtotal:	$ 736,100
				20% Contingency:	*$ 147,220*
				8% Engineering:	*$ 58,888*
				3% Inspection:	*$ 22,083*
				2% Mobilization/Demobilization:	*$ 14,722*
				NCSA TOTAL:	**$ 979,000**
Sewer					
5	4-inch PVC Lateral	1150	LF	$ 12	$ 13,800
Water					
8	3/4-inch PE Service Pipe	1150	LF	$ 6	$ 6,900
9	Locate and Connect to Existing Well Service Line	23	EA	$ 200	$ 4,600
				CUSTOMER Subtotal:	$ 25,300
				20% Contingency:	*$ 5,060*
				CUSTOMER Total:	**$ 30,360**
				Total (NCSA + Customer) Project Cost:	**$ 1,009,000**

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Nellysford Alternative 3 - Independent Nellysford System Phase 2 (Option B - Force Main)

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	8-inch Force Main	5000	LF	$ 30	$ 150,000
2	Locate and Connect to Existing House Connection	23	EA	$ 200	$ 4,600
3	Jack Service Across Road	11	EA	$ 800	$ 8,800
Water					
1	12-inch PVC Water Main	5000	LF	$ 35	$ 175,000
2	Fire Hydrants	8	EA	$ 2,500	$ 20,000
3	12" Valves	4	EA	$ 1,500	$ 6,000
4	Develop New Well	1	LS	$ 100,000	$ 100,000
5	6-inch Well Piping	1000	LF	$ 25	$ 25,000
6	Install Water Service by Jacking	11	EA	$ 800	$ 8,800
7	Water Meter Assembly	23	EA	$ 300	$ 6,900
Misc					
1	Erosion Control/Restoration	5000	LF	$ 10.00	$ 50,000
				NCSA Subtotal:	$ 555,100
				20% Contingency:	*$ 111,020*
				8% Engineering:	*$ 44,408*
				3% Inspection:	*$ 16,653*
				2% Mobilization/Demobilization:	*$ 11,102*
				NCSA TOTAL:	**$ 738,000**
Sewer					
4	1 1/4-inch PE Service Pipe	1150	LF	$ 10	$ 11,500
5	Grinder Pump	23	EA	$ 6,000	$ 138,000
Water					
8	3/4-inch PE Service Pipe	1150	LF	$ 6	$ 6,900
9	Locate and Connect to Existing Well Service Line	23	EA	$ 200	$ 4,600
				CUSTOMER Subtotal:	$ 161,000
				20% Contingency:	*$ 32,200*
				CUSTOMER Total:	**$ 193,200**
				Total (NCSA + Customer) Project Cost:	**$ 931,000**

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Nellysford Alternative 3 - Independent Nellysford System
Phase 3 - Serve North of Nellysford (Option A - Gravity)

Item	Description	Quantity	Unit	Unit Price	Total
Water					
1	12-inch PVC Water Main	5700	LF	$ 54	$ 307,800
2	Add Additional Wells	2	LS	$ 100,000	$ 200,000
Sewer					
1	12-inch Sanitary Sewer	5700	LF	$ 58	$ 330,600
2	Standard Manholes	19	EA	$ 4,000	$ 76,000
3	8-inch Force Main	2700	LF	$ -	$ -
4	1 mgd Suction Lift Pump Station	1	LS	$ 300,000	$ 300,000
5	Upgrade WWTP	65000	Gal	$ 5	$ 325,000
				Subtotal:	**$ 1,539,400**
				20% Contingency:	*$ 307,880*
				8% Engineering:	*$ 123,152*
				3% Inspection:	*$ 46,182*
				Total Project Cost:	**$ 2,017,000**

Nellysford Alternative 3 - Independent Nellysford System
Phase 3 - Serve North of Nellysford (Option B - Force Main)

Item	Description	Quantity	Unit	Unit Price	Total
Water					
1	12-inch PVC Water Main	5700	LF	$ 54	$ 307,800
2	Add Additional Wells	2	LS	$ 100,000	$ 200,000
Sewer					
1	8-inch Force Main	2700	LF	$ 49	$ 132,300
2	Upgrade WWTP	65000	Gal	$ 5	$ 325,000
				Subtotal:	**$ 965,100**
				20% Contingency:	*$ 193,020*
				8% Engineering:	*$ 77,208*
				3% Inspection:	*$ 28,953*
				Total Project Cost:	**$ 1,264,000**

Prepared by: MAL

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
Beech Grove Cost Estimate Summary

Project	Phase/Option	NCSA Total	Customer Total	Total Project Estimate *
Beech Grove - Connect to Nellysford Water and Sewer Systems	Phase 1	$ 737,000	$ 84,000	**$ 821,000**
	Phase 2, Option A (Gravity)	$ 2,141,000	$ 26,640	**$ 2,168,000**
	Phase 3, Option A (Gravity)	$ 1,012,000	$ 453,360	**$ 1,465,000**
	Subtotals for Gravity Option:	*$ 3,890,000*	*$ 564,000*	***$ 4,454,000***
	Phase 1	$ 737,000	$ 84,000	**$ 821,000**
	Phase 2, Option B (Force Main)	$ 1,871,000	$ 288,600	**$ 2,160,000**
	Phase 3, Option B (Force Main)	$ 617,000	$ 453,360	**$ 1,070,000**
	Subtotals for Force Main Option:	*$ 3,225,000*	*$ 825,960*	***$ 4,050,960***
Beech Grove - Develop Independent Water and Sewer Systems	Phase 1	$ 1,355,000	$ 13,200	**$ 1,368,000**
	Phase 2, Option A (Gravity)	$ 2,141,000	$ 26,640	**$ 2,168,000**
	Phase 3, Option A (Gravity)	$ 1,012,000	$ 453,360	**$ 1,465,000**
	Subtotals for Gravity Option:	*$ 4,508,000*	*$ 493,200*	***$ 5,001,200***
	Phase 1	$ 1,355,000	$ 13,200	**$ 1,368,000**
	Phase 2, Option B (Force Main)	$ 1,871,000	$ 288,600	**$ 2,160,000**
	Phase 3, Option B (Force Main)	$ 617,000	$ 453,360	**$ 1,070,000**
	Subtotals for Force Main Option:	*$ 3,843,000*	*$ 755,160*	***$ 4,598,160***

Note 1: Legal, Administration, and Easement Costs are not included

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Prepared By: MAL/BLJ
1/28/01

Beech Grove Alternative 1 - Connect to Nellysford Service Area Phase 1 (Only Consider Force Main Option)

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	8-inch Force Main	3600	LF	$ 30	$ 108,000
2	Locate and Connect to Existing House Connection	10	EA	$ 200	$ 2,000
3	Jack Service Across Road	3	EA	$ 800	$ 2,400
Water					
1	Develop New Well	1	LS	$ 100,000	$ 100,000
2	6-inch Piping to Well	4000	LF	$ 25	$ 100,000
3	12-inch PVC Water Main	3600	LF	$ 35	$ 126,000
4	Fire Hydrants	12	EA	$ 2,500	$ 30,000
5	12" Valves	3	EA	$ 1,500	$ 4,500
6	Install Water Service by Jacking	3	EA	$ 800	$ 2,400
7	Water Meter Assembly	10	EA	$ 300	$ 3,000
Misc					
1	Erosion Control/Restoration	7600	LF	$ 10.00	$ 76,000
				NCSA Subtotal:	$ 554,300
				20% Contingency:	$ *110,860*
				8% Engineering:	$ *44,344*
				3% Inspection:	$ *16,629*
				2% Mobilization/Demobilization:	$ *11,086*
				NCSA TOTAL:	**$ 737,000**
Sewer					
4	1 1/4-inch PE Service Pipe	500	LF	$ 10	$ 5,000
5	Grinder Pump	10	EA	$ 6,000	$ 60,000
Water					
8	3/4-inch PE Service Pipe	500	LF	$ 6	$ 3,000
9	Locate and Connect to Existing Well Service Line	10	EA	$ 200	$ 2,000
				CUSTOMER Subtotal:	$ 70,000
				20% Contingency:	$ *14,000*
				CUSTOMER Total:	**$ 84,000**
				Total (NCSA + Customer) Project Cost:	**$ 821,000**

* Note: Requires that Phase 1A/1B and Phase 2A/2B of the Nellysford Service Area be constructed.

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
Preliminary Cost Estimates

Prepared By: MAL/BLJ
1/28/01

Beech Grove Alternative 2 - Independent Water/Sewer System Phase 1 (Only Consider Gravity Option)

	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	Package Wastewater Plant (Assumes 25,000 GPD)	1	LS	$ 300,000	$ 300,000
2	12-inch Gravity Sewer	3600	LF	$ 45	$ 162,000
3	Standard Manholes	12	EA	$ 4,000	$ 48,000
4	6-inch PVC lateral stubs	10	EA	$ 800	$ 8,000
5	Road Boring	3	EA	$ 3,000	$ 9,000
Water					
1	30,000 Gallon Water Storage Tank	1	LS	$ 50,000	$ 50,000
2	Develop New Well	1	LS	$ 100,000	$ 100,000
3	6-inch Piping to Well	4000	LF	$ 25	$ 100,000
4	12-inch PVC Water Main	3600	LF	$ 35	$ 126,000
5	Fire Hydrants	12	EA	$ 2,500	$ 30,000
6	12" Valves	3	EA	$ 1,500	$ 4,500
7	Install Water Service by Jacking	3	EA	$ 800	$ 2,400
8	Water Meter Assembly	10	EA	$ 300	$ 3,000
Misc					
1	Erosion Control/Restoration	7600	LF	$ 10.00	$ 76,000
				NCSA Subtotal:	$ 1,018,900
				20% Contingency:	*$ 203,780*
				8% Engineering:	*$ 81,512*
				3% Inspection:	*$ 30,567*
				2% Mobilization/Demobilization:	*$ 20,378*
				NCSA TOTAL:	**$ 1,355,000**
Sewer					
6	4-inch PVC Lateral	500	LF	$ 12	$ 6,000
Water					
9	3/4-inch PE Service Pipe	500	LF	$ 6	$ 3,000
10	Locate and Connect to Existing Well Service Line	10	EA	$ 200	$ 2,000
				CUSTOMER Subtotal:	$ 11,000
				20% Contingency:	*$ 2,200*
				CUSTOMER Total:	**$ 13,200**
				Total (NCSA + Customer) Project Cost:	**$ 1,368,000**

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
Preliminary Cost Estimates

Prepared By: MAL/BLJ
1/28/01

Beech Grove Phase 2 (Either Initial Alternative Phase 1)
Option A - Gravity Sewer

	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	12-inch Gravity Sewer	5500	LF	$ 45	$ 247,500
2	Standard Manholes	18	EA	$ 4,000	$ 72,000
3	6-inch PVC lateral stubs	37	EA	$ 800	$ 29,600
4	Road Boring	12	EA	$ 3,000	$ 36,000
Water					
1	500,000 Gallon Water Storage Tank	1	LS	$ 300,000	$ 300,000
2	Develop New Well	1	LS	$ 100,000	$ 100,000
3	6-inch Piping to Well	400	LF	$ 25	$ 10,000
4	12-inch PVC Water Main	15500	LF	$ 35	$ 542,500
5	Fire Hydrants	26	EA	$ 2,500	$ 65,000
6	12" Valves	12	EA	$ 1,500	$ 18,000
7	PRV and Master Meter Vault	1	LS	$ 30,000	$ 30,000
Misc					
1	Erosion Control/Restoration	15900	LF	$ 10.00	$ 159,000
				NCSA Subtotal:	$ 1,609,600
				20% Contingency:	$ *321,920*
				8% Engineering:	$ *128,768*
				3% Inspection:	$ *48,288*
				2% Mobilization/Demobilization:	$ *32,192*
				NCSA TOTAL:	**$ 2,141,000**
Sewer					
5	4-inch PVC Lateral	1850	LF	$ 12	$ 22,200
				CUSTOMER Subtotal:	$ 22,200
				20% Contingency:	$ *4,440*
				CUSTOMER Total:	**$ 26,640**
				Total (NCSA + Customer) Project Cost:	**$ 2,168,000**

* Note: It is assumed that Phase 2 water will also require the construction of the Phase 3 infrastructure, to provide ample fire protection & additional well supply.

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
Preliminary Cost Estimates

Prepared By: MAL/BLJ
1/28/01

Beech Grove Phase 2 (Either Initial Alternative Phase 1) Option B - Force Main

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	8-inch Force Main	5500	LF	$ 30	$ 165,000
2	Locate and Connect to Existing House Connection	37	EA	$ 200	$ 7,400
3	Jack Service Across Road	12	EA	$ 800	$ 9,600
Water					
1	500,000 Gallon Water Storage Tank	1	LS	$ 300,000	$ 300,000
2	Develop New Well	1	LS	$ 100,000	$ 100,000
3	6-inch Piping to Well	400	LF	$ 25	$ 10,000
4	12-inch PVC Water Main	15500	LF	$ 35	$ 542,500
5	Fire Hydrants	26	EA	$ 2,500	$ 65,000
6	12" Valves	12	EA	$ 1,500	$ 18,000
7	PRV and Master Meter Vault	1	LS	$ 30,000	$ 30,000
Misc					
1	Erosion Control/Restoration	15900	LF	$ 10.00	$ 159,000
				NCSA Subtotal:	$ 1,406,500
				20% Contingency:	$ *281,300*
				8% Engineering:	$ *112,520*
				3% Inspection:	$ *42,195*
				2% Mobilization/Demobilization:	$ *28,130*
				NCSA TOTAL:	**$ 1,871,000**
Sewer					
4	1 1/4-inch PE Service Pipe	1850	LF	$ 10	$ 18,500
5	Grinder Pump	37	EA	$ 6,000	$ 222,000
				CUSTOMER Subtotal:	$ 240,500
				20% Contingency:	$ *48,100*
				CUSTOMER Total:	**$ 288,600**
				Total (NCSA + Customer) Project Cost:	**$ 2,160,000**

* Note: It is assumed that Phase 2 water will also require the construction of the Phase 3 infrastructure, to provide ample fire protection & additional well supply.

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
Preliminary Cost Estimates

Prepared By: MAL/BLJ
1/28/01

Beech Grove Phase 3 (Either Initial Alternative Phase 1)
Option A - Gravity Sewer

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	10-inch Gravity Sewer	7500	LF	$ 40	$ 300,000
2	Standard Manholes	25	EA	$ 4,000	$ 100,000
3	6-inch PVC lateral stubs	50	EA	$ 800	$ 40,000
4	Road Boring	25	EA	$ 3,000	$ 75,000
Water					
1	Develop New Well	1	LS	$ 100,000	$ 100,000
2	6-inch Piping to Well	400	LF	$ 25	$ 10,000
3	Install Water Service by Jacking	37	EA	$ 800	$ 29,600
4	Water Meter Assembly	105	EA	$ 300	$ 31,500
Misc					
1	Erosion Control/Restoration	7500	LF	$ 10.00	$ 75,000
				NCSA Subtotal:	$ 761,100
				20% Contingency:	$ *152,220*
				8% Engineering:	$ *60,888*
				3% Inspection:	$ *22,833*
				2% Mobilization/Demobilization:	$ *15,222*
				NCSA TOTAL:	**$ 1,012,000**
Sewer					
5	1 1/4-inch PE Service Pipe	2500	LF	$ 10	$ 25,000
6	Grinder Pump	50	EA	$ 6,000	$ 300,000
Water					
5	3/4-inch PE Service Pipe	5300	LF	$ 6	$ 31,800
6	Locate and Connect to Existing Well Service Line	105	EA	$ 200	$ 21,000
				CUSTOMER Subtotal:	$ 377,800
				20% Contingency:	$ *75,560*
				CUSTOMER Total:	**$ 453,360**
				Total (NCSA + Customer) Project Cost:	**$ 1,465,000**

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
Preliminary Cost Estimates

Prepared By: MAL/BLJ
1/28/01

Beech Grove Phase 3 (Either Initial Alternative Phase 1)
Option B - Force Main

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	6-inch Force Main	7500	LF	$ 25	$ 187,500
2	Locate and Connect to Existing House Connection	50	EA	$ 200	$ 10,000
3	Jack Service Across Road	25	EA	$ 800	$ 20,000
Water					
1	Develop New Well	1	LS	$ 100,000	$ 100,000
2	6-inch Piping to Well	400	LF	$ 25	$ 10,000
3	Install Water Service by Jacking	37	EA	$ 800	$ 29,600
4	Water Meter Assembly	105	EA	$ 300	$ 31,500
Misc					
1	Erosion Control/Restoration	7500	LF	$ 10.00	$ 75,000
				NCSA Subtotal:	$ 463,600
				20% Contingency:	*$ 92,720*
				8% Engineering:	*$ 37,088*
				3% Inspection:	*$ 13,908*
				2% Mobilization/Demobilization:	*$ 9,272*
				NCSA TOTAL:	**$ 617,000**
Sewer					
4	1 1/4-inch PE Service Pipe	2500	LF	$ 10	$ 25,000
5	Grinder Pump	50	EA	$ 6,000	$ 300,000
Water					
5	3/4-inch PE Service Pipe	5300	LF	$ 6	$ 31,800
6	Locate and Connect to Existing Well Service Line	105	EA	$ 200	$ 21,000
				CUSTOMER Subtotal:	$ 377,800
				20% Contingency:	*$ 75,560*
				CUSTOMER Total:	**$ 453,360**
				Total (NCSA + Customer) Project Cost:	**$ 1,070,000**

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
Avon/Afton/Long Term Cost Estimate Summary

Prepared by: MAL

Project	Phase/Option	Sewer Total	Water Total	Total Project Estimate *
Avon Water and Sewer System	Phase 1 (Initial System)	$ 2,460,000	$ 2,570,000	**$ 5,030,000**
	Phase 2 (Long Term Plan)	$ 470,000	$ 130,000	**$ 600,000**
	Subtotals:	*$ 2,930,000*	*$ 2,700,000*	***$ 5,630,000***
Avon Water and Sewer System	Phase 1 (Initial System)	$ 950,000	$ 1,260,000	**$ 2,210,000**
	Phase 2 (Long Term Plan)	$ 190,000	n/a	**$ 190,000**
	Subtotals:	*$ 1,140,000*	*$ 1,260,000*	***$ 2,400,000***
Impoundment for Regional Water Service	n/a	n/a	$ 4,930,000	**$ 4,930,000**
Regional WWTP in Nellysford	n/a	$ 5,800,000	n/a	**$ 5,800,000**

Note 1: Legal, Administration, and Easement Costs are not included

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
Preliminary Cost Estimates

Prepared By: MAL/BLJ
1/28/01

Avon Area
*Phase 1 (Initial System)**

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	8-inch Gravity Sewer	12500	LF	$ 48	$ 600,000
2	Manholes	50	EA	$ 4,000	$ 200,000
3	6-inch Force Main	6400	LF	$ 39	$ 249,600
4	Local (100,000 gpd) WWTP	1	LS	$ 800,000	$ 800,000
				Sewer Subtotal:	$ 1,849,600
				20% Contingency:	*$ 369,920*
				8% Engineering:	*$ 147,968*
				3% Inspection:	*$ 55,488*
				2% Mobilization/Demobilization:	*$ 36,992*
				SEWER TOTAL:	**$ 2,460,000**
Water					
1	500,000 gallon Ground Storage Tank	1	LS	$ 300,000	$ 300,000
2	Develop wells	4	EA	$ 100,000	$ 400,000
3	6-inch waterline for wells	4000	LF	$ 39	$ 156,000
4	12-inch Water Main	20000	LF	$ 54	$ 1,080,000
				Water Subtotal:	$ 1,936,000
				20% Contingency:	*$ 387,200*
				8% Engineering:	*$ 154,880*
				3% Inspection:	*$ 58,080*
				2% Mobilization/Demobilization:	*$ 38,720*
				WATER TOTAL:	**$ 2,570,000**
				Total (Water and Sewer) Project Cost:	**$ 5,030,000**

*Note: This "initial system" could be broken up into smaller phases if necessary because of cost constraints.

Avon Area
Phase 2 (Long Term Plan)

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	Abandon WWTP	1	LS	$ 50,000	$ 50,000
2	Avon Pump Station to Regional WWTP	1	LS	$ 300,000	$ 300,000
				Sewer Subtotal:	$ 350,000
				20% Contingency:	*$ 70,000*
				8% Engineering:	*$ 28,000*
				3% Inspection:	*$ 10,500*
				2% Mobilization/Demobilization:	*$ 7,000*
				SEWER TOTAL:	**$ 470,000**
Water					
1	Booster Pump Station (from central water plant)	1	EA	$ 100,000	$ 100,000
				Water Subtotal:	$ 100,000
				20% Contingency:	*$ 20,000*
				8% Engineering:	*$ 8,000*
				3% Inspection:	*$ 3,000*
				2% Mobilization/Demobilization:	*$ 2,000*
				WATER TOTAL:	**$ 130,000**
				Total (Water and Sewer) Project Cost:	**$ 600,000**

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
Preliminary Cost Estimates

Prepared By: MAL/BLJ
1/28/01

*Afton Area Phase 1 (Initial System)**

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	8-inch Gravity Sewer	6500	LF	$ 48	$ 312,000
2	Manholes	25	EA	$ 4,000	$ 100,000
3	Package (25,000 gpd) WWTP	1	LS	$ 300,000	$ 300,000
				Sewer Subtotal:	$ 712,000
				20% Contingency:	*$ 142,400*
				8% Engineering:	*$ 56,960*
				3% Inspection:	*$ 21,360*
				2% Mobilization/Demobilization:	*$ 14,240*
				SEWER TOTAL:	**$ 950,000**
Water					
1	200,000 gallon Ground Storage Tank	1	LS	$ 200,000	$ 200,000
2	Develop wells	2	EA	$ 100,000	$ 200,000
3	6-inch waterline for wells	2000	LF	$ 39	$ 78,000
4	12-inch Water Main	6500	LF	$ 54	$ 351,000
5	PRVs and Vault	4	EA	$ 30,000	$ 120,000
				Water Subtotal:	$ 949,000
				20% Contingency:	*$ 189,800*
				8% Engineering:	*$ 75,920*
				3% Inspection:	*$ 28,470*
				2% Mobilization/Demobilization:	*$ 18,980*
				WATER TOTAL:	**$ 1,260,000**
				Total (Water and Sewer) Project Cost:	**$ 2,210,000**

*Note: This "initial system" could be broken up into smaller phases if necessary because of cost constraints.

Afton Area Phase 2 (Long Term Plan)

Item	Description	Quantity	Unit	Unit Price	Total
Sewer					
1	8-inch Gravity Sewer	2000	LF	$ 48	$ 96,000
2	Manholes	10	EA	$ 4,000	$ 40,000
3	Abandon WWTP, transfer wastewater to Avon	1	LS	$ 10,000	$ 10,000
				Sewer Subtotal:	$ 146,000
				20% Contingency:	*$ 29,200*
				8% Engineering:	*$ 11,680*
				3% Inspection:	*$ 4,380*
				2% Mobilization/Demobilization:	*$ 2,920*
				SEWER TOTAL:	**$ 190,000**
Water					
	Due to the high elevation, no water system interconnections are anticipated				
				Total (Water and Sewer) Project Cost:	**$ 190,000**

Nelson County Service Authority
Rockfish Valley Corridor Water and Sewer Study
Preliminary Cost Estimates

Prepared By: MAL/BLJ
1/28/01

Long Term Corridor Estimates
Impoundment for Regional Service

Water

1	15 MG Surface Water Impoundment	1	LS	$	450,000	$	450,000
2	250,000 gpd Water Treatment Plant	1	LS	$	700,000	$	700,000
3	12-inch Transmission Main through Rockfish Central	40000	LF	$	54	$	2,160,000
4	Ground Storage Tank in Rockfish Central	1	LS	$	300,000	$	300,000
5	Booster Pump Stations	1	EA	$	100,000	$	100,000
					WATER Subtotal:	$	3,710,000
					20% Contingency:	$	*742,000*
					8% Engineering:	$	*296,800*
					3% Inspection:	$	*111,300*
					2% Mobilization/Demobilization:	$	*74,200*
					WATER TOTAL:	**$**	**4,930,000**

Total Project Cost:	**$**	**4,930,000**

Long Term Estimates
Regional WWTP in Nellysford Area

Sewer

1	250,000 gpd WWTP (upgradable to 500,000 gpd)	1	LS	$	2,200,000	$	2,200,000
2	12-inch Force Main through Rockfish Central	40000	LF	$	54	$	2,160,000
					SEWER Subtotal:	$	4,360,000
					20% Contingency:	$	*872,000*
					8% Engineering:	$	*348,800*
					3% Inspection:	$	*130,800*
					2% Mobilization/Demobilization:	$	*87,200*
					WATER TOTAL:	**$**	**5,800,000**

Total Project Cost:	**$**	**5,800,000**

Nelson County Service Authority Rockfish Valley Corridor Water and Sewer Study
Summary of Typical Project Costs for Water and Sewer Improvements

Prepared By: MAL/BLJ

Project	Construction Cost Estimate	20% Contingency	12% Engineering & Inspection	Total Project Estimate *
General Water System Improvement Costs				
Drill & Develop New Well (20 to 40 gpm)	$ 100,000	$ 20,000	$ 12,000	**$ 132,000**
New Surface Water Impoundment (15 MG)	$ 450,000	$ 90,000	$ 54,000	**$ 594,000**
New Surface Water Impoundment (30 MG)	$ 700,000	$ 140,000	$ 84,000	**$ 924,000**
New Water Plant (250,000 GPD)	$ 700,000	$ 140,000	$ 84,000	**$ 924,000**
New Water Plant (500,000 GPD)	$ 1,050,000	$ 210,000	$ 126,000	**$ 1,386,000**
Ground Storage Tank (500,000 Gals)	$ 300,000	$ 60,000	$ 36,000	**$ 396,000**
Elevated Water Storage Tank (500,000 Gals)	$ 900,000	$ 180,000	$ 108,000	**$ 1,188,000**
12" Water Transmission Main (per 1,000 feet)	$ 60,000	$ 12,000	$ 7,200	**$ 79,000**
		$ -	$ -	**$ -**
General Sewer System Improvement Costs				
Package WWTP (25,000 GPD)	$ 300,000	$ 60,000	$ 36,000	**$ 396,000**
Local WWTP (100,000 GPD)	$ 800,000	$ 160,000	$ 96,000	**$ 1,056,000**
Regional WWTP (250,000 GPD)	$ 2,200,000	$ 440,000	$ 264,000	**$ 2,904,000**
Regional WWTP (500,000 GPD)	$ 3,000,000	$ 600,000	$ 360,000	**$ 3,960,000**
12" Gravity Sanitary Sewer (per 1,000 feet)	$ 75,000	$ 15,000	$ 9,000	**$ 99,000**
6" Sanitary Force Main (per 1,000 feet)	$ 25,000	$ 5,000	$ 3,000	**$ 33,000**
Sewage Pump Station (100 gpm)	$ 75,000	$ 15,000	$ 9,000	**$ 99,000**
		$ -	$ -	**$ -**
		$ -	$ -	**$ -**
		$ -	$ -	**$ -**

Note: Legal, Administration, and Easement Costs are not included

Appendix IV

Environmental Assessment

NELSON COUNTY SERVICE AUTHORITY
EXPANSION OF WATER AND WASTEWATER SYSTEM
ROCKFISH VALLEY CORRIDOR

ENVIRONMENTAL ASSESSMENT REPORT

DAA PROJECT NO. R01148.05

Prepared for:
NELSON COUNTY SERVICE AUTHORITY
Lovingston, Virginia

Prepared by:
DRAPER ADEN ASSOCIATES
Richmond, Virginia

January, 2002

NELSON COUNTY SERVICE AUTHORITY
EXPANSION OF WATER AND WASTEWATER SYSTEM
ROCKFISH VALLEY CORRIDOR

ENVIRONMENTAL ASSESSMENT REPORT

DAA PROJECT NO. R01148.05

P. Matt Overton (MS)
Project Biologist

Mark D. Williams
Environmental Scientist

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NELSON COUNTY SERVICE AUTHORITY
EXPANSION OF WATER AND WASTEWATER SYSTEM
ROCKFISH VALLEY CORRIDOR

ENVIRONMENTAL ASSESSMENT REPORT

DAA PROJECT NO. R01148.05

1.0 PURPOSE AND NEED

1.1 Project Description

The Rockfish Valley Corridor is located in the northwestern corner of Nelson County, Virginia. It generally follows Route 151 from U.S. Route 250 south towards Beech Grove Road, which leads to the entrance of Wintergreen Mountain Resort. The terrain is hilly, with the Blue Ridge Mountains to the west and broad, flat land sloping towards the Rockfish River to the east. The Nelson County Service Authority has asked Draper Aden Associates to develop a water and sewer distribution plan that can accommodate future growth in the region.

1.2 Purpose and Need of Project

The Rockfish Valley corridor is expected to have a high growth rate over the next 20 years. There is speculative evidence that on-site wells and drainfields will not be sufficient to promote the desired economic growth. Several of the drainfields in the Nellysford area are failing, or are constructed in high water tables. The goal of this Environmental Assessment Report is to evaluate the environmental impacts of each solution that has been proposed to solve the water and wastewater utility problems in Nellysford.

2.0 ALTERNATIVES TO THE PROPOSED ACTION

Several alternatives have been presented in the study as possible ways to provide water and sewer service to the Rockfish Valley Corridor.

2.1 Design Alternatives

2.1.1 No action

An alternative of "No Action" was considered by the Service Authority, but was not selected as the best alternative. With the continued expansion of the Stoney Creek development in Nellysford, it is anticipated that there is a great potential for residential, light-industrial, and commercial development in this corridor. Currently, there are no public water or sewer facilities in the area to support such growth.

The Beech Grove, Nellysford, Avon, and Afton areas are all served by individual wells and septic drainfields. There are no public utilities available. The Stoney Creek water system consists of two active wells, a 400,000 gallon storage tank, a pressure reducing valve (PRV), and approximately 12.5 miles of distribution main. The system is currently permitted for 107,200 gallons per day (gpd).

The Stoney Creek sewer system has approximately 7,900 feet of 8-inch gravity sewer, 5,650 feet of 4-inch force main and 1,500 feet of 2-inch force main. There are two (2) suction lift pump stations, and one grinder pump station in the system. A third pump station and associated gravity sewer/force main is planned near the entrance of the development.

The private owner of the Stoney Creek utilities is the Wintergreen Valley Utility Company. The company is not willing to turn its system over to the Service Authority at this time.

With the future growth that is anticipated (as detailed in the associated PER), the "No Action" alternative would leave the Service Authority with insufficient capacity to handle the waste generated.

Without the assistance of Federal funding (detailed in the PER), the County cannot build the treatment works to expand the existing network, nor can it construct a water distribution system to handle the inevitable growth.

2.1.2 Wastewater alternatives

Several engineering designs were considered for sewer improvements. A specific alternative has not been indicated as the primary choice at this time.

A comparative table summarizing all wastewater alternatives considered is presented below.

SUMMARY OF WASTEWATER TREATMENT ALTERNATIVES	
Alternative #1 – enhanced on-site treatment	
Technical Feasibility	Unsatisfactory
Economic Feasibility	$505,000
Environmental Feasibility	Satisfactory
Mitigation Requirements	Satisfactory
Alternative #2 – obtain treatment from Stoney Creek	
Technical Feasibility	Satisfactory
Economic Feasibility	$3,357,000
Environmental Feasibility	Satisfactory
Mitigation Requirements	Satisfactory
Alternative #3 – develop a treatment and collection system	
Technical Feasibility	Satisfactory
Economic Feasibility	$2,402,000
Environmental Feasibility	Satisfactory
Mitigation Requirements	Satisfactory
Alternative #4 – problem drainfields become Stoney Creek customers	
Technical Feasibility	Satisfactory
Economic Feasibility	not determined
Environmental Feasibility	Satisfactory
Mitigation Requirements	Satisfactory
Alternative #5 – pump to Stoney Creek and expand	
Technical Feasibility	Satisfactory
Economic Feasibility	$3,357,000
Environmental Feasibility	Satisfactory
Mitigation Requirements	Satisfactory

2.1.3 Water distribution alternatives

Several alternatives for water distribution were considered. A specific alternative has not been indicated as the primary choice at this time. A comparative table summarizing all water distribution alternatives considered is presented below.

SUMMARY OF WATER DISTRIBUTION ALTERNATIVES	
Alternative #1 – develop an independent system	
Technical Feasibility	Satisfactory
Economic Feasibility	$2,679,000
Environmental Feasibility	Satisfactory
Mitigation Requirements	Satisfactory
Alternative #2 – extend the Stoney Creek system	
Technical Feasibility	Satisfactory
Economic Feasibility	$2,311,000
Environmental Feasibility	Satisfactory
Mitigation Requirements	Satisfactory
Alternative #3 – purchase the Stoney Creek system and expand	
Technical Feasibility	Satisfactory
Economic Feasibility	$2,311,000
Environmental Feasibility	Satisfactory
Mitigation Requirements	Satisfactory

2.2 Siting Locations

Associated sewer lines and water lines shall be placed within the roadway easements whenever possible. Associated maps are presented in APPENDIX 1.

2.3 System Capacities

The capacities of each alternative have not been calculated at the time of this report.

3.0 AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES

This section discusses impacts to specific environmental resources with regard to the chosen options discussed in SECTION 2.0.

3.1 Land Use / Important Farmland / Formally Classified Land

3.1.1 Affected Environment

The proposed project will develop a collection system that will require the placement of utility lines to transport wastewater to a treatment plant. The utility lines will be placed in existing roadway easements when practicable; however, design will necessitate the crossing of farmland as well.

Several soil types in the project area are classified as important farmland, where drainage features have been added.

The project may affect land use, important farmland, or formally classified land.

3.1.2 Environmental Consequences

Design of the wastewater collection system may have environmental consequences if specified soil types are in the project area.

3.1.3 Mitigation

Soil types defined as important farmland will be avoided when practicable. In addition, the subterranean placement of utility lines will only affect the environment during construction. Following construction, contours will be returned to their prior condition.

3.2 Floodplains

3.2.1 Affected Environment

The proposed project may be located within the FEMA-mapped 100-year floodplain (see map in APPENDIX 1). According to VDH requirements, all mechanical and electrical equipment should either be located above or protected from a 100-year flood. The treatment works must also remain fully operational during a 25-year flood.

3.2.2 Environmental Consequences

The proposed project will have construction impacts along Route 151, which lies within the floodplain intermittently. Utility lines placed in these areas will be placed in the floodplain as well.

3.2.3 Mitigation

The Authority shall adopt and strictly follow an Erosion and Sediment Control Plan approved in accordance with the latest revision of the Virginia Erosion and Sediment Control Handbook *by an appropriate authority. An approved erosion plan is measurable and enforceable, and any violation must be reported to the regulating agency. Following construction, contours will be returned to their prior condition to preserve the natural elevation of the 100-year floodplain.*

3.3 Wetlands

3.3.1 Affected Environment

Numerous stream crossings are required for the proposed project. The Nelson County Service Authority shall seek permits from the US Army Corps of Engineers and the Virginia Department of Environmental Quality, and will ensure that stream impacts are minimized. In addition, if treatment plants or pump stations are incorporated into the Plan, they would be placed near wetlands in the vicinity of the Rockfish River. Should it become necessary to cross the Rockfish River, a permit may be required by the Virginia Marine Resources Commission. Plan sheets, to be utilized during construction, shall have wetland limits clearly delineated.

3.3.2 Environmental Consequences

Impacts to streams during construction are intended to be temporary. Proper E&S control will ensure that sediments will not be introduced to the streams. Affected wetland areas shall be allowed to re-vegetate naturally, and all grading will reestablish the original contours. The use of trenchless technology (directional drilling) will also be considered on a stream-by-stream basis.

3.3.3 Mitigation

The Authority shall adopt and strictly follow an Erosion and Sediment Control Plan approved in accordance with the latest revision of the Virginia Erosion and Sediment Control Handbook *by an appropriate authority. An approved erosion plan is measurable and enforceable, and any violation must be reported to the regulating agency. If mitigation of wetland impacts is required as a condition of a Corps permit (or a Virginia Water Quality Permit as issued by DEQ), then the Service Authority shall follow those instructions accordingly. It is not expected that wetland compensation will be required.*

3.4 Cultural Resources

3.4.1 Affected Environment

The proposed project is in the vicinity of many identified cultural resources. Conversely, the placement of utility lines only requires a temporary (subterranean) disturbance and usually does not appear to affect cultural resources. Draper Aden personnel have performed research in the offices of the Department of Historic Resources (see APPENDIX 1 for a list of nearby historical resources).

3.4.2 Environmental Consequences

Efforts will be made during the design of the utility system to avoid the identified cultural resources. When a subterranean utility line must be placed in the vicinity of a resource, impacts are only temporary.

3.4.3 Mitigation

Since there do not appear to be adverse impacts, mitigation is not necessary.

3.5 Biological Resources

3.5.1 Affected Environment

The Virginia Natural Heritage Program lists several species that are considered rare in the Commonwealth of Virginia that have been observed in Nelson County (APPENDIX 2). These species (yellow lance, Elliptio lanceolata; *green floater,* Lasmigona subviridis; *swamp-pink,* Helonias bullata*) were not observed within the immediate project area. Additional studies may be warranted.*

Our evaluation suggests that the proposed impacts are not likely to jeopardize either threatened or endangered species as identified under the Endangered Species Act (ESA), nor is it likely to destroy or adversely modify the critical habitat of such species.

*Conversely, the Virginia Department of Game and Inland Fisheries has documented a nest of the state-threatened loggerhead shrike (*Lanius ludovicianus*) in the project area. Coordination with the Department will ensure that this resource is avoided. In addition, three wild trout streams are recognized in the area, and should be avoided to the maximum extent practicable.*

3.5.2 Environmental Consequences

The resources listed above require coordination with the identified agencies. Efforts will be made to avoid the threatened resources, thereby eliminating the possibility of environmental consequences.

3.5.3 Mitigation

Since there will not be adverse impacts (because of the avoidance of threatened resources), mitigation is not necessary.

3.6 Water Quality Issues

3.6.1 Affected Environment

The existing wastewater treatment plant in Stoney Creek is permitted for a daily flow volume of 65,000 gallons. Current usage is approximately 5,000 gallons. Most of the users in the project area are currently discharging to septic systems. Discharge limits are strictly regulated through the issuance of a DEQ VPDES discharge permit.

3.6.2 Environmental Consequences

The development of a central wastewater collection system will allow many of the septic dischargers to connect to an aerobic treatment plant. Water quality, especially groundwater, should be greatly improved. A permit and continued monitoring by the Department of Environmental Quality will ensure that discharge limits are met.

3.6.3 Mitigation

Discharge limits are measurable and enforceable, and any violation must be reported to the Department of Environmental Quality.

3.7 Coastal Resources

3.7.1 Affected Environment

The proposed project will not affect coastal resources.

3.7.2 Environmental Consequences

There do not appear to be environmental consequences to this action.

3.7.3 Mitigation

Since there do not appear to be adverse impacts, mitigation is not necessary.

3.8 Socio-Economic/Environmental Justice Issues

3.8.1 Affected Environment

The proposed project may add an additional wastewater treatment plant to the County's resources, placing no new burdens on potentially affected parties. The project should benefit all socio-economic communities through improved water treatment and greater commercial opportunities.

The expansion of the wastewater collection system will enable future commercial growth and also provide a socio-economic benefit to the community through employment growth. A larger tax base and an improved local economy will support the entire community.

3.8.2 Environmental Consequences

There do not appear to be environmental consequences to this action.

3.8.3 Mitigation

Since there do not appear to be adverse impacts, mitigation is not necessary.

3.9 Miscellaneous Issues

3.9.1 Affected Environment

There may be temporary issues during the construction phase such as air quality, noise, traffic flow, and dust.

3.9.2 Environmental Consequences

Temporary impacts can potentially disrupt the lives of residents, livestock, and wildlife.

3.9.3 Mitigation

All construction activities along State Route 151 will be coordinated with the Virginia Department of Transportation in an effort to reduce impacts to traffic flow.

All construction activities must meet local, state, and federal regulations regarding noise pollution. Any violation must be reported to the appropriate authority.

All construction activities must meet appropriate air quality standards as established by local ordinance and Virginia Administrative Codes. Any violation must be reported to the regulatory authority.

4.0 SUMMARY OF MITIGATION

4.1 Structural

There does not appear to be a significant environmental impact due to the proposed project. Since the collection system will cross several jurisdictional streams, there will be temporary impacts that will need to be permitted under the Corps of Engineers NWP 12, the DEQ WP-2 permit, and possibly a permit from VMRC. Should the cumulative impacts become greater than those allowed under the aforementioned general permits, then an Individual Permit may be required. In addition, a potential treatment plant will have a permanent outfall that will also require a nationwide permit and a VPDES discharge permit.

4.2 Restrictive

Impacts to sensitive areas are expected to be minimal. When a Corps of Engineers Nationwide Permit 12 is issued for the project, certain conditions must be met. The Service Authority does not anticipate further restrictions on the project.

The Virginia Department of Environmental Quality has established a goal of no net loss of wetlands in the Commonwealth. This goal is required by law after October 1, 2001. All impacts must be mitigated through the creation of additional wetlands, stream restoration, or the use of an *in-lieu-of* fee fund. It is not anticipated that wetland compensation will be required; however, if there are impacts due to future construction, the Authority will propose one of the compensation methods listed above.

There may be temporary impacts to historical properties or archeological sites; however, if additional sites are uncovered during construction, work must cease and contact made with the Department of Historical Resources and RD/RUS. Work may not resume until clearance is granted.

4.3 Regulatory

Certain portions of the project will cross jurisdictional wetlands or waters of the U.S. Permits shall be obtained from the U.S. Army Corps of Engineers and from the Virginia Department of Environmental Quality before disturbing those areas. Additional consultation with the Virginia Marine Resources Commission will determine whether a permit will be required from their office.

There may be temporary issues during the construction phase such as air quality, noise, traffic flow, and dust. All impacts must meet local, state, and federal regulations regarding noise pollution. Any violation must be reported to the appropriate authority.

4.4 Awareness

Comments from third-party agencies have been solicited to verify the status of wetlands, historical resources, agricultural lands, or threatened and endangered species. Any comments received are attached in APPENDIX 2.

5.0 CORRESPONDENCE AND COORDINATION

Coordination with appropriate federal and state agencies has been initiated. Copies of the referenced documents are provided in APPENDIX 2. The following agencies have been contacted:

- U.S. Army Corps of Engineers
- Virginia Department of Conservation and Recreation
- Virginia Department of Environmental Quality
- Virginia Department of Game and Inland Fisheries
- Virginia Department of Historical Resources
- Virginia Marine Resources Commission

All comments received will be investigated and incorporated into the Environmental Report. All replies are included in APPENDIX 2.

6.0 EXHIBITS

All pertinent maps and supporting figures are included in APPENDIX 1.

7.0 LIMITATIONS

This document was prepared by Draper Aden Associates in accordance with generally accepted standards of environmental practice for the exclusive use of the referenced client, for specific application to the referenced site. No other warranty is either expressed or implied.

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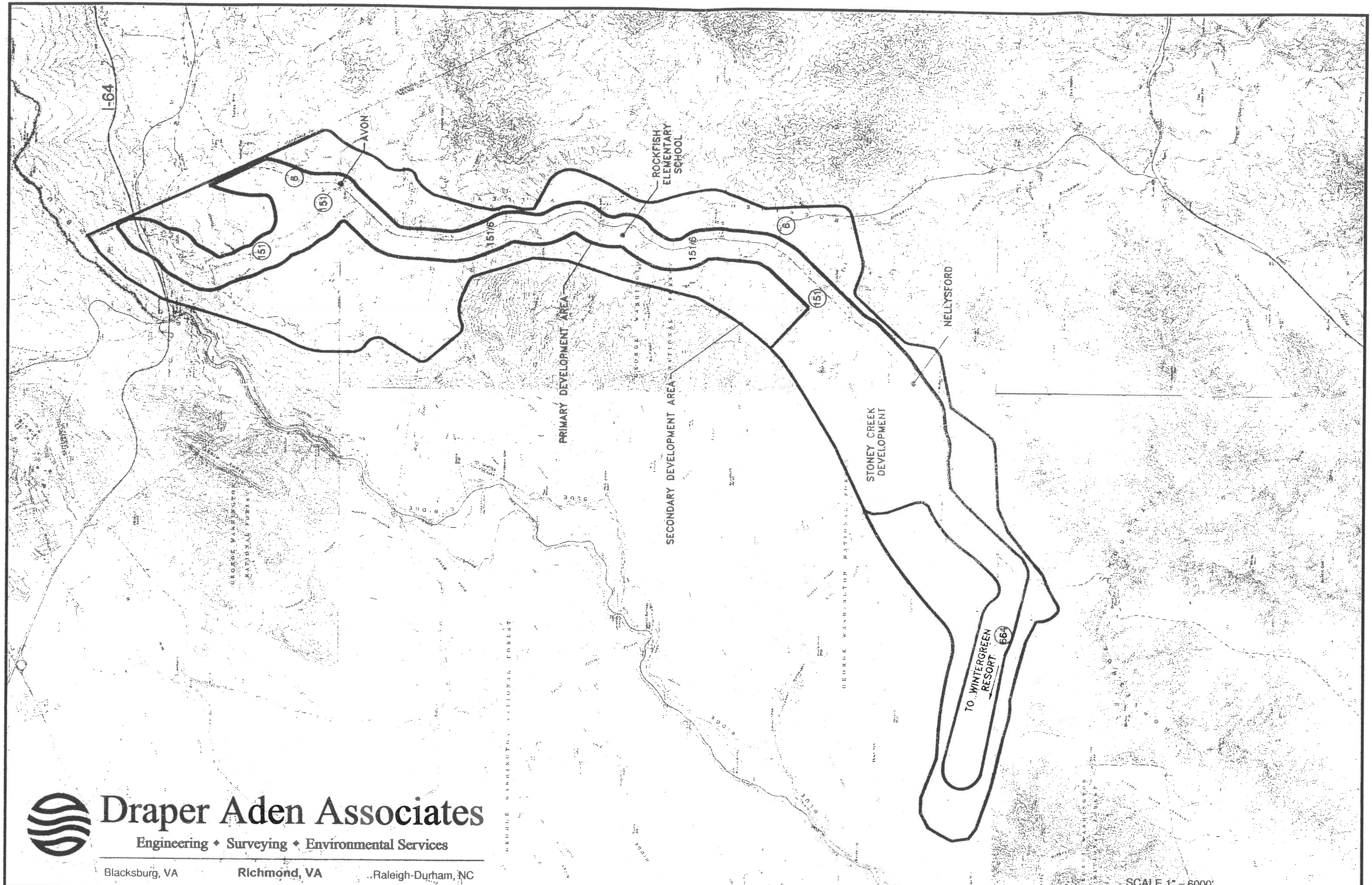
Conclusions presented in this report are based upon a review of available information, the results of our field studies, and professional judgment. Our conclusions do not reflect variations in subsurface groundwater quality that might exist between or beyond sampling points or between specific sampling events.

To the best of our knowledge, information provided by others is true and accurate, unless otherwise noted.

SITE PLAN



I-64
AVON
ROCKFISH ELEMENTARY SCHOOL
8
151
151/6
6
PRIMARY DEVELOPMENT AREA
SECONDARY DEVELOPMENT AREA
NELLYSFORD
STONEY CREEK DEVELOPMENT
664
TO WINTERGREEN RESORT
GEORGE WASHINGTON NATIONAL FOREST
Draper Aden Associates
Engineering ◆ Surveying ◆ Environmental Services
Blacksburg, VA
Richmond, VA
Raleigh-Durham, NC
SCALE 1" = 6000'

Nelson County – Rockfish Soil Survey

3B	Belvoir sandy loam, 2-7%
7B	Chatauge loam, 1-4% *
8A	Codurus silt loam, 0-2%, occ. flooded *
10A	Colvard fine sandy loam, 0-2%, occ. flooded *
11A	Craigsville very cobbly loam, 0-2%, freq. flooded
12B	Delanco loam, 2-7% *
13C	Edneytown loam, 7-15%
14C	Edneytown-Peaks complex, 7-15%
14D	Edneytown-Peaks complex, 15-35%
14E	Edneytown-Peaks complex, 35-55%
21A	Hatboro loam, 0-2%, freq. flooded *
22B	Hayesville loam, 2-7% *
22C	Hayesville loam,7-15%
22D	Hayesville loam, 15-25%
23C	Hayesville clay loam, 2-7%
23D	Hayesville clay loam, 7-15%
28B	Lew silt loam, 2-7%
29B	Lew silt loam, 2-7%, stony
30C	Lew Channery silt loam, 7-15%
30D	Lew Channery silt loam, 15-25%
30E	Lew Channery silt loam, 25-75%
32B	Minnieville loam, 2-7% *
32C	Minnieville loam, 7-15%
33C	Myersville-Catoctin complex, 2-7%
33D	Myersville-Catoctin complex, 7-15%
33E	Myersville-Catoctin complex, 15-25%
34D	Occoquan loam, 15-25%
34E	Occoquan loam, 25-50%
35D	Occoquan loam, 15-25%, stony
35E	Occoquan loam, 25-50%, stony
40C	Saunook loam, 7-15%, stony
43A	Suches loam, 0-2%, freq. flooded
46C	Thurmont loam, 7-15%
49B	Unison loam, 2-7% *
49C	Unison loam, 7-15%
49D	Unisom loam, 15-25%
52B	Wintergreen loam, 2-7%
52C	Wintergreen loam, 7-15%
52D	Wintergreen loam, 15-25%
53C	Wintergreen clay loam, 2-7%
53D	Wintergreen clay loam, 15-25%
53E	Wintergreen clay loam, 25-50%
W	Water

* Prime farmland, where drained

ELEVATION REFERENCE MARKS

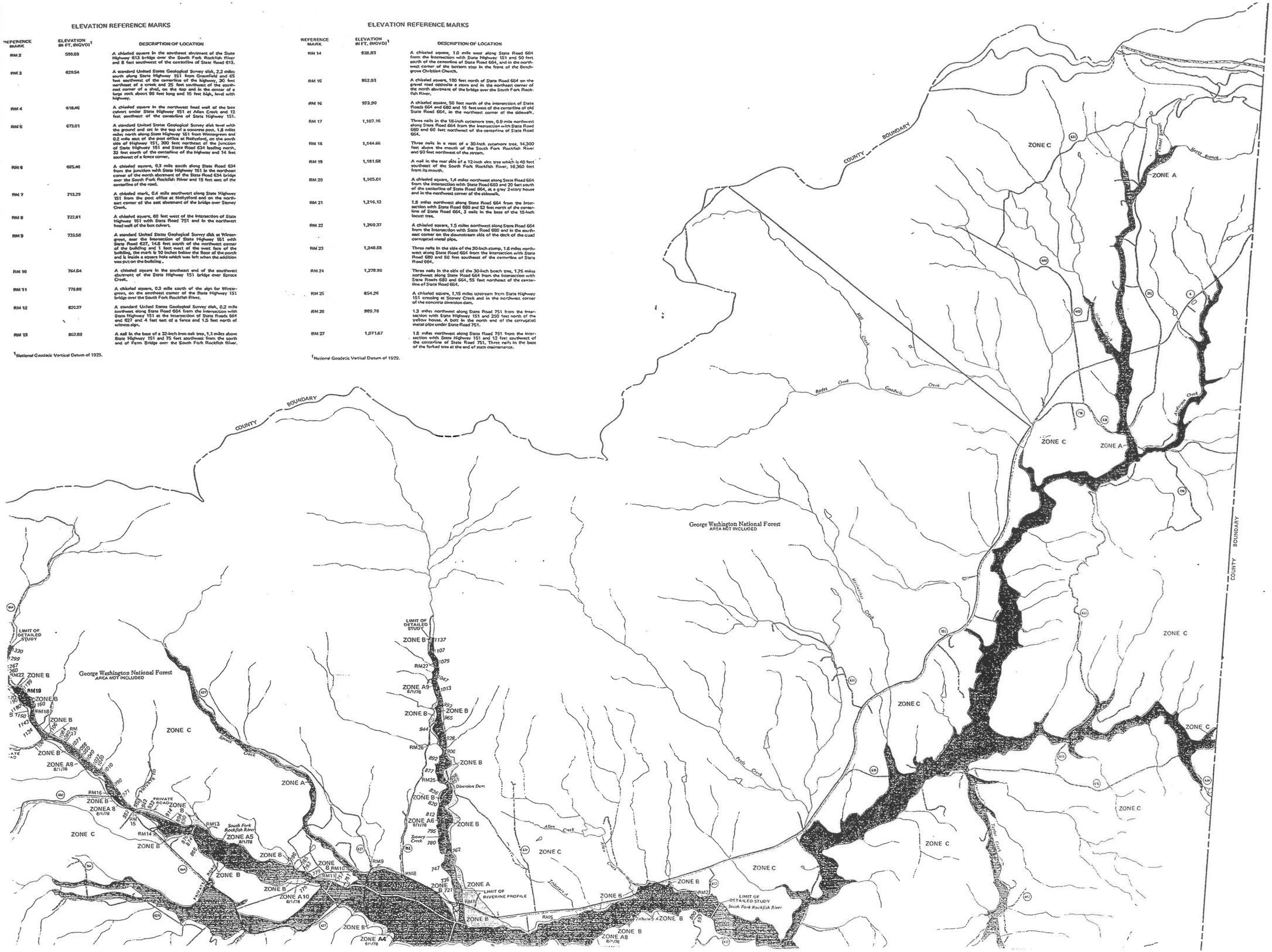
REFERENCE MARK	ELEVATION IN FT. (NGVD)[1]	DESCRIPTION OF LOCATION
RM 2	599.03	A chiseled square in the southeast abutment of the State Highway 613 bridge over the South Fork Rockfish River and 8 feet southwest of the centerline of State Road 613.
RM 3	620.54	A standard United States Geological Survey disk, 2.2 miles south along State Highway 151 from Greenfield and 65 feet southwest of the centerline of the highway, 30 feet northeast of a creek and 25 feet southwest of the southeast corner of a shed, on the top and in the center of a large rock about 90 feet long and 15 feet high, level with highway.
RM 4	618.46	A chiseled square in the northwest head wall of the box culvert under State Highway 151 at Allen Creek and 12 feet southwest of the centerline of State Highway 151.
RM 5	672.01	A standard United States Geological Survey disk level with the ground and set in the top of a concrete post, 1.8 miles miles north along State Highway 151 from Wintergreen and 0.2 mile east of the post office at Nellysford, on the south side of Highway 151, 200 feet northeast of the junction of State Highway 151 and State Road 634 leading north, 33 feet south of the centerline of the highway and 14 feet southwest of a fence corner.
RM 6	605.46	A chiseled square, 0.3 mile south along State Road 634 from the junction with State Highway 151 in the northeast corner of the north abutment of the State Road 634 bridge over the South Fork Rockfish River and 15 feet east of the centerline of the road.
RM 7	713.29	A chiseled mark, 0.4 mile southwest along State Highway 151 from the post office at Nellysford and on the northeast corner of the east abutment of the bridge over Stoney Creek.
RM 8	722.81	A chiseled square, 60 feet west of the intersection of State Highway 151 with State Road 751 and in the northwest head wall of the box culvert.
RM 9	731.58	A standard United States Geological Survey disk at Wintergreen, near the intersection of State Highway 151 with State Road 627, 14.8 feet south of the northwest corner of the building and 1 foot west of the west face of the building, the mark is 10 inches below the floor of the porch and is inside a square hole which was left when the addition was put on the building.
RM 10	764.54	A chiseled square in the southeast end of the southwest abutment of the State Highway 151 bridge over Spruce Creek.
RM 11	779.88	A chiseled square, 0.2 mile south of the sign for Wintergreen, on the southeast corner of the State Highway 151 bridge over the South Fork Rockfish River.
RM 12	820.37	A standard United States Geological Survey disk, 0.2 mile southwest along State Road 664 from the intersection with State Highway 151 at the intersection of State Roads 664 and 627 and 4 feet west of a fence and 1.5 feet north of witness sign.
RM 13	863.89	A nail in the base of a 32-inch iron oak tree, 1.1 miles above State Highway 151 and 75 feet southwest from the south end of Ferm Bridge over the South Fork Rockfish River.

[1]National Geodetic Vertical Datum of 1929.

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION IN FT. (NGVD)[1]	DESCRIPTION OF LOCATION
RM 14	928.83	A chiseled square, 1.0 mile west along State Road 664 from the intersection with State Highway 151 and 50 feet south of the centerline of State Road 664, and in the northwest corner of the bottom step in front of the Beechgrove Christian Church.
RM 15	952.93	A chiseled square, 100 feet north of State Road 664 on the gravel road opposite a store and in the northeast corner of the north abutment of the bridge over the South Fork Rockfish River.
RM 16	973.30	A chiseled square, 50 feet north of the intersection of State Roads 664 and 680 and 15 feet west of the centerline of old State Road 664, in the northeast corner of the sidewalk.
RM 17	1,107.16	Three nails in the 18-inch sycamore tree, 0.9 mile northwest along State Road 664 from the intersection with State Road 680 and 60 feet northwest of the centerline of State Road 664.
RM 18	1,144.66	Three nails in a root of a 30-inch sycamore tree, 14,300 feet above the mouth of the South Fork Rockfish River and 90 feet northwest of the stream.
RM 19	1,181.58	A nail in the rear side of a 12-inch elm tree which is 40 feet southeast of the South Fork Rockfish River, 16,360 feet from its mouth.
RM 20	1,165.01	A chiseled square, 1.4 miles northwest along State Road 664 from the intersection with State Road 680 and 20 feet south of the centerline of State Road 664, at a gray 2-story house and in the northwest corner of the sidewalk.
RM 21	1,216.12	1.5 miles northwest along State Road 664 from the intersection with State Road 680 and 52 feet north of the centerline of State Road 664, 3 nails in the base of the 15-inch locust tree.
RM 22	1,260.37	A chiseled square, 1.5 miles northwest along State Road 664 from the intersection with State Road 680 and in the southeast corner on the downstream side of the deck of the road corrugated metal pipe.
RM 23	1,248.58	Three nails in the side of the 30-inch stump, 1.6 miles northwest along State Road 664 from the intersection with State Road 680 and 50 feet southeast of the centerline of State Road 664.
RM 24	1,278.90	Three nails in the side of the 30-inch beech tree, 1.75 miles northwest along State Road 664 from the intersection with State Roads 680 and 664, 55 feet northeast of the centerline of State Road 664.
RM 25	854.26	A chiseled square, 1.15 miles upstream from State Highway 151 crossing at Stoney Creek and in the northwest corner of the concrete diversion dam.
RM 26	989.76	1.3 miles northwest along State Road 751 from the intersection with State Highway 151 and 250 feet north of the yellow house. A bolt in the north end of the corrugated metal pipe under State Road 751.
RM 27	1,071.67	1.8 miles northwest along State Road 751 from the intersection with State Highway 151 and 12 feet southwest of the centerline of State Road 751. Three nails in the base of the forked tree at the end of state maintenance.

[1]National Geodetic Vertical Datum of 1929.



100-Year Flood Boundary

Zone Designations* With Date of Identification e.g., 1/2/74

100-Year Flood Boundary

500-Year Flood Boundary

ZONE B

Base Flood Elevation Line With Elevation in Feet** — 513

Base Flood Elevation in Feet Where Uniform Within Zone** — (EL 987)

Elevation Reference Mark — RM7×

River Mile — M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

INITIAL IDENTIFICATION
NOVEMBER 22, 1974

CONVERSION TO REGULAR PROGRAM
AUGUST 1, 1978

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620, or (800) 424-8872.

APPROXIMATE SCALE
2000 0 2000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

NELSON COUNTY, VIRGINIA

UNINCORPORATED AREAS

COMMUNITY-PANEL NUMBER
510102 0050 A

PAGE 50 OF 150
(SEE MAP INDEX FOR PAGES NOT PRINTED)

EFFECTIVE
AUGUST 1, 1978

LIST OF HISTORICAL RESOURCES

NELSON COUNTY
LIST OF HISTORICAL RESOURCES

QUAD SHEET	NUMBER	ALTERNATE NUMBER	OWNER	ADDRESS	AGE	DESCRIPTION
Waynesboro East	62-22		Russell	Rt. 610	1913	Swannanoa
	62-49		Cook	Rt. 151	1840	Fairview
	62-58		Gray	Rt. 637	1771	McCue House
	62-60		Wine	Rt. 6	1850	Mountain View
	62-62		Seawell	Rt. 151	1840	By-the-Way
	62-63		Dodd	Rt. 151	1830	Dodd House
	62-5009		Curry	Rt. 6	1870	Haven House
	62-5010		Robinson	Rt. 6	1900	Critzer House
	62-5076		Curry	Rt. 6	1870	Haven Garage
Greenfield	62-7		Hebron Baptist Church	Rt. 638	1852	church
	62-14		Rockfish Church	Rt. 151	1853	church
	62-45		Riddick	Rt. 151	1840	High View
	62-47			Rt. 151	1850	
	62-48		Fallis	Rt. 151	1780	Johnny Fall House
	62-73			Rt. 151		
	62-86		Johnson	Rt. 638	1821	Rodes House
	62-460			Rt. 633		
	62-461			Rt. 635		town of Greenfield
	62-462			Rt. 635		town of Greenfield
	62-463			Rt. 635		town of Greenfield
	62-464			Rt. 635		town of Greenfield
	62-465			Rt. 635		town of Greenfield
	62-466			Rt. 635		town of Greenfield
	62-467			Rt. 635		Mt. Woodland Church
	62-468			Rt. 635		town of Greenfield
	62-5004		Simons	Rt. 709	1887	Page House
	62-5005		Ramsey	Rt. 151	1800	Samuel Fox house
	62-5006		Debnam	Rt. 151	1900	Avon Post Office, General Store
	62-5007		Gibson	Rt. 151	1860	Onan
	62-5012		Gibson	Rt. 151	1893	Goodloe Store
	62-5019		Whitehead	Rt. 151	1913	Valley Farm
	62-5039		Cornelius	Rt. 613	1913	Meander Inn
	62-5082			Rt. 613		bridge
	44NE0013	NE-110	Higgenbottoms	Rt. 638		quartz flakes
	44NE0014	NE-111		Rt. 636		quartzite
	44NE0015	NE-112		Rt. 636		tools
	44NE0016	NE-113	Anderson	Rt. 6		chips
	44NE0018	NE-115		Rt. 6		points
Sherando						
Horseshoe Mountain	62-83	house #204	nursery	Rt. 151		outbuilding
	62-5084		bridge 1032	Rt. 151	1936	bridge

APPENDIX 2

DOCUMENTS

LIST OF THREATENED AND ENDANGERED SPECIES

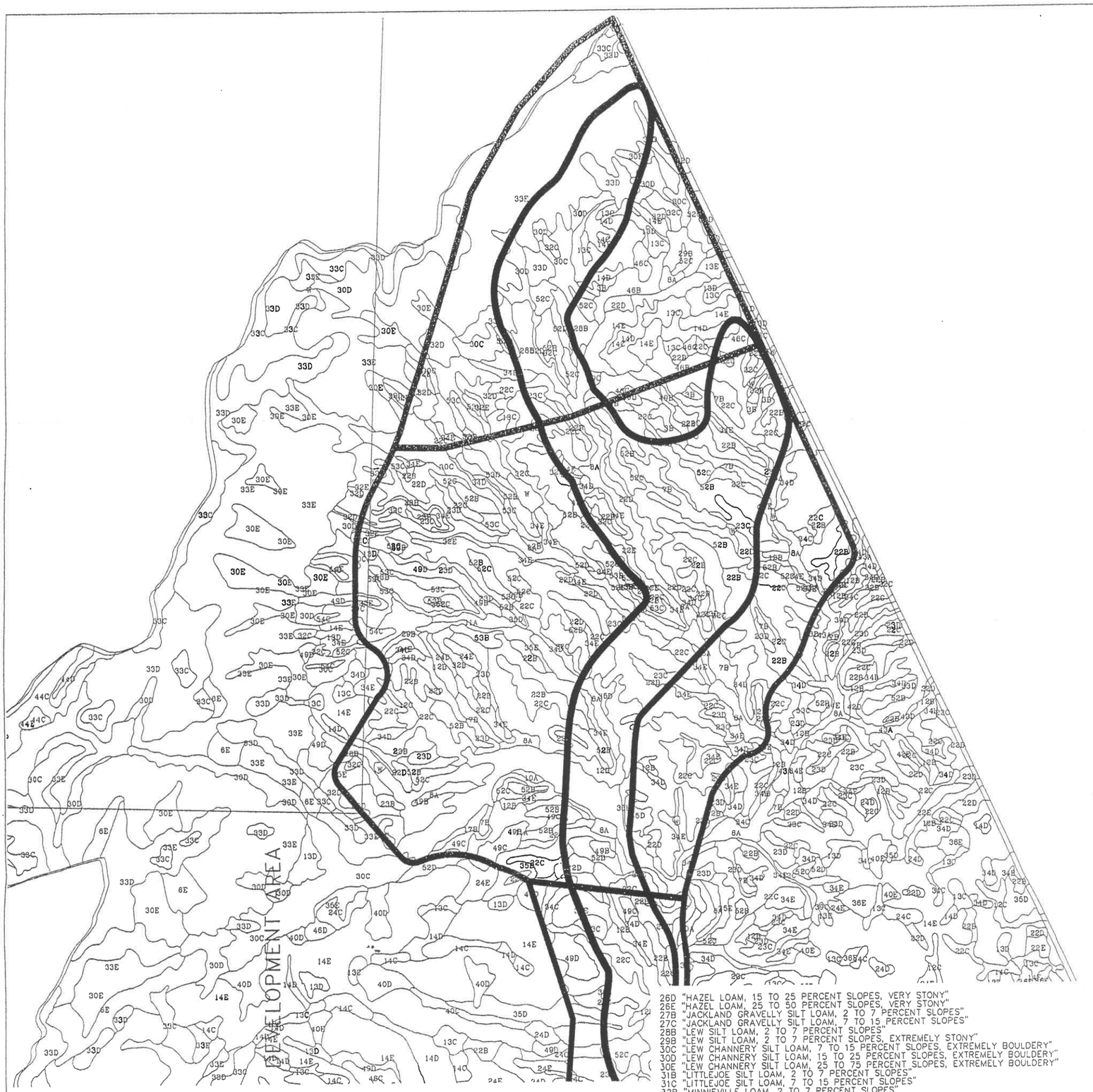
Natural Heritage Resources of Nelson County, Virginia

For an explanation of the rank and status codes click *here*

last updated: FEBRUARY 2000

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	LAST SE SINCE 1
** COMMUNITIES						
	MONTANE ACIDIC SEEPAGE SWAMP					Y
	APPALACHIAN BOG					Y
	EASTERN HEMLOCK FOREST					No D
	HIGH ELEVATION OUTCROP BARREN					Y
	LOW ELEVATION BASIC OUTCROP BARREN					Y
** INVERTEBRATES						
ELLIPTIO LANCEOLATA	YELLOW LANCE	G2G3	S2S3		SC	Y
ESCARYUS CRYPTOROBIUS	MONTANE CENTIPEDE	G2	S2			Y
LASMIGONA SUBVIRIDIS	GREEN FLOATER	G3	S2		SC	Y
SPEYERIA IDALIA	REGAL FRITILLARY	G3	S1			No D
STYLURUS AMNICOLA	RIVERINE CLUBTAIL	G3	S1			N
STYLURUS LAURAE	LAURA'S CLUBTAIL	G4	S2			N

SOIL SURVEY MAP



1D "ARCOLA GRAVELLY SILT LOAM, 15 TO 25 PERCENT SLOPES"
1E "ARCOLA GRAVELLY SILT LOAM, 25 TO 50 PERCENT SLOPES"
2A "BATTEAU LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
3B "BELVOIR SANDY LOAM, 2 TO 7 PERCENT SLOPES"
4B "BUFFSTAT SILT LOAM, 2 TO 7 PERCENT SLOPES"
4C "BUFFSTAT SILT LOAM, 7 TO 15 PERCENT SLOPES"
4D "BUFFSTAT SILT LOAM, 15 TO 25 PERCENT SLOPES"
5C "BUGLEY CHANNERY SILT LOAM, 7 TO 15 PERCENT SLOPES"
5D "BUGLEY CHANNERY SILT LOAM, 15 TO 25 PERCENT SLOPES"
5E "BUGLEY CHANNERY SILT LOAM, 25 TO 50 PERCENT SLOPES"
6E "CATOCTIN-ROCK OUTCROP COMPLEX, 25 TO 75 PERCENT SLOPES, EXTREMELY STONY"
7B "CHATUGE LOAM, 1 TO 4 PERCENT SLOPES"
8A "CODORUS SILT LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
9B "COLLEEN GRAVELLY LOAM, 2 TO 7 PERCENT SLOPES"
9C "COLLEEN GRAVELLY LOAM, 7 TO 15 PERCENT SLOPES"
9D "COLLEEN GRAVELLY LOAM, 15 TO 25 PERCENT SLOPES"
10A "COLVARD FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
11A "CRAIGSVILLE VERY COBBLY LOAM, 0 TO 2 PERCENT SLOPES, FREQUENTLY FLOODED"
12B "DELANCO LOAM, 2 TO 7 PERCENT SLOPES"
12C "DELANCO LOAM, 7 TO 15 PERCENT SLOPES"
13C "EDNEYTOWN LOAM, 7 TO 15 PERCENT SLOPES"
13D "EDNEYTOWN LOAM, 15 TO 25 PERCENT SLOPES"
13E "EDNEYTOWN LOAM, 25 TO 50 PERCENT SLOPES"
14C "EDNEYTOWN-PEAKS COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
14D "EDNEYTOWN-PEAKS COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
14E "EDNEYTOWN-PEAKS COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
14F "EDNEYTOWN-PEAKS COMPLEX, 55 TO 75 PERCENT SLOPES, EXTREMELY STONY"
15B "ELIOAK LOAM, 2 TO 7 PERCENT SLOPES"
15C "ELIOAK LOAM, 7 TO 15 PERCENT SLOPES"
15D "ELIOAK LOAM, 15 TO 25 PERCENT SLOPES"
16C "ELIOAK CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED"
16D "ELIOAK CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED"
17B "ELSINBORO LOAM, 2 TO 7 PERCENT SLOPES, RARELY FLOODED"
18C "FAUQUIER LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
18D "FAUQUIER LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
18E "FAUQUIER LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
19A "GALTSMILL FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
20D "GLENELG SILT LOAM, 15 TO 25 PERCENT SLOPES"
21A "HATBORO LOAM, 0 TO 2 PERCENT SLOPES, FREQUENTLY FLOODED"
22B "HAYESVILLE LOAM, 2 TO 7 PERCENT SLOPES"
22C "HAYESVILLE LOAM, 7 TO 15 PERCENT SLOPES"
22D "HAYESVILLE LOAM, 15 TO 25 PERCENT SLOPES"
22E "HAYESVILLE LOAM, 25 TO 50 PERCENT SLOPES"
23B "HAYESVILLE CLAY LOAM, 2 TO 7 PERCENT SLOPES, SEVERELY ERODED"
23C "HAYESVILLE CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED"
23D "HAYESVILLE CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED"
23E "HAYESVILLE CLAY LOAM, 25 TO 50 PERCENT SLOPES, SEVERELY ERODED"
24C "HAYESVILLE LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
24D "HAYESVILLE LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
24E "HAYESVILLE LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
25C "HAZEL CHANNERY LOAM, 7 TO 15 PERCENT SLOPES"
25D "HAZEL CHANNERY LOAM, 15 TO 25 PERCENT SLOPES"
25E "HAZEL CHANNERY LOAM, 25 TO 50 PERCENT SLOPES"
26D "HAZEL LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
26E "HAZEL LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
27B "JACKLAND GRAVELLY SILT LOAM, 2 TO 7 PERCENT SLOPES"
27C "JACKLAND GRAVELLY SILT LOAM, 7 TO 15 PERCENT SLOPES"
28B "LEW SILT LOAM, 2 TO 7 PERCENT SLOPES"
29B "LEW SILT LOAM, 2 TO 7 PERCENT SLOPES, EXTREMELY STONY"
30C "LEW CHANNERY SILT LOAM, 7 TO 15 PERCENT SLOPES, EXTREMELY BOULDERY"
30D "LEW CHANNERY SILT LOAM, 15 TO 25 PERCENT SLOPES, EXTREMELY BOULDERY"
30E "LEW CHANNERY SILT LOAM, 25 TO 75 PERCENT SLOPES, EXTREMELY BOULDERY"
31B "LITTLEJOE SILT LOAM, 2 TO 7 PERCENT SLOPES"
31C "LITTLEJOE SILT LOAM, 7 TO 15 PERCENT SLOPES"
32B "MINNIEVILLE LOAM, 2 TO 7 PERCENT SLOPES"
32C "MINNIEVILLE LOAM, 7 TO 15 PERCENT SLOPES"
32D "MINNIEVILLE LOAM, 15 TO 25 PERCENT SLOPES"
32E "MINNIEVILLE LOAM, 25 TO 50 PERCENT SLOPES"
33C "MYERSVILLE-CATOCTIN COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
33D "MYERSVILLE-CATOCTIN COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
33E "MYERSVILLE-CATOCTIN COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
34C "OCCOQUAN LOAM, 7 TO 15 PERCENT SLOPES"
34D "OCCOQUAN LOAM, 15 TO 25 PERCENT SLOPES"
34E "OCCOQUAN LOAM, 25 TO 50 PERCENT SLOPES"
35D "OCCOQUAN LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
35E "OCCOQUAN LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
36D "PEAKS-ROCK OUTCROP COMPLEX, 15 TO 35 PERCENT SLOPES"
36E "PEAKS-ROCK OUTCROP COMPLEX, 35 TO 55 PERCENT SLOPES"
36F "PEAKS-ROCK OUTCROP COMPLEX, 55 TO 75 PERCENT SLOPES"
37A "PINEYWOODS SILT LOAM, 0 TO 2 PERCENT SLOPES"
38 "PITS, QUARRY"
39C "SAUNOOK LOAM, 7 TO 15 PERCENT SLOPES"
39D "SAUNOOK LOAM, 15 TO 25 PERCENT SLOPES"
40C "SAUNOOK LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
40D "SAUNOOK LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
40E "SAUNOOK LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
41B "SKETERVILLE SILT LOAM, 2 TO 7 PERCENT SLOPES"
42C "SPRIGGS LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
42D "SPRIGGS LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
42E "SPRIGGS LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
43A "SUCHES LOAM, 0 TO 2 PERCENT SLOPES, FREQUENTLY FLOODED"
44C "SYLCO-SYLVATUS COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
44D "SYLCO-SYLVATUS COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
44E "SYLCO-SYLVATUS COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
45E "SYLVATUS-ROCK OUTCROP COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
45F "SYLVATUS-ROCK OUTCROP COMPLEX, 55 TO 70 PERCENT SLOPES, EXTREMELY STONY"
46B "THURMONT LOAM, 2 TO 7 PERCENT SLOPES"
46C "THURMONT LOAM, 7 TO 15 PERCENT SLOPES"
46D "THURMONT LOAM, 15 TO 25 PERCENT SLOPES"
47B "THURMONT LOAM, 2 TO 7 PERCENT SLOPES, VERY STONY"
47C "THURMONT LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
47D "THURMONT LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
48 "UDORTHENTS, SMOOTHED"
49B "UNISON LOAM, 2 TO 7 PERCENT SLOPES"
49C "UNISON LOAM, 7 TO 15 PERCENT SLOPES"
49D "UNISON LOAM, 15 TO 25 PERCENT SLOPES"
50B "WARMINSTER CLAY LOAM, 2 TO 7 PERCENT SLOPES"
50C "WARMINSTER CLAY LOAM, 7 TO 15 PERCENT SLOPES"
50D "WARMINSTER CLAY LOAM, 15 TO 25 PERCENT SLOPES"
51A "WINGINA LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
52B "WINTERGREEN LOAM, 2 TO 7 PERCENT SLOPES"
52C "WINTERGREEN LOAM, 7 TO 15 PERCENT SLOPES"
52D "WINTERGREEN LOAM, 15 TO 25 PERCENT SLOPES"
53B "WINTERGREEN CLAY LOAM, 2 TO 7 PERCENT SLOPES, SEVERELY ERODED"
53C "WINTERGREEN CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED"
53D "WINTERGREEN CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED"
54C "WINTERGREEN LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
55A "YOGAVILLE LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
W WATER

OF

PLANNING

Month DD, YYYY

DATE

1" = 2000'

SCALE

initials

CHECKED BY

initials

DRAWN BY

initials

DESIGNED BY

REVISIONS

Draper Aden Associates
Engineering • Surveying • Environmental Services

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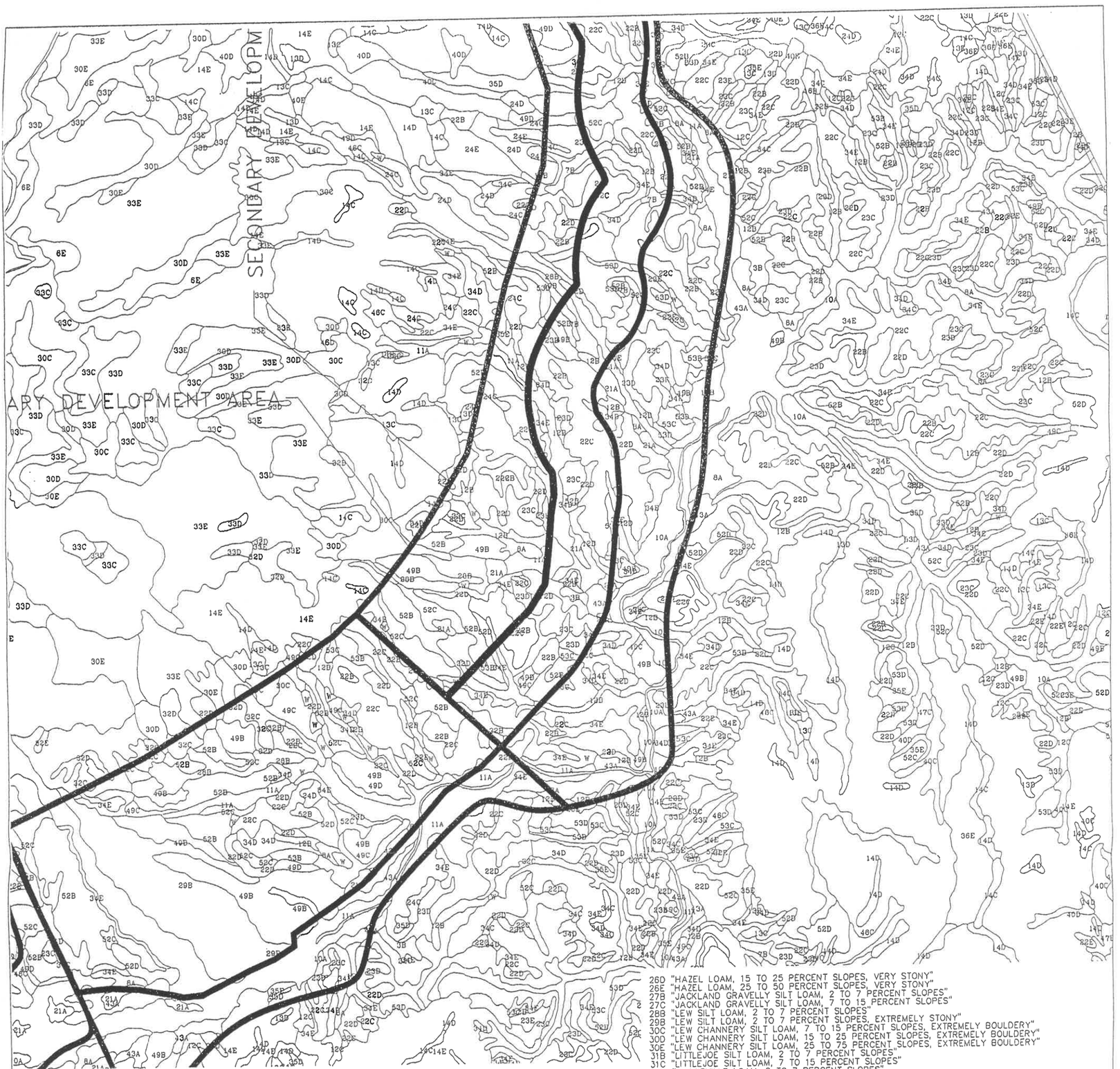

10 "ARCOLA GRAVELLY SILT LOAM, 15 TO 25 PERCENT SLOPES"
1E "ARCOLA GRAVELLY SILT LOAM, 25 TO 50 PERCENT SLOPES"
2A "BATTEAU LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
3B "BELVOIR SANDY LOAM, 2 TO 7 PERCENT SLOPES"
4B "BUFFSTAT SILT LOAM, 2 TO 7 PERCENT SLOPES"
4C "BUFFSTAT SILT LOAM, 7 TO 15 PERCENT SLOPES"
4D "BUFFSTAT SILT LOAM, 15 TO 25 PERCENT SLOPES"
5C "BUGLEY CHANNERY SILT LOAM, 7 TO 15 PERCENT SLOPES"
5D "BUGLEY CHANNERY SILT LOAM, 15 TO 25 PERCENT SLOPES"
5E "BUGLEY CHANNERY SILT LOAM, 25 TO 50 PERCENT SLOPES"
6E "CATOCTIN-ROCK OUTCROP COMPLEX, 25 TO 75 PERCENT SLOPES, EXTREMELY STONY"
7B "CHATUGE LOAM, 1 TO 4 PERCENT SLOPES"
8A "CODORUS SILT LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
9B "COLLEEN GRAVELLY LOAM, 2 TO 7 PERCENT SLOPES"
9C "COLLEEN GRAVELLY LOAM, 7 TO 15 PERCENT SLOPES"
9D "COLLEEN GRAVELLY LOAM, 15 TO 25 PERCENT SLOPES"
10A "COLVARD FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
11A "CRAIGSVILLE VERY COBBLY LOAM, 0 TO 2 PERCENT SLOPES, FREQUENTLY FLOODED"
12B "DELANCO LOAM, 2 TO 7 PERCENT SLOPES"
12C "DELANCO LOAM, 7 TO 15 PERCENT SLOPES"
13C "EDNEYTOWN LOAM, 7 TO 15 PERCENT SLOPES"
13D "EDNEYTOWN LOAM, 15 TO 25 PERCENT SLOPES"
13E "EDNEYTOWN LOAM, 25 TO 50 PERCENT SLOPES"
14C "EDNEYTOWN-PEAKS COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
14D "EDNEYTOWN-PEAKS COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
14E "EDNEYTOWN-PEAKS COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
14F "EDNEYTOWN-PEAKS COMPLEX, 55 TO 75 PERCENT SLOPES, EXTREMELY STONY"
15B "ELIOAK LOAM, 2 TO 7 PERCENT SLOPES"
15C "ELIOAK LOAM, 7 TO 15 PERCENT SLOPES"
15D "ELIOAK LOAM, 15 TO 25 PERCENT SLOPES"
16C "ELIOAK CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED"
16D "ELIOAK CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED"
17B "ELSINBORO LOAM, 2 TO 7 PERCENT SLOPES, RARELY FLOODED"
18C "FAUQUIER LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
18D "FAUQUIER LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
18E "FAUQUIER LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
19A "GALTSMILL FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
20D "GLENELG SILT LOAM, 15 TO 25 PERCENT SLOPES"
21A "HATBORO LOAM, 0 TO 2 PERCENT SLOPES, FREQUENTLY FLOODED"
22B "HAYESVILLE LOAM, 2 TO 7 PERCENT SLOPES"
22C "HAYESVILLE LOAM, 7 TO 15 PERCENT SLOPES"
22D "HAYESVILLE LOAM, 15 TO 25 PERCENT SLOPES"
22E "HAYESVILLE LOAM, 25 TO 50 PERCENT SLOPES"
23B "HAYESVILLE CLAY LOAM, 2 TO 7 PERCENT SLOPES, SEVERELY ERODED"
23C "HAYESVILLE CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED"
23D "HAYESVILLE CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED"
23E "HAYESVILLE CLAY LOAM, 25 TO 50 PERCENT SLOPES, SEVERELY ERODED"
24C "HAYESVILLE LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
24D "HAYESVILLE LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
24E "HAYESVILLE LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
25C "HAZEL CHANNERY LOAM, 7 TO 15 PERCENT SLOPES"
25D "HAZEL CHANNERY LOAM, 15 TO 25 PERCENT SLOPES"
25E "HAZEL CHANNERY LOAM, 25 TO 50 PERCENT SLOPES"

26D "HAZEL LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
26E "HAZEL LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
27B "JACKLAND GRAVELLY SILT LOAM, 2 TO 7 PERCENT SLOPES"
27C "JACKLAND GRAVELLY SILT LOAM, 7 TO 15 PERCENT SLOPES"
28B "LEW SILT LOAM, 2 TO 7 PERCENT SLOPES"
28B "LEW SILT LOAM, 2 TO 7 PERCENT SLOPES, EXTREMELY STONY"
30C "LEW CHANNERY SILT LOAM, 7 TO 15 PERCENT SLOPES, EXTREMELY BOULDERY"
30D "LEW CHANNERY SILT LOAM, 15 TO 25 PERCENT SLOPES, EXTREMELY BOULDERY"
30E "LEW CHANNERY SILT LOAM, 25 TO 75 PERCENT SLOPES, EXTREMELY BOULDERY"
31B "LITTLEJOE SILT LOAM, 2 TO 7 PERCENT SLOPES"
31C "LITTLEJOE SILT LOAM, 7 TO 15 PERCENT SLOPES"
32B "MINNIEVILLE LOAM, 2 TO 7 PERCENT SLOPES"
32C "MINNIEVILLE LOAM, 7 TO 15 PERCENT SLOPES"
32D "MINNIEVILLE LOAM, 15 TO 25 PERCENT SLOPES"
32E "MINNIEVILLE LOAM, 25 TO 50 PERCENT SLOPES"
33C "MYERSVILLE-CATOCTIN COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
33D "MYERSVILLE-CATOCTIN COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
33E "MYERSVILLE-CATOCTIN COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
34C "OCCOQUAN LOAM, 7 TO 15 PERCENT SLOPES"
34D "OCCOQUAN LOAM, 15 TO 25 PERCENT SLOPES"
34E "OCCOQUAN LOAM, 25 TO 50 PERCENT SLOPES"
35D "OCCOQUAN LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
35E "OCCOQUAN LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
36D "PEAKS-ROCK OUTCROP COMPLEX, 15 TO 35 PERCENT SLOPES"
36E "PEAKS-ROCK OUTCROP COMPLEX, 35 TO 55 PERCENT SLOPES"
36F "PEAKS-ROCK OUTCROP COMPLEX, 55 TO 75 PERCENT SLOPES"
37A "PINEYWOODS SILT LOAM, 0 TO 2 PERCENT SLOPES"
38 "PITS, QUARRY"
39C "SAUNOOK LOAM, 7 TO 15 PERCENT SLOPES"
39D "SAUNOOK LOAM, 15 TO 25 PERCENT SLOPES"
40C "SAUNOOK LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
40D "SAUNOOK LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
40E "SAUNOOK LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
41B "SKETERVILLE SILT LOAM, 2 TO 7 PERCENT SLOPES"
42C "SPRIGGS LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
42D "SPRIGGS LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
42E "SPRIGGS LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
43A "SUCCESS LOAM, 0 TO 2 PERCENT SLOPES, FREQUENTLY FLOODED"
44C "SYLCO-SYLVATUS COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
44D "SYLCO-SYLVATUS COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
44E "SYLCO-SYLVATUS COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
45E "SYLVATUS-ROCK OUTCROP COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
45F "SYLVATUS-ROCK OUTCROP COMPLEX, 55 TO 70 PERCENT SLOPES, EXTREMELY STONY"
46B "THURMONT LOAM, 2 TO 7 PERCENT SLOPES"
46C "THURMONT LOAM, 7 TO 15 PERCENT SLOPES"
46D "THURMONT LOAM, 15 TO 25 PERCENT SLOPES"
47B "THURMONT LOAM, 2 TO 7 PERCENT SLOPES, VERY STONY"
47C "THURMONT LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
47D "THURMONT LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
48 "UDORTHENTS, SMOOTHED"
49B "UNISON LOAM, 2 TO 7 PERCENT SLOPES"
49C "UNISON LOAM, 7 TO 15 PERCENT SLOPES"
49D "UNISON LOAM, 15 TO 25 PERCENT SLOPES"
50B "WARMINSTER CLAY LOAM, 2 TO 7 PERCENT SLOPES"
50C "WARMINSTER CLAY LOAM, 7 TO 15 PERCENT SLOPES"
50D "WARMINSTER CLAY LOAM, 15 TO 25 PERCENT SLOPES"
51A "WINGINA LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
52B "WINTERGREEN LOAM, 2 TO 7 PERCENT SLOPES"
52C "WINTERGREEN LOAM, 7 TO 15 PERCENT SLOPES"
52D "WINTERGREEN LOAM, 15 TO 25 PERCENT SLOPES"
53B "WINTERGREEN CLAY LOAM, 2 TO 7 PERCENT SLOPES, SEVERELY ERODED"
53C "WINTERGREEN CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED"
53D "WINTERGREEN CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED"
54C "WINTERGREEN LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
55A "YOGAVILLE LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
W WATER

OF	
PROJECT NUMBER	NN-NNNN-NN
DATE:	Month DD, YYYY
SCALE:	1" = 3000'
CHECKED BY:	Initials
DRAWN BY:	Initials
DESIGNED BY:	Initials
REVISIONS	

Draper Aden Associates
Engineering • Surveying • Environmental Services

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Raleigh-Durham, NC
2521 Schieferin Road, Suite 105
Apex, NC 27502
919-387-9997 Fax: 919-387-9994

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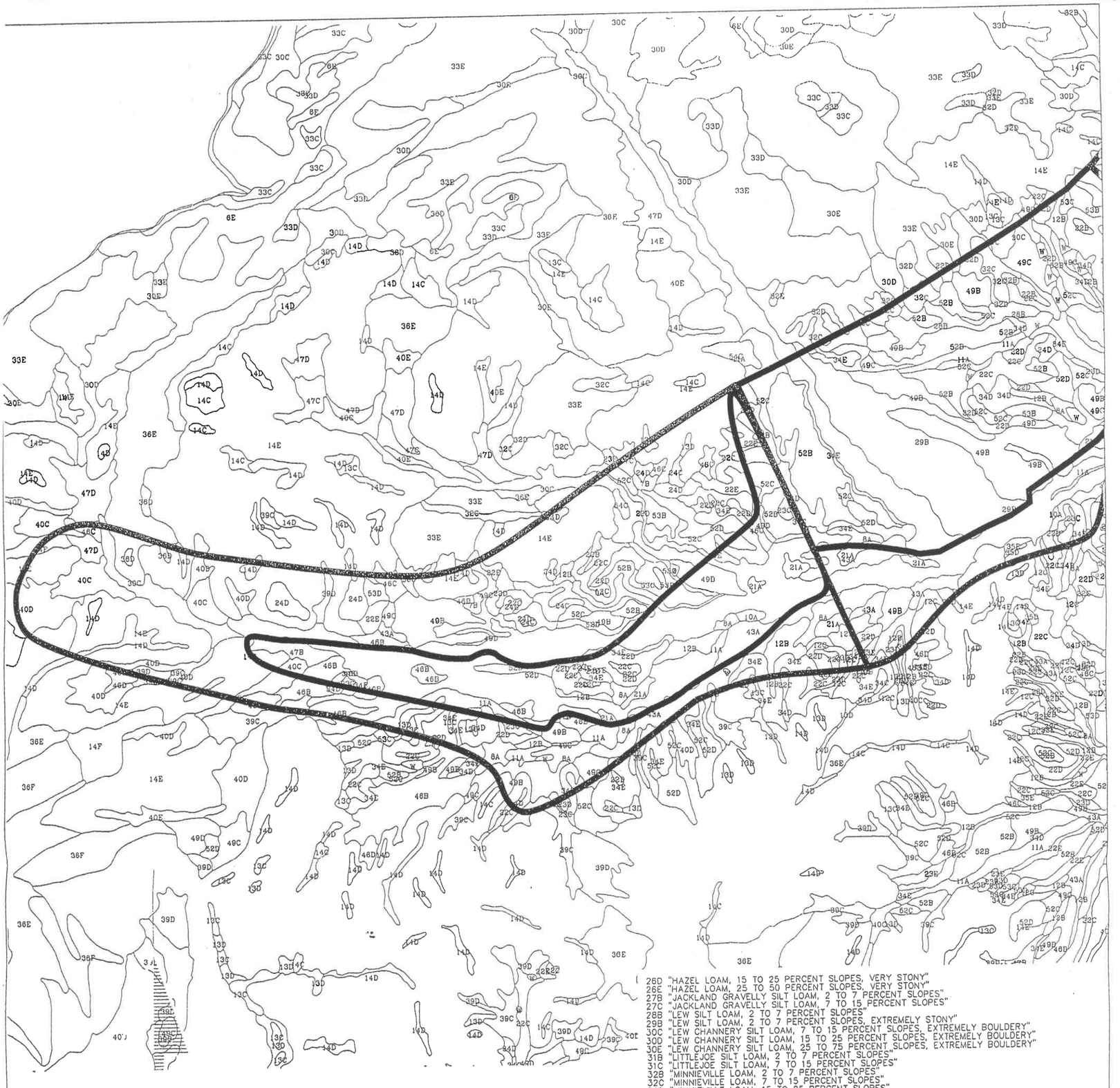

1D "ARCOLA GRAVELLY SILT LOAM, 15 TO 25 PERCENT SLOPES"
1E "ARCOLA GRAVELLY SILT LOAM, 25 TO 50 PERCENT SLOPES"
2A "BATTEAU LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
3B "BELVOIR SANDY LOAM, 2 TO 7 PERCENT SLOPES"
4B "BUFFSTAT SILT LOAM, 2 TO 7 PERCENT SLOPES"
4C "BUFFSTAT SILT LOAM, 7 TO 15 PERCENT SLOPES"
4D "BUFFSTAT SILT LOAM, 15 TO 25 PERCENT SLOPES"
5C "BUGLEY CHANNERY SILT LOAM, 7 TO 15 PERCENT SLOPES"
5D "BUGLEY CHANNERY SILT LOAM, 15 TO 25 PERCENT SLOPES"
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12B "DELANCO LOAM, 2 TO 7 PERCENT SLOPES"
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13C "EDNEYTOWN LOAM, 7 TO 15 PERCENT SLOPES"
13D "EDNEYTOWN LOAM, 15 TO 25 PERCENT SLOPES"
13E "EDNEYTOWN LOAM, 25 TO 50 PERCENT SLOPES"
14C "EDNEYTOWN-PEAKS COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
14D "EDNEYTOWN-PEAKS COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
14E "EDNEYTOWN-PEAKS COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
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15B "ELIOAK LOAM, 2 TO 7 PERCENT SLOPES"
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15D "ELIOAK LOAM, 15 TO 25 PERCENT SLOPES"
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18E "FAUQUIER LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
19A "GALTSMILL FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
20D "GLENELG SILT LOAM, 15 TO 25 PERCENT SLOPES"
21A "HATBORO LOAM, 0 TO 2 PERCENT SLOPES, FREQUENTLY FLOODED"
22B "HAYESVILLE LOAM, 2 TO 7 PERCENT SLOPES"
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23D "HAYESVILLE CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED"
23E "HAYESVILLE CLAY LOAM, 25 TO 50 PERCENT SLOPES, SEVERELY ERODED"
24C "HAYESVILLE LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
24D "HAYESVILLE LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
24E "HAYESVILLE LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
25C "HAZEL CHANNERY LOAM, 7 TO 15 PERCENT SLOPES"
25D "HAZEL CHANNERY LOAM, 15 TO 25 PERCENT SLOPES"
25E "HAZEL CHANNERY LOAM, 25 TO 50 PERCENT SLOPES"
26D "HAZEL LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
26E "HAZEL LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
27B "JACKLAND GRAVELLY SILT LOAM, 2 TO 7 PERCENT SLOPES"
27C "JACKLAND GRAVELLY SILT LOAM, 7 TO 15 PERCENT SLOPES"
28B "LEW SILT LOAM, 2 TO 7 PERCENT SLOPES"
29B "LEW SILT LOAM, 2 TO 7 PERCENT SLOPES, EXTREMELY STONY"
30C "LEW CHANNERY SILT LOAM, 7 TO 15 PERCENT SLOPES, EXTREMELY BOULDERY"
30D "LEW CHANNERY SILT LOAM, 15 TO 25 PERCENT SLOPES, EXTREMELY BOULDERY"
30E "LEW CHANNERY SILT LOAM, 25 TO 75 PERCENT SLOPES, EXTREMELY BOULDERY"
31B "LITTLEJOE SILT LOAM, 2 TO 7 PERCENT SLOPES"
31C "LITTLEJOE SILT LOAM, 7 TO 15 PERCENT SLOPES"
32B "MINNIEVILLE LOAM, 2 TO 7 PERCENT SLOPES"
32C "MINNIEVILLE LOAM, 7 TO 15 PERCENT SLOPES"
32D "MINNIEVILLE LOAM, 15 TO 25 PERCENT SLOPES"
32E "MINNIEVILLE LOAM, 25 TO 50 PERCENT SLOPES"
33C "MYERSVILLE-CATOCTIN COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
33D "MYERSVILLE-CATOCTIN COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
33E "MYERSVILLE-CATOCTIN COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
34C "OCCOQUAN LOAM, 7 TO 15 PERCENT SLOPES"
34D "OCCOQUAN LOAM, 15 TO 25 PERCENT SLOPES"
34E "OCCOQUAN LOAM, 25 TO 50 PERCENT SLOPES"
35D "OCCOQUAN LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
35E "OCCOQUAN LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
36D "PEAKS-ROCK OUTCROP COMPLEX, 15 TO 35 PERCENT SLOPES"
36E "PEAKS-ROCK OUTCROP COMPLEX, 35 TO 55 PERCENT SLOPES"
36F "PEAKS-ROCK OUTCROP COMPLEX, 55 TO 75 PERCENT SLOPES"
37A "PINEYWOODS SILT LOAM, 0 TO 2 PERCENT SLOPES"
38 "PITS, QUARRY"
39C "SAUNOOK LOAM, 7 TO 15 PERCENT SLOPES"
39D "SAUNOOK LOAM, 15 TO 25 PERCENT SLOPES"
40C "SAUNOOK LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
40D "SAUNOOK LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
40E "SAUNOOK LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
41B "SKETTERVILLE SILT LOAM, 2 TO 7 PERCENT SLOPES"
42C "SPRIGGS LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
42D "SPRIGGS LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
42E "SPRIGGS LOAM, 25 TO 50 PERCENT SLOPES, VERY STONY"
43A "SUCHES LOAM, 0 TO 2 PERCENT SLOPES, FREQUENTLY FLOODED"
44C "SYLCO-SYLVATUS COMPLEX, 7 TO 15 PERCENT SLOPES, EXTREMELY STONY"
44D "SYLCO-SYLVATUS COMPLEX, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY"
44E "SYLCO-SYLVATUS COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
45E "SYLVATUS-ROCK OUTCROP COMPLEX, 35 TO 55 PERCENT SLOPES, EXTREMELY STONY"
45F "SYLVATUS-ROCK OUTCROP COMPLEX, 55 TO 70 PERCENT SLOPES, EXTREMELY STONY"
46B "THURMONT LOAM, 2 TO 7 PERCENT SLOPES"
46C "THURMONT LOAM, 7 TO 15 PERCENT SLOPES"
46D "THURMONT LOAM, 15 TO 25 PERCENT SLOPES"
47B "THURMONT LOAM, 2 TO 7 PERCENT SLOPES, VERY STONY"
47C "THURMONT LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
47D "THURMONT LOAM, 15 TO 25 PERCENT SLOPES, VERY STONY"
48 "UDORTHENTS, SMOOTHED"
49B "UNISON LOAM, 2 TO 7 PERCENT SLOPES"
49C "UNISON LOAM, 7 TO 15 PERCENT SLOPES"
49D "UNISON LOAM, 15 TO 25 PERCENT SLOPES"
50B "WARMINSTER CLAY LOAM, 2 TO 7 PERCENT SLOPES"
50C "WARMINSTER CLAY LOAM, 7 TO 15 PERCENT SLOPES"
50D "WARMINSTER CLAY LOAM, 15 TO 25 PERCENT SLOPES"
51A "WINGINA LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
52B "WINTERGREEN LOAM, 2 TO 7 PERCENT SLOPES"
52C "WINTERGREEN LOAM, 7 TO 15 PERCENT SLOPES"
52D "WINTERGREEN LOAM, 15 TO 25 PERCENT SLOPES"
53B "WINTERGREEN CLAY LOAM, 2 TO 7 PERCENT SLOPES, SEVERELY ERODED"
53C "WINTERGREEN CLAY LOAM, 7 TO 15 PERCENT SLOPES, SEVERELY ERODED"
53D "WINTERGREEN CLAY LOAM, 15 TO 25 PERCENT SLOPES, SEVERELY ERODED"
54C "WINTERGREEN LOAM, 7 TO 15 PERCENT SLOPES, VERY STONY"
55A "YOGAVILLE LOAM, 0 TO 2 PERCENT SLOPES, OCCASIONALLY FLOODED"
W WATER

OF

PROJECT MANAGER: RNNNNN-NN
DATE: Month DD, YYYY
SCALE: 1" = 3000'
CHECKED BY: Initials
DRAWN BY: Initials
DESIGNED BY: Initials

REVISIONS

Draper Aden Associates
Engineering ◆ Surveying ◆ Environmental Services

Blacksburg, VA
200 South Main Street
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291

Richmond, VA
8090 Villa Park Drive
Richmond, VA 23228
804-264-2228 Fax: 804-264-0773

Raleigh-Durham, NC
2521 Schoolside Road, Suite 105
Apex, NC 27502
919-307-9997 Fax: 919-367-9994

www.daa.com

LETTERS FROM STATE AND FEDERAL AGENCIES

COMMONWEALTH of VIRGINIA

James S. Gilmore, III
Governor

Ronald P. Hamm
Secretary of Natural Resources

Marine Resources Commission
2600 Washington Avenue
Third Floor
Newport News, Virginia 23607

William A. Pruitt
Commissioner

December 17, 2001

Mr. P. Matt Overton
Draper Aden & Associates
8090 Villa Park Drive
Richmond, VA 23228

RE: Nelson County
Water System Improvements

Dear Mr. Overton:

In response to your request for comments regarding the above-referenced proposed activities, I would like to offer the following.

The Virginia Marine Resources Commission, pursuant to Title 28.2 of the Code of Virginia, is responsible for protecting and preserving the marine fisheries, submerged lands, and tidal wetlands throughout the Commonwealth. The Commission issues permits for encroachment over these State-owned submerged lands. While this agency has jurisdiction over all waters of the Commonwealth we routinely assert jurisdiction over encroachments which have a contributing watershed greater than 5 square miles upstream of where the impacts occur.

As a result of a desktop review of the information you submitted, we are unable to determine the extent of the impacts to our jurisdiction. However, when you identify the specific stream crossings we will be very willing to review them at that time.

We would like to thank you for the opportunity to provide comments early in the planning process and stand ready to assist you in any way we can with this project.

Sincerely,

Jeffrey P. Madden
Environmental Engineer

JPM/lmw
HM
cc: Army Corps of Engineers

JAN 14 2002

COMMONWEALTH of VIRGINIA

Department of Historic Resources

2801 Kensington Avenue, Richmond, Virginia 23221

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

Kathleen S. Kilpatrick
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
TDD: (804) 367-2386
www.dhr.state.va.us

January 11, 2002

Mr. P. Matt Overton
Draper Aden Associates
8090 Villa Park Drive
Richmond, Virginia 23228

Re: Rockfish Water and Sewer
Nelson County, Virginia
DHR File Number 2002-0034

Dear Mr. Overton:

Thank you for consulting with our office in regard to the referenced project. We understand that you have completed an archives search and that several previously identified historic properties lie within or adjacent to the project area. Before we are able to complete our review, we require a USGS quad map indicating the relationship of these historic properties to the project area.

In accordance with the Advisory Council on Historic Preservation's implementing regulations 36CFR800.2(a)(4), while a federal agency (in this case the Corps of Engineers) may delegate applicants, consultants or designees to prepare information, analyses and recommendations, the agency official remains legally responsible for all required findings and determinations. It is therefore the responsibility of the Corps to make any effect determinations with regard to this project as stipulated in 36CFR800.4 and 800.5. The Corps should then request our concurrence with said finding. In addition, the Corps will need to define the Area of Potential Effect for the project.

Thank you again for consulting with us. Please feel free to contact me at (804) 367-2323 ext. 140 or lrichards@dhr.state.va.us if you have any questions or concerns.

Sincerely,

Lily A. Richards
Archaeologist and Historian, Division of Resource Services and Review

C. Nora Eisley, Corps of Engineers

Program Services Div.
10 Courthouse Ave.
Petersburg, VA 23803
Tel: (804) 863-1685
Fax: (804) 862-6196

Petersburg Office
19-B Bollingbrook Street
Petersburg, VA 23803
Tel: (804) 863-1620
Fax: (804) 863-1627

Portsmouth Office
612 Court St., 3rd Fl.
Portsmouth, VA 23704
Tel: (757) 396-6707
Fax: (757) 396-6712

Roanoke Office
1030 Penmar Ave., SE
Roanoke, VA 24013
Tel: (540) 857-7585
Fax: (540) 857-7588

Winchester Office
107 N. Kent St., #203
Winchester, VA 22601
Tel: (540) 722-3427
Fax: (540) 722-7535

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

David G. Brickley
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

217 Governor Street, 3rd Floor

TDD (804) 786-2121 Richmond, Virginia 23219 (804) 786-7951 FAX (804) 371-2674

http://www.state.va.us/~dcr/vaher.html

October 25, 2001

Matt Overton
Draper Aden Associates
8090 Villa Park Drive
Richmond, Virginia 23228

Re: Nelson County Service Authority; Construction of New Wastewater and Water Utility Lines near Route 151

Dear Mr. Overton:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biological and Conservation Data System (BCD) for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

BCD documents the presence of natural heritage resources in the project vicinity. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

In addition, our files do not indicate the presence of any State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

New and updated information is continually added to BCD. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

A fee of $ 50.00 has been assessed for the service of providing this information. Please find enclosed an invoice for that amount. Please return one copy of the invoice along with your remittance made payable to the Treasurer of Virginia, Department of Conservation and Recreation, 203 Governor Street, Suite 402, Richmond, VA 23219, ATTN: Cashier. Payment is due within thirty days of the invoice date.

Should you have any questions or concerns, feel free to contact me at 804-371-2708. Thank you for the opportunity to comment on this project.

Sincerely,

S. René Hypes

S. René Hypes
Project Review Coordinator

COMMONWEALTH of VIRGINIA

James S. Gilmore, III
Governor
John Paul Woodley, Jr.
Secretary of Natural Resources

Department of Game and Inland Fisheries

William L. Woodfin, Jr.
Director

November 30, 2001

P. Matt Overton
Draper Aden Associates
8090 Villa Park Drive
Richmond, VA 23228

RE: ESSLOG #15726, New Wastewater and Water Utility Lines, Nelson Co. Service Authority

Dear Mr. Overton:

This letter is in response to your request for information related to the presence of threatened or endangered species in the vicinity of the above referenced project.

A nest of the *state threatened* loggerhead shrike (*Lanius ludovicianus*) has been documented in the project area. In addition, three stream reaches classified as wild trout streams are crossed by the project area. They are Paul's Creek (Class IV, TSS93461, RM 1.3-3.6), Stony Creek (Class II, TSS93401, brook trout, RM 4.2-8.0), and Spruce Creek (Class II, TSS93465, brook trout, RM 1.5-4.2). The applicant should coordinate with this Department to evaluate potential impacts to these resources.

Information about fish and wildlife species was generated from our agency's computerized Fish and Wildlife Information System, which describes animals that are known or may occur in a particular geographic area. Field surveys may be necessary to determine the presence or absence of some of these species on or near the proposed area. Also, additional sensitive animal species may be present, but their presence has not been documented in our information system.

Endangered plants and insects are under the jurisdiction of the Virginia Department of Agriculture and Consumer Services, Bureau of Plant Protection. Questions concerning sensitive plant and insect species occurring at the project site should be directed to Keith Tignor at (804) 786-3515.

There is a processing charge of $25.00 for our response. Please remit a check, made payable to **TREASURER OF VIRGINIA**, within 30 days to MaryBeth Murr at the address listed on the first page. Include a copy of this letter with your payment to ensure that your account is properly credited.

This letter summarizes the likelihood of the occurrence of endangered or threatened animal species

at the project site. If you have additional questions in this regard, please contact me at (804) 367-0909. Please note that this response does not address any other environmental concerns; these issues are analyzed by our Environmental Services Section, in conjunction with interagency review of applications for state and federal permits. If you have any questions in this regard, please contact Tom Wilcox or Brian Moyer at (804) 367-6913.

The Fish and Wildlife Information Service, the system of databases used to provide the information in this letter, can now be accessed via the Internet! The Service currently provides access to current and comprehensive information about all of Virginia's fish and wildlife resources, including those listed as threatened, endangered, or special concern; colonial birds; waterfowl; trout streams; and all wildlife. Users can choose a geographic location and generate a report of species known or likely to occur around that point. From our main web page, at www.dgif.state.va.us, choose the hyperlink to "Wildlife Information Online". For more information, please contact Amy Martin, Online Service Coordinator, at (804) 367-2211.

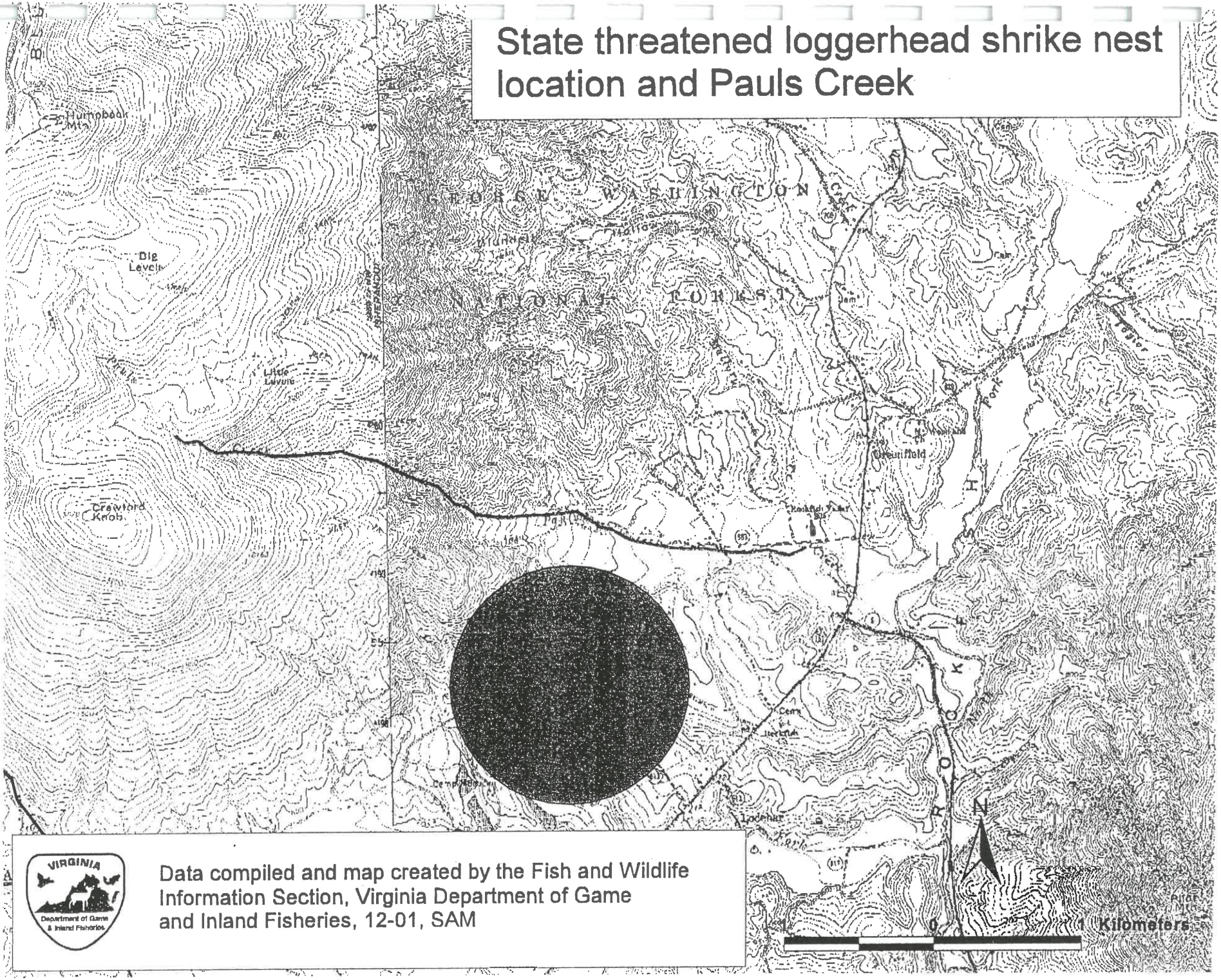
Thank you for your interest in the wildlife resources of Virginia.

Sincerely,

Shelly A. Miller
Wildlife Diversity Biologist

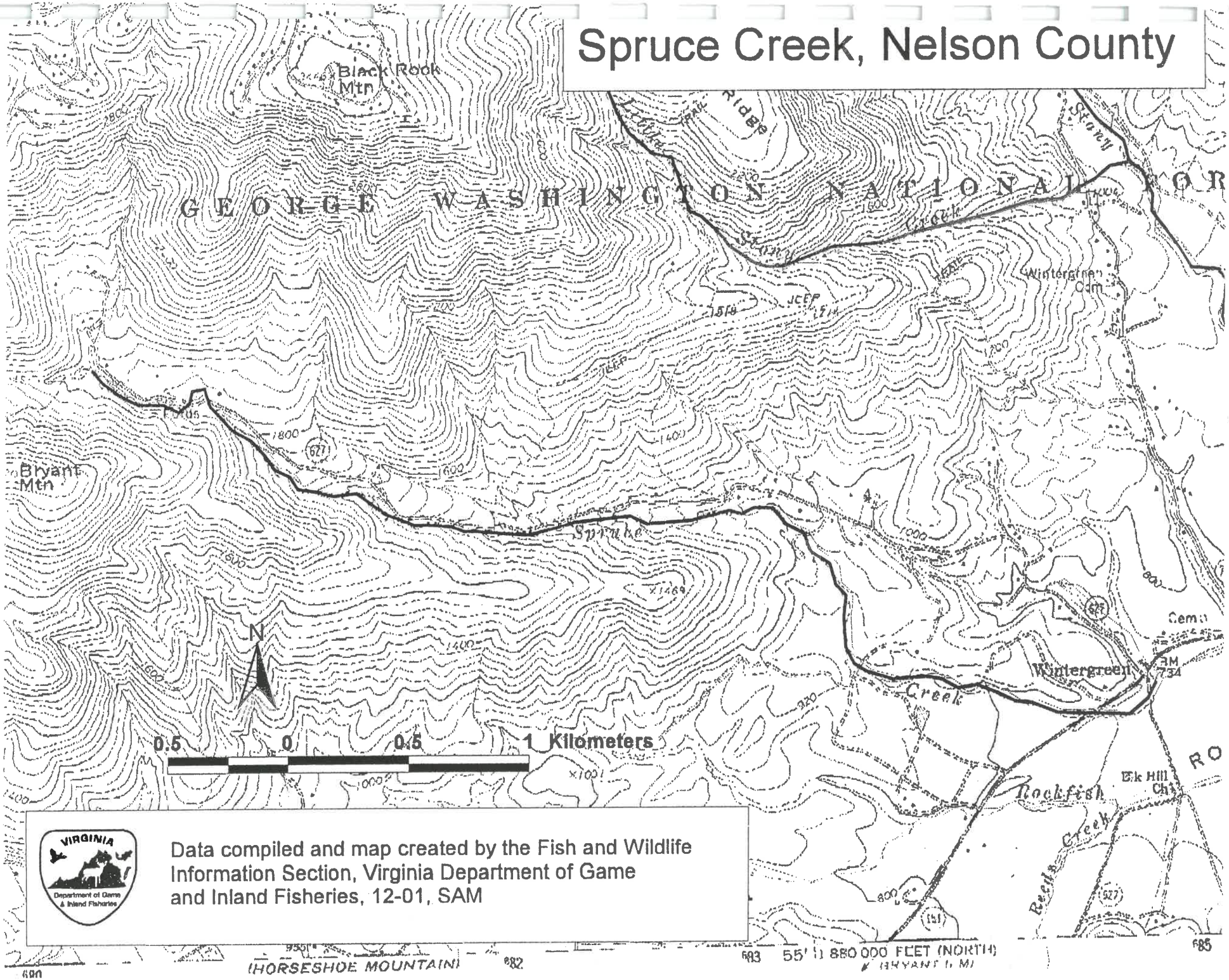
cc: R.T. Fernald, VDGIF

State threatened loggerhead shrike nest location and Pauls Creek

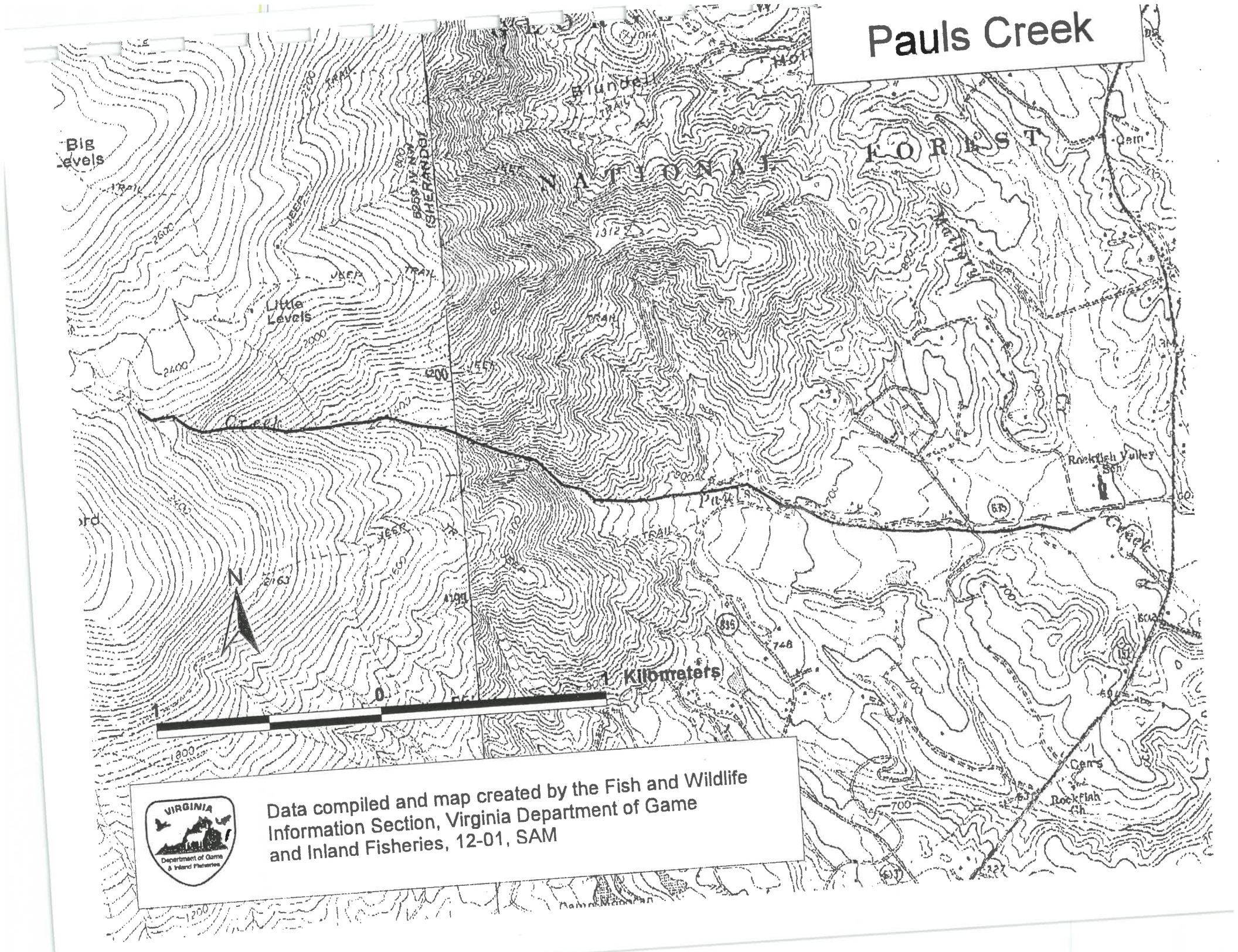


Data compiled and map created by the Fish and Wildlife Information Section, Virginia Department of Game and Inland Fisheries, 12-01, SAM

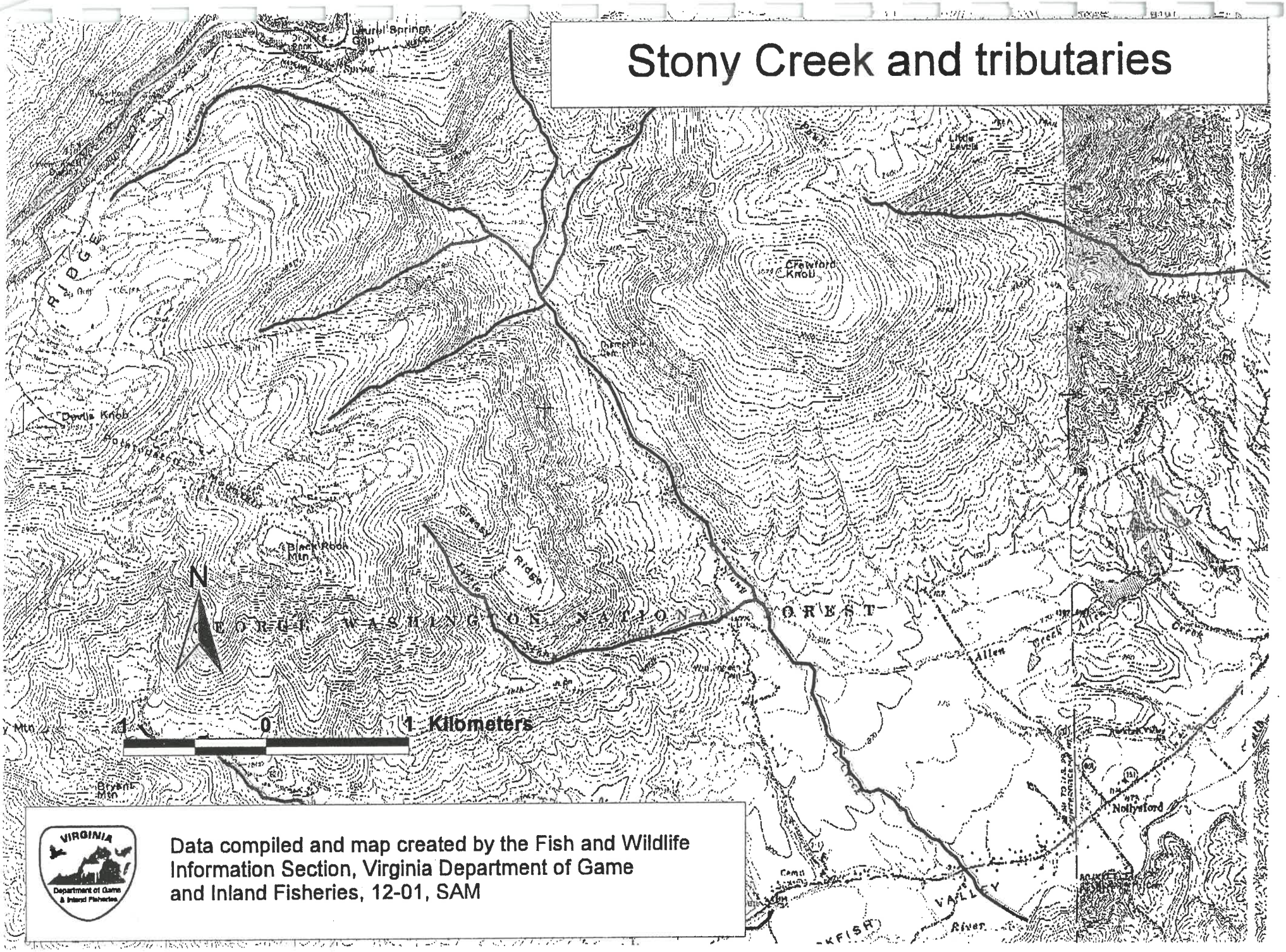
Spruce Creek, Nelson County



Data compiled and map created by the Fish and Wildlife Information Section, Virginia Department of Game and Inland Fisheries, 12-01, SAM


Pauls Creek
Big Levels
Little Levels
Blundell
NATIONAL FOREST
Rockfish Valley
Pauls Creek
N
0
1 Kilometers
Data compiled and map created by the Fish and Wildlife Information Section, Virginia Department of Game and Inland Fisheries, 12-01, SAM
VIRGINIA
Department of Game & Inland Fisheries

Stony Creek and tributaries



Data compiled and map created by the Fish and Wildlife Information Section, Virginia Department of Game and Inland Fisheries, 12-01, SAM

** VASCULAR PLANTS

ALNUS INCANA SSP RUGOSA	SPECKLED ALDER	G5T5	S2			Y
ARABIS HIRSUTA VAR ADPRESSIPILIS	HAIRY ROCKCRESS	G5T4Q	S1S2			N
ARNOGLOSSUM MUEHLENBERGII	GREAT INDIAN-PLANTAIN	G4	S2			N
CALYCANTHUS FLORIDUS VAR GLAUCUS	SMOOTH SWEET-SHRUB	G5T5	S1?			N
EPILOBIUM LEPTOPHYLLUM	LINEAR-LEAVED WILLOW-HERB	G5	S2			N
HELONIAS BULLATA	SWAMP-PINK	G3	S2S3	LT	LE	Y
HUPERZIA APPALACHIANA	APPALACHIAN FIR-CLUBMOSS	G4G5	S2			Y
LEUCOTHOE FONTANESIANA	HIGHLAND DOG-HOBBLE	G5	S1S2			N
MINUARTIA GROENLANDICA	MOUNTAIN SANDWORT	G5	S1			Y
POTENTILLA ARGUTA	TALL CINQUEFOIL	G5	S1			Y
SIBBALDIOPSIS TRIDENTATA	THREE-TOOTHED CINQUEFOIL	G5	S2			Y
SOLIDAGO ULIGINOSA VAR ULIGINOSA	BOG GOLDENROD	G4G5T?	S2			N

23 Records Processed

Return to the county list
Return to the Virginia Natural Heritage Program *home page*

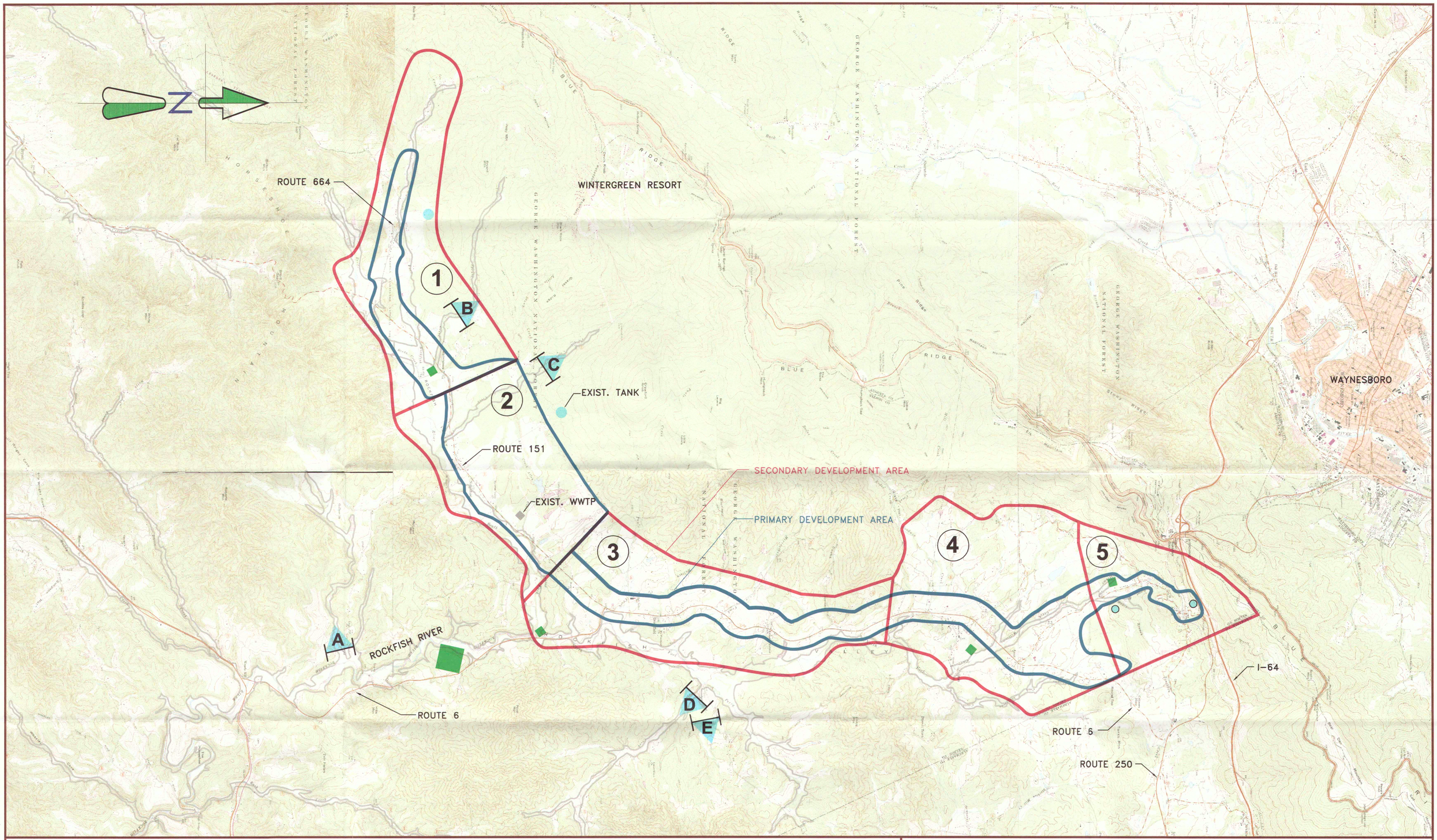


PLATE 1 - FACILITIES MASTER PLAN

ROCKFISH VALLEY CORRIDOR WATER AND SEWER STUDY

1	BEECH GROVE	4	AVON
2	NELLYSFORD	5	AFTON
3	ROCKFISH/CENTRAL		

SCALE: 1" = 3000'

LEGEND

- PRIMARY SERVICE AREA
- SECONDARY SERVICE AREA
- APPROXIMATE FLOOD PLAIN LIMITS
- POTENTIAL WATER STORAGE TANK
- POTENTIAL WATER IMPOUNDMENT & WTP
- POTENTIAL WWTP
- POTENTIAL REGIONAL WWTP

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services