

Interstate 81 Interchange Development Suitability Study For Botetourt County, Virginia



DRAFT



Prepared by the
Roanoke Valley-Alleghany Regional Commission
March 2004



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PURPOSE OF STUDY

The purpose of this study is to update the Fifth Planning District Commission's 1988 I-81 Interchange Study for Botetourt County, Virginia and review the impact of the improvements proposed in the Virginia Department of Transportation's 1998 Interstate 81 Improvement Study. The study reviews factors that will influence future land use at Interstate 81 Exits 156, 162, 167 and 168. The study is intended to describe existing conditions at each interchange and to recommend general future land uses. The recommendations in this study are intended for use in the update of the Future Land Use element of the Botetourt County Comprehensive Plan.

As development reduces the amount of land available in southern Botetourt County, it is expected that growth will move along Routes 220, 11 and Interstate 81. There is potential for development to take place at or near interchanges where easy transportation access is available.

The study is focused only on existing and future use at each interchange and does not discuss design or engineering issues related to improving Interstate 81. The basis for the traffic information in the report is the Interstate 81 Improvement Study and the I-81 Interchange Study for Botetourt County, Virginia. Additional information was obtained from the Botetourt County Comprehensive Plan, Countywide Water and Wastewater Analysis for Botetourt County, VDOT Daily Traffic Volumes Jurisdiction Report for Botetourt County, Soil Survey of Botetourt County, the Botetourt County GIS, and field work.

OVERVIEW OF INTERCHANGES

Interchange Study Areas

A base map for each study area was prepared using digital tax parcel data from the Botetourt County GIS. Data for each of the study components were collected and mapped. Map 1 on the following page shows the locations of the interchanges.

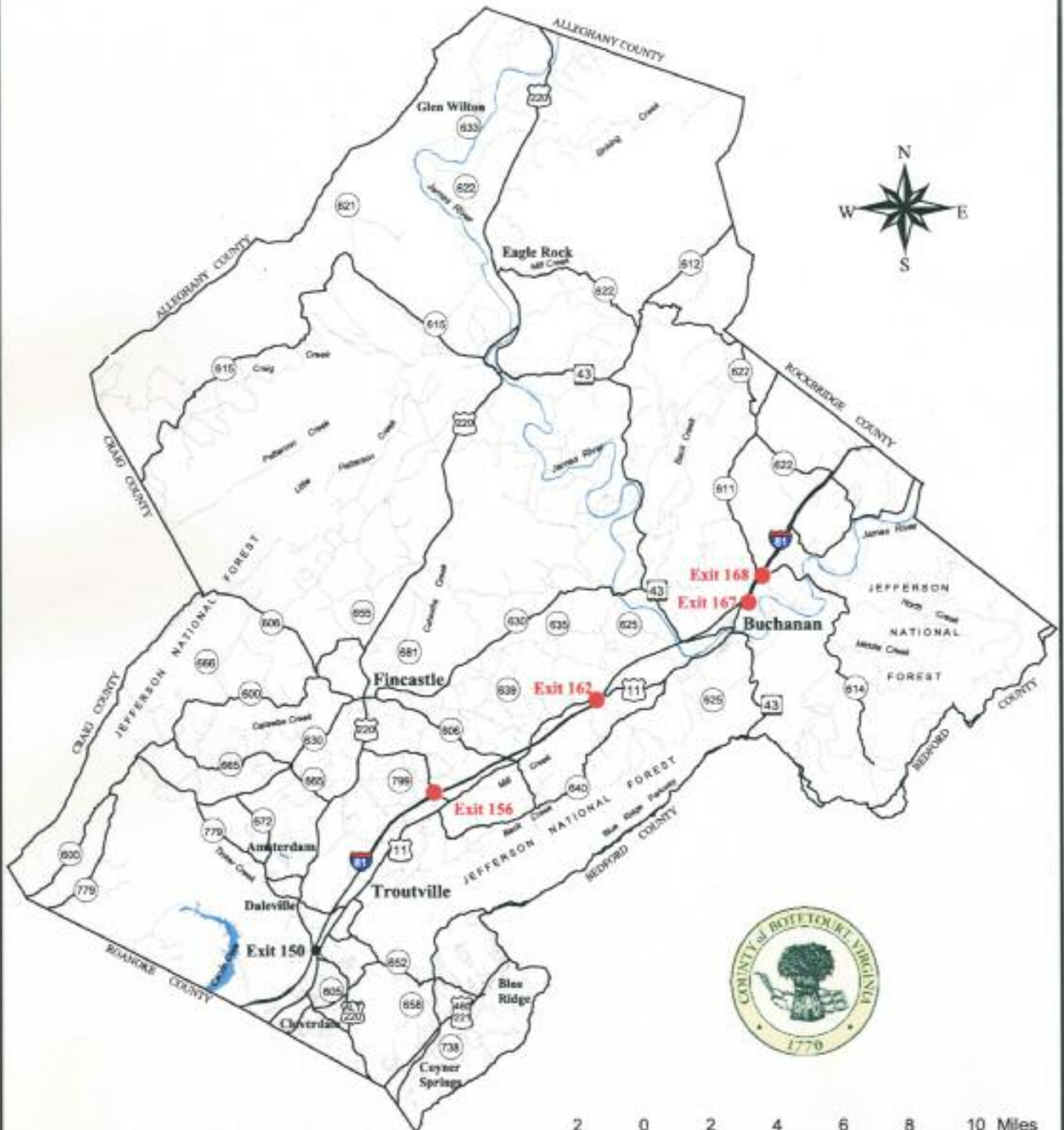
Exit 156 is located approximately 12 miles north of Roanoke City and 4 miles north of the Town of Troutville. The exit provides access to Virginia State Route 640, which in turn connects U.S. Route 220 to U.S. Route 11. The study area around Exit 156 includes 8.3 miles of Interstate 81, 7.2 miles of U.S. Route 11, and all of State Route 640 from the interchange southeast to its intersection with U.S. Route 11, and a small portion of U.S. Route 11 itself, as well as a section of State Route 640 to the northwest.

The Exit 162 interchange is located approximately 18 miles north of Roanoke City and 5 miles southwest of the Town of Buchanan. Exit 162 is the southern access to Buchanan via U.S. Route 11. The Exit 162 study area encompasses 10 miles of Interstate 81, and 10.3 miles of U.S. Route 11. Interstate 81 and U.S. Route 11 cross at the interchange and take a northeast-southwest direction at this exit.

Exit 167 and Exit 168 are located only 0.8 miles apart, both immediately north of the Town of Buchanan. Exit 167 is not a full interchange, offering only north entrance to Interstate 81 and a south exit to U.S. Route 11. The study area at Exit 167 and 168 includes 6.6 miles of Interstate 81, 5.6 miles of U.S. Route 11. U.S. Route 11 merges with Interstate 81 at this interchange (to the north they share the same highway/travelway). The only other state maintained road in this study area is Frontage Road 054 which parallels Interstate 81 to its west.

Exit 168 provides access to State Route 614 to Arcadia, two frontage roads F-054 and F-055, running parallel to the interstate to the west and east. It is the most intensely developed of the four interchanges in the study. The Exit feeds directly into State Routes 614 and 624 to the east, and offers access to two frontage roads, F-054 to the west and F-055 to the east.

Map 1 Interchange Locations Botetourt County



Sources: 1992 US Census TIGER files, Virginia Department of Transportation 1993, 1998
Prepared by the Roanoke Valley-Alleghany Regional Commission, June 2003

2 0 2 4 6 8 10 Miles

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TRAFFIC AND TRANSPORTATION ANALYSIS

Traffic Projections

Information in the following section is taken from VDOT's Interstate 81 Improvement Study that was completed by Wiley & Wilson in 1998. The scope of the VDOT study involved the collection of traffic data, the development of a calibrated CORSIM simulation model, and the analysis of existing and future traffic operations on Interstate 81 (including ramps) and its crossroads.



The VDOT study presents smoothed 1997 traffic data, 2010 forecasted traffic data, and design year 2020 forecasted traffic data and projected design hour volumes. The data indicates main line, ramp and connecting roadway volumes and turning movements. The main line (I-81), ramp and connecting roadway volumes are included in this study and illustrated on the following pages along with noted trends.

For further detail and additional information, including aerial images, CORSIM diagrams, typical road section designs, bridge structure data, and cost estimates for the proposed improvements to I-81, refer to the Interstate 81 Improvement Study.

Exit 156

The Interstate 81 Improvement Study projects AADT and peak hour volumes on Interstate 81 (Tables 1-6) to increase by 55-60% by 2010 and 93-100% by 2020 with no projected increase in percentage of truck traffic. Only a slight decrease in LOS, from A to B, on Interstate 81 is projected at this interchange. Interstate 81 north and south of the interchange is projected have little or no change with a LOS B by 2020.

The VDOT study is projecting no decrease in LOS for the interchange ramps and State Route 640. Route 640 traffic volume on the south side of the interchange - coming from U.S. Route 11 - is projected to increase 100% while traffic on the north side is projected to increase 75% by 2020.

Traffic volumes on the northbound entrance ramp and southbound exit ramp are projected to increase by 100% while the northbound exit ramp and southbound entrance ramp are projected to increase 71% by 2020.

Table 1
I-81 Northbound, South of Exit 156

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	15,950	24,600	30,800	1	25%	93%
Peak Hour	1,230	1,950	2,430	1	25%	98%
% Trucks / AADT	36	36	36	0	0%	0%
% Trucks / PH	33	33	33	0	0%	0%
LOS	B	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 2
I-81 Northbound, North of Exit Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	15,250	23,700	29,600	1	25%	94%
Peak Hour	1,130	1,820	2,260	1	24%	100%
% Trucks / AADT	36	36	36	0	0%	0%
% Trucks / PH	33	33	33	0	0%	0%
LOS	A	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 3
I-81 Northbound, North of Exit 156

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	15,450	24,000	30,000	1	25%	94%
Peak Hour	1,160	1,865	2,320	1	24%	100%
% Trucks / AADT	36	36	36	0	0%	0%
% Trucks / PH	34	34	34	0	0%	0%
LOS	A	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 4
I-81 Southbound, North of Exit 156

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	15,450	24,000	30,000	1	25%	94%
Peak Hour	1,140	1,810	2,270	1	25%	99%
% Trucks / AADT	30	30	30	0	0%	0%
% Trucks / PH	28	28	28	0	0%	0%
LOS	B	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 5
I-81 Southbound, South of I-81 Southbound Exit Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	15,250	23,700	29,600	1	25%	94%
Peak Hour	1,140	1,780	2,230	1	25%	96%
% Trucks / AADT	28	28	28	0	0%	0%
% Trucks / PH	28	28	28	0	0%	0%
LOS	B	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 6
I-81 Southbound, South of Exit 156

	1,997	2,010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	15,950	24,600	30,800	1	25%	93%
Peak Hour	1,160	1,830	2,300	1	26%	98%
% Trucks / AADT	25	25	25	0	0%	0%
% Trucks / PH	27	28	28	0	0%	4%
LOS	A	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 7
I-81 Northbound Exit Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	700	900	1,200	0	33%	71%
Peak Hour	100	130	170	0	31%	70%
% Trucks / AADT	10	10	10	0	0%	0%
% Trucks / PH	14	14	14	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 8
I-81 Northbound, Entrance Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	200	300	400	1	33%	100%
Peak Hour	30	45	60	1	33%	100%
% Trucks / AADT	25	25	25	0	0%	0%
% Trucks / PH	15	15	15	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 9
I-81 Southbound Exit Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	200	300	400	1	33%	100%
Peak Hour	20	30	40	1	33%	100%
% Trucks / AADT	19	19	19	0	0%	0%
% Trucks / PH	25	25	25	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 10
I-81 Southbound, Entrance Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	700	900	1,200	0	33%	71%
Peak Hour	110	150	190	0	27%	73%
% Trucks / AADT	17	17	17	0	0%	0%
% Trucks / PH	1	1	1	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 11
Rt. 640 Northbound, South of Exit 156

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	700	1,000	1,400	0	40%	100%
Peak Hour	90	144	190	1	32%	111%
% Trucks / AADT	10	10	10	0	0%	0%
% Trucks / PH	5	5	5	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 12
Rt. 640 Northbound, South of I-81 Southbound Exit Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	730	1,050	1,450	0	38%	99%
Peak Hour	90	130	180	0	38%	100%
% Trucks / AADT	1	1	1	0	0%	0%
% Trucks / PH	3	3	3	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 13
Rt. 640 Northbound, North of I-81 Southbound Exit Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	400	500	700	0	40%	75%
Peak Hour	60	102	130	1	27%	117%
% Trucks / AADT	2	2	2	0	0%	0%
% Trucks / PH	3	3	3	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 14
Rt. 640 Southbound, North of Exit 156

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	400	500	700	0	40%	75%
Peak Hour	70	88	110	0	25%	57%
% Trucks / AADT	1	1	1	0	0%	0%
% Trucks / PH	30	2	2	-1	0%	-93%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 15
Rt. 640 Southbound, South of I-81 Southbound Entrance Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	390	590	690	1	17%	77%
Peak Hour	40	60	70	1	17%	75%
% Trucks / AADT	3	3	3	0	0%	0%
% Trucks / PH	4	4	4	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 16
Rt. 640 Southbound, South of I-81 Northbound

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	700	1,000	1,400	0	40%	100%
Peak Hour	90	115	150	0	30%	67%
% Trucks / AADT	3	3	3	0	0%	0%
% Trucks / PH	30	30	30	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Exit 162

The Interstate 81 Improvement Study projects an AADT increase on Interstate 81 from 1997 to 2010 is 55% while the increase from 1997 to 2020 is 93% (Tables 17-22). Peak hour volume on Interstate 81 is projected to increase by 98% from 1997 to 2020. Interstate 81 southbound is projected to have an increase in percentage of truck traffic in the peak hour of only 1% north of the interchange and 4% south of the interchange.

While Interstate 81 AADT is projected to increase 93% (Tables 23-26), the AADT for the ramps at this interchange are projected to increase 129% to 140% from 1997 to 2020.

U.S. Route 11 AADT north of the interchange is projected (Table 29) to increase 131% from 1997 to 2020 while still maintaining a LOS of A. U.S. Route 11 southbound, south of the interchange has a projected AADT increase of 117% and peak hour increase of 280% from 1997 to 2020. U.S. Route 11 northbound, south of the interchange has a projected AADT increase of only 65% and peak hour increase of 58% for

the same time period. The Interstate 81 Improvement Study does not provide a reason for the difference in volumes.

Table 17
I-81 Northbound, South of Exit 162

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	15,450	24,000	30,000	1	25%	94%
Peak Hour	1,160	1,865	2,320	1	24%	100%
% Trucks / AADT	36	36	36	0	0%	0%
% Trucks / PH	34	34	34	0	0%	0%
LOS	B	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 18
I-81 Northbound, North of Exit Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	14,750	22,900	28,400	1	24%	93%
Peak Hour	1,080	1,745	2,140	1	23%	98%
% Trucks / AADT	38	38	38	0	0%	0%
% Trucks / PH	35	35	35	0	0%	0%
LOS	A	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 19
I-81 Northbound, North of Exit 162

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	15,000	23,300	29,000	1	24%	93%
Peak Hour	1,120	1,815	2,240	1	23%	100%
% Trucks / AADT	38	38	38	0	0%	0%
% Trucks / PH	35	35	35	0	0%	0%
LOS	A	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 20
I-81 Southbound, North of Exit 162

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	15,000	23,300	29,000	1	24%	93%
Peak Hour	1,080	1,730	2,160	1	25%	100%
% Trucks / AADT	35	35	35	0	0%	0%
% Trucks / PH	30	30	30	0	0%	1%
LOS	A	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 21
I-81 Southbound, South of Exit Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	14,750	22,900	28,400	1	24%	93%
Peak Hour	1,060	1,700	2,110	1	24%	99%
% Trucks / AADT	28	28	32	0	14%	14%
% Trucks / PH	28	28	29	0	4%	4%
LOS	A	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 22
I-81 Southbound, South of Exit 162

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	15,450	24,000	30,000	1	25%	94%
Peak Hour	1,140	1,810	2,270	1	25%	99%
% Trucks / AADT	30	30	30	0	0%	0%
% Trucks / PH	28	28	28	0	0%	0%
LOS	A	B	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 23
I-81 Northbound, Exit Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	700	1,100	1,600	1	45%	129%
Peak Hour	80	120	180	1	50%	125%
% Trucks / AADT	6	6	6	0	0%	0%
% Trucks / PH	8	8	8	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 24
I-81 Northbound, Entrance Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	250	400	600	1	50%	140%
Peak Hour	40	70	100	1	43%	150%
% Trucks / AADT	8	8	8	0	0%	0%
% Trucks / PH	19	19	19	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 25
I-81 Southbound, Exit Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	250	400	600	1	50%	140%
Peak Hour	20	30	50	1	67%	150%
% Trucks / AADT	26	26	26	0	0%	0%
% Trucks / PH	1	1	1	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 26
I-81 Southbound, Entrance Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	700	1,100	1,600	1	45%	129%
Peak Hour	90	150	210	1	40%	133%
% Trucks / AADT	11	11	11	0	0%	0%
% Trucks / PH	2	11	2	5	-82%	0%
LOS	A	A	B			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 27
Rt. 11 Northbound, South of Exit 162

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	2,000	2,600	3,300	0	27%	65%
Peak Hour	240	320	380	0	19%	58%
% Trucks / AADT	4	4	4	0	0%	0%
% Trucks / PH	9	9	9	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 28
Rt. 11 Northbound, North of I-81 Entrance Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	2,300	3,130	3,770	0	20%	64%
Peak Hour	250	340	410	0	21%	64%
% Trucks / AADT	4	4	4	0	0%	0%
% Trucks / PH	15	15	15	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 29
Rt. 11 Northbound, North of Exit 162

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	1,600	2,600	3,700	1	42%	131%
Peak Hour	160	220	300	0	36%	88%
% Trucks / AADT	3	3	3	0	0%	0%
% Trucks / PH	14	14	14	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 30
Rt. 11 Southbound, North of Exit 162

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	1,600	2,600	3,700	1	42%	131%
Peak Hour	170	303	450	1	49%	165%
% Trucks / AADT	9	9	9	0	0%	0%
% Trucks / PH	4	4	4	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 31
Rt. 11 Southbound, South of I-81 Exit Ramp

	1997	2010	2020 Preferred Alternative	Change 1997 - 2010	Change 2010 - 2020	Change 1997 - 2020
AADT	1,650	2,260	3,580	0	58%	117%
Peak Hour	121	290	460	1	59%	280%
% Trucks / AADT	10	10	10	0	0%	0%
% Trucks / PH	7	7	7	0	0%	0%
LOS	A	A	A			

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Exit 167

The VDOT Interstate 81 Improvement Study discusses the potential closing of Exit 167. The analysis for this consideration shows that the elimination of Exit 167 ramps improves operation of traffic on this section of Interstate 81 while having no negative impact on traffic flow at Exit 168. The option for leaving the existing interchange ramps, with modification to the alignment of Interstate 81 to improve traffic flow, has also been presented by VDOT. For the purpose of this study, it is assumed that the interchange *will* remain open.

A significant decrease in the level of service (LOS) is projected (Tables 32-35) on Interstate 81 for the improvement option without truck lane restrictions from LOS B to LOS D, E, and F by year 2020. Improvements with truck lane restrictions will result in LOS remaining at level B.

Traffic on Interstate 81 in this area is expected to increase 25% by 2010 and almost double by 2020 with or without truck lane restrictions. The significant increase in traffic volume will make the area more attractive to commercial development such as gas stations and convenience stores.

The southbound exit ramp peak hour traffic (Table 37) is projected to increase by 400% from 1997 to 2020 and AADT has a projected increase of 117%. The AADT and peak hour traffic on the ramps and on U.S. Route 11 are projected to double from 1997 to 2020.

Severely limited sight distance at the end of the southbound exit ramp on Frontage Road 055, in combination with the offset intersection of Frontage Road 055 complicate turning movements and hinder safety at this ramp. Development taking place adjacent to the interchange should be required to demonstrate that adequate design of access to the property will be provided and will not negatively impact the flow of traffic at the interchange.

Table 32
I-81 Northbound, South of Exit 167

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	15,000	23,260	29,000	29,000	55%	25%	25%	93%	93%
Peak Hour	1,120	1,815	2,240	2,240	62%	23%	23%	100%	100%
% Trucks / AADT	38	38	38	38	0%	0%	0%	0%	0%
% Trucks / PH	35	35	35	35	0%	0%	0%	0%	0%
LOS	B	C	D	B					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 33
I-81 Northbound, North of Exit 167

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	15,800	24,425	30,550	30,550	55%	25%	25%	93%	93%
Peak Hour	1,300	2,075	2,590	2,590	60%	25%	25%	99%	99%
% Trucks / AADT	37	37	37	37	0%	0%	0%	0%	0%
% Trucks / PH	32	33	33	33	3%	0%	0%	3%	3%
LOS	B	C	F	B					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 34
I-81 Southbound, North of Exit 167

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	15,300	25,725	29,650	29,650	68%	15%	15%	94%	94%
Peak Hour	1,100	1,790	2,260	2,260	63%	26%	26%	105%	105%
% Trucks / AADT	35	35	35	35	0%	0%	0%	0%	0%
% Trucks / PH	30	30	30	30	0%	0%	0%	0%	0%
LOS	B	B	C	B					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 35
I-81 Southbound, South of Exit 167

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	15,000	23,260	29,000	29,000	55%	25%	25%	93%	93%
Peak Hour	1,080	1,740	2,160	2,160	61%	24%	24%	100%	100%
% Trucks / AADT	35	35	35	35	0%	0%	0%	0%	0%
% Trucks / PH	30	30	30	30	0%	0%	0%	0%	0%
LOS	C	D	E	B					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 36
Northbound Entrance Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	800	1,165	1,550	1,550	46%	33%	33%	94%	94%
Peak Hour	180	260	350	350	44%	35%	35%	94%	94%
% Trucks / AADT	25	25	25	25	0%	0%	0%	0%	0%
% Trucks / PH	25	25	25	25	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 37
Southbound Exit Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	300	465	650	650	55%	40%	40%	117%	117%
Peak Hour	20	50	100	100	150%	100%	100%	400%	400%
% Trucks / AADT	50	50	50	50	0%	0%	0%	0%	0%
% Trucks / PH	25	25	25	25	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 38
Rt. 11 Northbound, South of Entrance Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	1,495	2,160	2,900	2,900	44%	34%	34%	94%	94%
Peak Hour	290	225	565	565	-22%	151%	151%	95%	95%
% Trucks / AADT	18	18	18	18	0%	0%	0%	0%	0%
% Trucks / PH	20	20	20	20	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 39
Rt. 11 Northbound, North of Entrance Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	675	985	1,350	1,350	46%	37%	37%	100%	100%
Peak Hour	115	165	215	215	43%	30%	30%	87%	87%
% Trucks / AADT	9	9	9	9	0%	0%	0%	0%	0%
% Trucks / PH	11	11	11	11	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 40
Rt. 11 Northbound, North of Exit Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	665	985	1,340	1,340	48%	36%	36%	102%	102%
Peak Hour	110	160	215	215	45%	34%	34%	95%	95%
% Trucks / AADT	9	9	9	9	0%	0%	0%	0%	0%
% Trucks / PH	11	11	11	11	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 41
Rt. 11 Southbound, North of Exit Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	1,055	1,520	1,940	1,940	44%	28%	28%	84%	84%
Peak Hour	115	180	210	210	57%	17%	17%	83%	83%
% Trucks / AADT	7	7	7	7	0%	0%	0%	0%	0%
% Trucks / PH	11	11	11	11	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 42
Rt. 11 Southbound, South of Exit Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	1,380	2,010	2,685	2,685	46%	34%	34%	95%	95%
Peak Hour	140	235	315	315	68%	34%	34%	125%	125%
% Trucks / AADT	17	17	17	17	0%	0%	0%	0%	0%
% Trucks / PH	15	15	15	15	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Exit 168

The AADT on Interstate 81 in this area is expected to increase 25% by 2010 and almost double by 2020 with or without truck lane restrictions (Tables 43-47). The Interstate 81 Improvement Study makes the assumption of no increase in the percentage of truck traffic at this interchange.

The Interstate 81 Improvement Study projects a significant decrease in the level of service (LOS) on Interstate 81 for this section. The I-81 northbound LOS drops to D south of the interchange and to F north of the interchange by 2010. Truck lane restrictions improve flow to LOS C and D for the respective sections by 2020.

There is a projected 20% decrease in percentage of truck traffic on northbound entrance ramp (Table 49). This is the only interchange in the study area with a projected change in percentage of truck traffic.

The southbound entrance ramp has an AADT projected increase of 80% with or without truck lane restrictions. However, peak hour projected to increase with truck lane restrictions is 133% compared to 167% with restrictions. Proposed truck lane restrictions reduce projected peak hour traffic on Route 614 southbound south of the interchange from 77% to 15%. The opposite effect occurs on Route 614 northbound (Table 53), from a projected decrease of 7% in 2020 without truck lane restrictions to a 78% increase with truck lane restrictions.

The significant increase in traffic volume will make the area more attractive to commercial development such as gas stations and convenience stores. Extension and/or improvement to access road past the Spice House restaurant could open up a large parcel south of the interchange for development. There is possibility of development along the frontage road north of interchange. Future development along the frontage road on the interchange's northwest corner is limited due to existing residential development.

Table 43
I-81 Northbound, South of Exit 168

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	15,800	24,425	30,550	30,550	55%	25%	25%	93%	93%
Peak Hour	1,300	2,075	2,590	2,590	60%	25%	25%	99%	99%
% Trucks / AADT	37	37	37	37	0%	0%	0%	0%	0%
% Trucks / PH	33	33	33	33	0%	0%	0%	0%	0%
LOS	B	D	F	C					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 44
I-81 Northbound, North of Exit 168

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	15,615	24,220	30,350	30,350	55%	25%	25%	94%	94%
Peak Hour	1,415	2,255	2,850	2,850	59%	26%	26%	101%	101%
% Trucks / AADT	38	38	38	38	0%	0%	0%	0%	0%
% Trucks / PH	34	34	34	34	0%	0%	0%	0%	0%
LOS	D	F	F	D					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 45
I-81 Southbound, North of Exit 168

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	15,300	23,870	30,000	30,000	56%	26%	26%	96%	96%
Peak Hour	1,150	1,850	2,360	2,350	61%	28%	27%	105%	104%
% Trucks / AADT	37	37	37	37	0%	0%	0%	0%	0%
% Trucks / PH	29	29	29	29	0%	0%	0%	0%	0%
LOS	B	C	D	B					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 46
I-81 Southbound, South of Exit Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	14,800	28,885	28,750	28,750	95%	0%	0%	94%	94%
Peak Hour	1,060	1,735	2,190	2,190	64%	26%	26%	107%	107%
% Trucks / AADT	35	35	35	35	0%	0%	0%	0%	0%
% Trucks / PH	29	29	29	29	0%	0%	0%	0%	0%
LOS	A	B	C	B					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 47
I-81 Southbound, South of Exit 168

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	15,300	23,725	29,650	29,650	55%	25%	25%	94%	94%
Peak Hour	1,100	1,790	2,260	2,260	63%	26%	26%	105%	105%
% Trucks / AADT	35	35	35	35	0%	0%	0%	0%	0%
% Trucks / PH	30	30	30	30	0%	0%	0%	0%	0%
LOS	B	C	C	B					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 48
Northbound Exit Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	660	925	1,200	1,200	40%	30%	30%	82%	82%
Peak Hour	50	70	90	90	40%	29%	29%	80%	80%
% Trucks / AADT	11	11	11	11	0%	0%	0%	0%	0%
% Trucks / PH	10	10	10	10	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 49
Northbound Entrance Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	475	720	1,000	1,000	52%	39%	39%	111%	111%
Peak Hour	165	250	350	350	52%	40%	40%	112%	112%
% Trucks / AADT	46	37	46	37	-20%	24%	0%	0%	-20%
% Trucks / PH	37	27	27	27	-27%	0%	0%	-27%	-27%
LOS	A	A	B	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 50
Southbound Exit Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	500	840	1,250	1,250	68%	49%	49%	150%	150%
Peak Hour	80	120	170	170	50%	42%	42%	113%	113%
% Trucks / AADT	70	70	70	70	0%	0%	0%	0%	0%
% Trucks / PH	29	29	29	29	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 51
Southbound Entrance Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	500	695	900	900	39%	29%	29%	80%	80%
Peak Hour	30	40	70	80	33%	75%	100%	133%	167%
% Trucks / AADT	15	15	15	15	0%	0%	0%	0%	0%
% Trucks / PH	50	50	50	50	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 52
Route 614 Southbound, South of Exit 168

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	675	935	1,025	1,025	39%	10%	10%	52%	52%
Peak Hour	65	70	115	75	8%	64%	7%	77%	15%
% Trucks / AADT	5	5	5	5	0%	0%	0%	0%	0%
% Trucks / PH	3	3	3	3	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 53
Route 614 Northbound, South of Exit 168

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	880	1,120	1,025	1,025	27%	-8%	-8%	16%	16%
Peak Hour	135	190	125	240	41%	-34%	26%	-7%	78%
% Trucks / AADT	5	5	5	5	0%	0%	0%	0%	0%
% Trucks / PH	3	3	3	3	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 54
Route 614 Northbound, North of I-81 Entrance Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	890	1,225	1,420	1,420	38%	16%	16%	60%	60%
Peak Hour	55	80	80	80	45%	0%	0%	45%	45%
% Trucks / AADT	5	5	5	5	0%	0%	0%	0%	0%
% Trucks / PH	3	3	3	3	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 55
Route 614 Northbound, North of Exit Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	940	835	1,620	1,620	-11%	94%	94%	72%	72%
Peak Hour	75	125	130	130	67%	4%	4%	73%	73%
% Trucks / AADT	5	5	5	5	0%	0%	0%	0%	0%
% Trucks / PH	3	3	3	3	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 56
Route 614 Southbound, North of Entrance Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	550	780	1,020	1,020	42%	31%	31%	85%	85%
Peak Hour	70	105	135	135	50%	29%	29%	93%	93%
% Trucks / AADT	5	5	5	5	0%	0%	0%	0%	0%
% Trucks / PH	3	3	3	3	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

Table 57
Route 614 Southbound, South of Entrance Ramp

	1997	2010	2020 w/o truck lane restrictions	2020 w/truck lane restrictions	Change 1997 - 2010	Change 2010 - 2020 w/o truck lane restrictions	Change 2010 - 2020 w/ truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions	Change 1997 - 2020 w/o truck lane restrictions
AADT	500	835	1,170	1,170	67%	40%	40%	134%	134%
Peak Hour	100	140	175	175	40%	25%	25%	75%	75%
% Trucks / AADT	5	5	5	5	0%	0%	0%	0%	0%
% Trucks / PH	3	3	3	3	0%	0%	0%	0%	0%
LOS	A	A	A	A					

Source: Interstate 81 Improvement Study, Virginia Department of Transportation, Wiley & Wilson, 1998.

LAND USE COMPONENTS

Land use at the four interchanges has some commonalities as well as some significant differences. The following discussion of each land use analysis component will indicate these commonalities where appropriate. An examination of the unique land use qualities at each exit forms the essence of the discussion.

Geologic Structure and Formations

Most of Botetourt County, including all four interchange study areas, is located within the Valley and Ridge physiographic province. Valley floors in this region are commonly underlain by rock which is primarily limestone or dolomite in character. In many areas this limestone is characterized by the formation and presence of caverns and sinkholes. This characteristic landform is known as karst.



The presence of karst geology necessitates that certain developmental constraints be observed, as will be discussed. Specifically, this means that caverns, sinkholes, and similar structures may be present on a site-specific basis. A site test is recommended for any given parcel of land.

The following information on geologic formations is drawn primarily from the U.S. Geological Survey's 7.5 minute geologic maps for the appropriate quadrangles and the 1988 Interstate 81 Improvement Study.

Exit 156

The Exit 156 study area has only one underlying formation: the Elbrook formation. The rock type in the Elbrook formation consists primarily of limestone and dolomite interlayered. A secondary component of the formation is shale.

These rock types present little structural barrier to medium-intensity land uses such as residential or small business building construction. More caution is advised in considering larger industrial-type buildings requiring deep footings sunk to bedrock. There are no known fault lines or fracture zones in the Exit 156 study area.

Exit 162

The Exit 162 study area has two primary geologic formations underlying the zone of influence: (1) the Elbrook formation, which comprises about 90% of the study area, and (2) the Rome Formation, which comprises the remaining 10%. The two formations contain similar rock types, with both consisting of limestone and dolomite interlayered, together with shale. The Elbrook's primary rock type is limestone, with shale secondary. These proportions are reversed in the Rome. At Exit 162 these rock types are structurally capable of supporting medium-intensity land uses, although larger, heavier structures might be more problematic. Site specific geological surveys should be performed prior to any construction. There are no known fault lines or fracture zones in the study area around Exit 162.

Exit 167

Three different geologic formations are located in the Exit 167 study area: Elbrook, Conocheague, and Martinsburg. The Elbrook, as discussed above, consists primarily of limestone and shale. The Conocheague formation is also characterized by limestone in thin-layered beds, with sandstone and dolomite interlaid. The Martinsburg formation generally contains more sandstone and less limestone than

the other two, according to the U.S. Geological Survey, and near the surface consists of sandstone and shale interlayered, with deeper beds of limestone and shale. In the study area, the Martinsburg appears to correspond more or less with the slopes of Purgatory Mountain, and the other two formations with the more level land to the east and south.

There is at least one fault present in the study area. The Pulaski-Staunton thrust fault trends northeast-southwest through the area and crosses the interstate just north of the interchange. This fault is lengthy but old, and has not undergone appreciable change in recent decades. The fault has at least two branch faults in the study area as well. One of these has not been detected by direct observation, but is inferred based on surrounding geological conditions. This unnamed branch, also trending northeast-southwest, apparently diverges from the main fault just outside the boundaries of the study area to the east, crosses U.S. Route 11 just south of the interchange, then follows a course parallel to, and within the interstate right-of-way. The other branch fault diverges from the main fault approximately 0.2 miles west of the interchange and roughly parallels the eastern slope of Purgatory Mountain.

The presence of faults such as these – old and inactive – is in general not considered to be a threat to more intensive development. The Pulaski-Staunton thrust fault most likely dates from the mountain-building activity that created the Appalachian Mountains. There is always the possibility that the land along the fault could shift again, however the likelihood would be considered small according to traditional geological theory.

Exit 168

The primary formations found in the Exit 168 zone of influence are the Elbrook and Conococheague. Both of these formations, as discussed above, are characterized by fairly large proportions of limestone, and present little impediment to small or medium-scale commercial use, and a somewhat greater degree of restriction on large industrial operations. There are no known faults in the Exit 168 study area.

Generalized Soil Classifications

The general soils classifications provided in the Soil Survey of Botetout County can be used to compare the suitability of large areas for general land uses. Because of the small scale of the soil units mapped, these classifications should not be used for site specific planning or engineering.

The Exit 156 and Exit 162 study areas are composed of the Frederick-Groseclose soil classification. The soils have a clayey subsoil and are gently sloping to moderately steep. The soil is very deep and well drained. The soil is formed from material weathered from dolomite and limestone. The major limitations of this classification are slope, erosion potential, rock outcrops, low soil fertility, and clayey subsoil.



Exit 167 is composed of Frederick-Carbo-Rock outcrop and Tumbling-Groseclose-Laidig soil classifications. The Frederick-Carbo-Rock outcrop soil is composed of rock outcrop and soils that have clayey subsoil and are gently sloping to steep. The soil is very deep or moderately deep and well drained. The soil is formed from material weathered from dolomite and limestone. The classification can be underlain by limestone and is found in areas of karst. Limitations for development on this soil include the depth to bedrock, the slope, the clayey subsoil, and the scattered outcrops of bedrock. The Tumbling-Groseclose-Laidig Soil Classification contains soils that have a loamy or clayey subsoil and are gently sloping to moderately steep, very deep and well-drained. The soil is formed in old colluvial deposits or in material weathered from limestone and shale. The soils limitations development on this soil are wetness in some areas, the slope and the clayey subsoil in some areas.

The Exit 168 study area is composed of the Frederick-Carbo-Rock outcrop soils with characteristics previously detailed.

Groundwater Assessment

There are four major groundwater aquifer systems in Botetourt County. All four interchanges are located in the Cambrian-Ordovician aquifer system as is nearly all of the Interstate 81 corridor in Botetourt County. This aquifer has good to excellent water-bearing capabilities and water quality is usually excellent. Problems with iron and sulfur concentrations or with extreme water hardness are sometimes encountered in the aquifer, but there are no known occurrences of these problems in the study areas.

As was discussed in the preceding section on geology, this part of Botetourt County is underlain by limestone, much of which is karstic. Karst areas present peculiar and difficult circumstances for groundwater protection planning. Because it is common to find rapid and lengthy movements of water through underground solution channels in the rock, contamination of groundwater can be far-reaching and difficult to mitigate. Septic systems pose a particular danger to the groundwater, since central sewage collection systems are not available at all of the interchanges. If public sewer lines – and water lines – were extended, the likelihood of groundwater contamination would be reduced. Until that time, the need for protective measures are justified.

Leaking underground storage tanks (UST) at gas stations are one of the most common sources of groundwater pollution (and in fact caused both pollution incidents reported to the Virginia Water Control Board from the study areas). Since development at the interchanges is likely to include vehicle service facilities, continued regulation of USTs by the Virginia Department of Environmental Quality is recommended.

Exit 156

The geologic formation in the study area, the Elbrook, is noted for its excellent water bearing properties, with high yields frequently encountered. There is only one known instance of groundwater contamination in the area. This occurred several years ago when the Texaco station experienced a leak in one of its underground fuel storage tanks. The owners of the property undertook remediation

Exit 162

The two geologic formations in the Exit 162 study area, the Elbrook and the Rome, both are noted for their excellent water bearing properties, with high yields frequently encountered. As a general rule, the Rome is the highest yielding formation in the Roanoke metropolitan area according to the Virginia Water Control Board.

The study area has experienced at least one known instance of groundwater contamination. The former Exxon station to the east of the interchange reported a suspected leak from the station's UST into the station's well in 1985. Upon investigation by the Virginia Water Control Board it was determined that the well was contaminated by gasoline. The well was subsequently abandoned. A nearby well, located approximately 40 feet from the station's well, later was checked and showed no sign of contamination. A new Exxon station was reopened in 2000 on the site with new tanks and a new building.

Exit 167

This interchange lies within the Conocheague formation. The Conocheague is similar in groundwater characteristics to other limestone-based formations in the study areas, with groundwater generally being present in large quantities and of good to excellent quality. The other limestone-based formation in the study area, the Elbrook, is discussed above. Groundwater potential in the third formation, the Martinsburg, is more variable: yields are usually less, although quantities of water may be present in both

sandstone and shale; and quality may be poor, with excessive iron, manganese, and sulfates commonly encountered.

Fault zones may be conduits for groundwater in otherwise low-permeability rock. The extensive fracturing of the rock allows infiltration and movement of water underground more rapidly and in greater quantities than might otherwise occur. The fault zones in the Exit 167 study area mean that a well drilled in the fault zone might be expected to have good yields; it also means the associated potential for pollution of the groundwater in these zones might be higher. In areas of fractured rock such as these, extra caution is advisable in introducing any foreign substance into the environment.

There are several facilities in the Exit 167 study area that might potentially pose a hazard to groundwater, including a Virginia Department of Transportation area for storage of equipment and supplies, and a petroleum products dealership. No pollution incidents have been reported to the Virginia Department of Environmental Quality to date. However, caution would be advised in permitting any additional operations which might introduce hazardous chemicals or biological toxins into the environment in this area.

Exit 168

The two formations in the study area, the Elbrook and the Conocheague, have been discussed previously. Groundwater quantity and quality in these two formations is generally good to excellent.

As the most developed of the four interchanges, Exit 168 might be expected to have the greatest likelihood of potential contamination. The greater number and size of commercial establishments at this interchange means that there is likely a larger volume of sewage generated, with a consequently greater threat of pollution.

Contamination by petroleum products occurred in 1983 when the Virginia Water Control Board was notified of a potential leak in the underground storage tanks of the Shell station at the northeast corner of the interchange. Upon investigation, it was determined that there was a leak and the station had the tank repaired. The petroleum contaminated the station's well. A new well was drilled nearby and it too was found to be contaminated. A third well was clear. Neither of the first two wells contained actual quantities of pure gasoline, rather the pollution took the form of a low concentration of dissolved gasoline in the water itself. To date, no further problems stemming from this incident have been reported. The incident points to the need for continued care in monitoring potential sources of pollution and in preventing the threat from becoming a reality.

Floodplain Assessment

The Botetourt County Zoning Ordinance establishes a Flood Hazard Overlay District imposing certain development standards and criteria to protect the 100-year floodplain. The ordinance contains a list of elements which must be considered before any County commission or board rezones property within the floodplain district.

The standard definitions of the 100-year floodplain used in development ordinances in Virginia are based on maps prepared by the Federal Emergency Management Administration. These maps are small scale and general and are meant to give only broad guidance in determining floodplain boundaries. To delineate site-specific floodplain limits, an engineering test is required. Nevertheless, the

FEMA maps are useful for defining whether a flood hazard exists in a given area, and as a basis for determining whether a site survey will be required prior to approval of development.



All four interchange study areas contain parts of FEMA-defined 100-year floodplains. Their boundaries were determined from FEMA's Flood Insurance Rate Map of unincorporated Botetourt County, dated July 15, 1978.

Exit 156

Although the area in the immediate vicinity of the entrance/exit ramps does not lie within any floodplain, there is a small portion of the study area within the 100-year floodplain of Mill Creek. The floodplain and Mill Creek cross U.S. Route 11 near its intersection with State Route 640, approximately 0.38 miles south of the interchange. According to the Flood Insurance Rate Map, Mill Creek essentially parallels U.S. 11 in this part of the County. Therefore the majority of U.S. Route 11 for approximately one mile northeast and one mile southwest of the Route 640/11 intersection is within the floodplain.

Since this location is at the closest and most easily accessible approach of U.S. Route 11 to Interstate 81 between Troutville and Exit 162, it would be expected that development pressures might be somewhat greater here than other locations farther away on U.S. Route 11. The fact that the location is within the floodplain, while not cause for automatic rejection as a building site, does indicate that site-specific studies are advisable before proceeding with plans for development near the intersection of State Route 640 and U.S. Route 11. Location nearer to the actual interchange would not be affected by the floodplain.

Exit 162

In contrast to Exit 156, significant portions of area are within the 100-year floodplain of Mill Creek. The edge of the floodplain nearer to U.S. Route 11 lies at an average distance of approximately 300 feet from that highway along its entire length in the zone. To the south, the floodplain converges with U.S. Route 11. West and south of the interchange, approximately 50 to 60% of the area between the creek and U.S. Route 11 is within the floodplain. Approximately 25% of the area north and east of the interchange is in the floodplain. There is no floodplain across U.S. Route 11 to the northwest. None of the existing commercial development at Exit 162 lies within the floodplain.

Exit 167

A narrow but lengthy floodplain lies within the Exit 47 study area. Near the northern boundary of the area, north of the interchange, Purgatory Creek crosses under I-81/U.S. 11 from northwest to southeast, then flows southward alongside the interstate and U.S. 11 for most of the study area. The floodplain runs parallel to the highway after the cross-under, and at points the edge of the floodplain appears to almost touch the road. Approaching Buchanan, the road and creek diverge leaving a widening strip of non-floodplain land in between.

At this interchange, some of the establishments on the east side of U.S. 11, including VDOT and perhaps Graves Oil Company, appear to be within or close to the floodplain. The lack of flat developable land in this area has led establishments to locate in what would otherwise be a poor location. This implies that future development will be difficult – encountering either hilly terrain or potential flooding, and competing for the small areas of flat, flood-free land.

Exit 168

Purgatory Creek flows down from the northwest to enter the study area due west of the interchange. It then runs parallel to Frontage Road 054 for a short distance before flowing more westward, then south east into the Exit 167 study area. According to FEMA map, at no point does the floodplain actually touch the frontage road, and it appears that few houses and no commercial establishments lie within its boundaries.

Historic Properties

According to the Virginia Department of Historic Resources records, only one historic property has been placed on the Virginia Landmarks Register. Greyledge is a 19th-century estate located on FR-054 and Route 611 south of interchange 168. The original Greek Revival two-story house was built prior to the Civil War with a second phase added in 1900.

Water and Wastewater Service Availability

Development in the interchange study areas, dense or large scale, is dependent of availability of water and wastewater systems. Little or no dense residential or commercial development can be recommended at the interchanges until water and wastewater service is provided to the study areas. While residential development can take place using individual wells and septic systems, commercial development would likely require a central water/wastewater system or an on-site package system.



In 2003 Botetourt County completed the Countywide Water and Wastewater Study that examined the growth that is anticipated over the next twenty years. Population projects in the report forecast continued growth in the southern section of the county as well as along the I-81 corridor north to Buchanan. System capacities and water usage for private, municipal, and County-owned systems were examined to identify systems that have excess capacity or need improvements.

Water

There are no County-owned water systems within the interchange study areas. Existing municipal water systems near the interchange study areas are operated by the towns of Buchanan and Troutville. There are numerous privately owned wells throughout the County and within the interchange study areas that serve residential and commercial uses. None of the interchange study areas are currently served by a public central water system.

The study divided the county into 13 zones, each of which was considered for growth potential and how water and sewer infrastructure might develop over a twenty-year period. Probable water projects were divided in three categories: immediate, short term (10-year) and long term (20-year). There is one zone for water projects along U.S. Route 11 that impact development at the interchanges, the 11 North Corridor. This project is considered to be long term.

The study anticipates that the full length of U.S. Route 11 will include water supply from the County within the study period of the report (20 years). The study states that a water main along U.S. Route 11 could be extended south along the corridor from the Town of Buchanan to serve commercial areas. An additional source of water could be made available from new wells in the Nace area or an intake on the James River. Related infrastructure, 10" - 12" water line, storage tanks and fire hydrants would need to be provided. The estimated capital cost for this service is \$5.5 million.

Wastewater

There are no County owned wastewater systems within the interchange study areas. The only municipal system near the interchange study areas is operated by the Town of Buchanan. Individual disposal systems consisting of septic tanks and drainfields serve residential and low density commercial development in the interchanges study areas. None of the interchange study areas are currently served by a public central wastewater system.

Probable wastewater projects were divided into two categories: short term (10-years) and long term (20-years). The U.S. 11 North Corridor is listed as a long term projects. The study anticipates that a “significant part, if not all” of U.S. Route 11 will include wastewater service within 20 years. Wastewater service is currently limited to the Town of Buchanan. The U.S. 11 North Corridor could be served by a southerly extension of service from Buchanan. The remainder of the corridor would be served by the end of the 20 year period. The estimated capital cost for this project is \$14 million.

The study concludes that achieving the county’s goals to: (1) own and operate water and wastewater systems using its own resources to the extent possible and (2) proactively provide for the needs of commercial and business interests along the main traffic corridors will require significant improvement and expansion of existing water and sewer systems over the next twenty years. The study also notes that “twenty year projections for water (and wastewater) growth are subjective” and that the long term U.S. Route 11 North projects “will need to be implemented, but potentially on a very different schedule.” The implementation schedule will have a direct impact on the type and timing of development that occurs at the interchanges.

EXISTING LAND USE

As has been noted, one of Botetourt County's predominant characteristics is its rural nature. This is specifically true for the four interchange study areas. Land use in each of the study areas ranges from undeveloped and agricultural land to limited commercial.

Exit 156

Map 2 presents information on current land uses in the Exit 156 study area. By far the greatest land uses are agricultural land and undeveloped land. Most of this land is in fact being actively farmed. The nearest commercial establishment is the Brugh's Mill Country Store, at the southwest corner of the interchange. There is a small parcel on a hill that serves as the site for a cellular tower on the southeast corner of the interchange. Route 640 connects Interstate 81 to U.S. Route 11. Several commercial establishments are located south of the U.S. Route 11/Route 640 intersection on U.S. Route 11 including a Texaco station, the Greenwood Restaurant, Hughs Body Shop, and Scott's BP station.



A temporary land use for a time was a Virginia Department of Transportation facility used to store roadwork equipment and machinery. This is located adjacent to the southbound entrance ramp, between the ramp and State Route 799 and fronting on Route 640. The site is currently used for storing mulch.

Other non-agricultural land use includes several residential subdivisions farther north along State Route 640. Similarly, a few houses are found south of the interchange near the intersection of State Route 640 with U.S. Route 11. Overall, Exit 156 is the least developed and most rural of the four interchanges.

Exit 162

Map 3 presents information on land uses currently in place in the Exit 162 study area. Although not quite as rural as Exit 156, the most significant land use around Exit 162 is agricultural/undeveloped land. As at Exit 156, most seems to be under active cultivation for crops and/or livestock. There are three small commercial areas in the vicinity: (1) the area fronting on U.S. Route 11 and adjacent to the interchange that is occupied by Buchanan Texaco gas station/convenience store; (2) an area south of the interchange on U.S. Route 11 consisting of the Botetourt Funeral Home, New Age Homes and Dominion First Realty (3) the southeast corner of the intersection of U.S. Route 11 and state route 636, occupied by a machine shop/garage; (4) an area on U.S. Route 11 northeast of the interchange occupied by Barries Exxon gas station/convenience store. An abandoned store is located northeast of the interchange on U.S. Route 11. A few scattered single-family dwellings are found both north and south of the interchange, with slightly greater residential concentrations farther north on U.S. Route 11.



Exit 167

Map 4 shows the existing land use around this interchange. To the west of the interstate are a number of small individual single-family dwellings along frontage road Frontage Road 054, extending in an unbroken string about halfway to Exit 168, with undeveloped land predominating beyond. In most cases these are not more than one lot deep, although there are two private roads extending westward from Frontage Road 054 which also serve residences.



South of the Interchange, along U.S. Route 11 approaching the Buchanan town limit, a Virginia Department of Transportation facility occupies space on the north and south sides of the road. This establishment encompasses both administrative functions and equipment and materials storage. Road salt is stored here as well as gravel and construction materials. Closer to Buchanan and farther from Exit 167 is Graves fuel oil storage and distribution facility, on the south side of U.S. Route 11, with several single-family dwellings adjoining it to the south. All of these buildings on the south side of U.S. Route 11 occupy a narrow strip of land between the highway and Purgatory Creek.

Exit 168

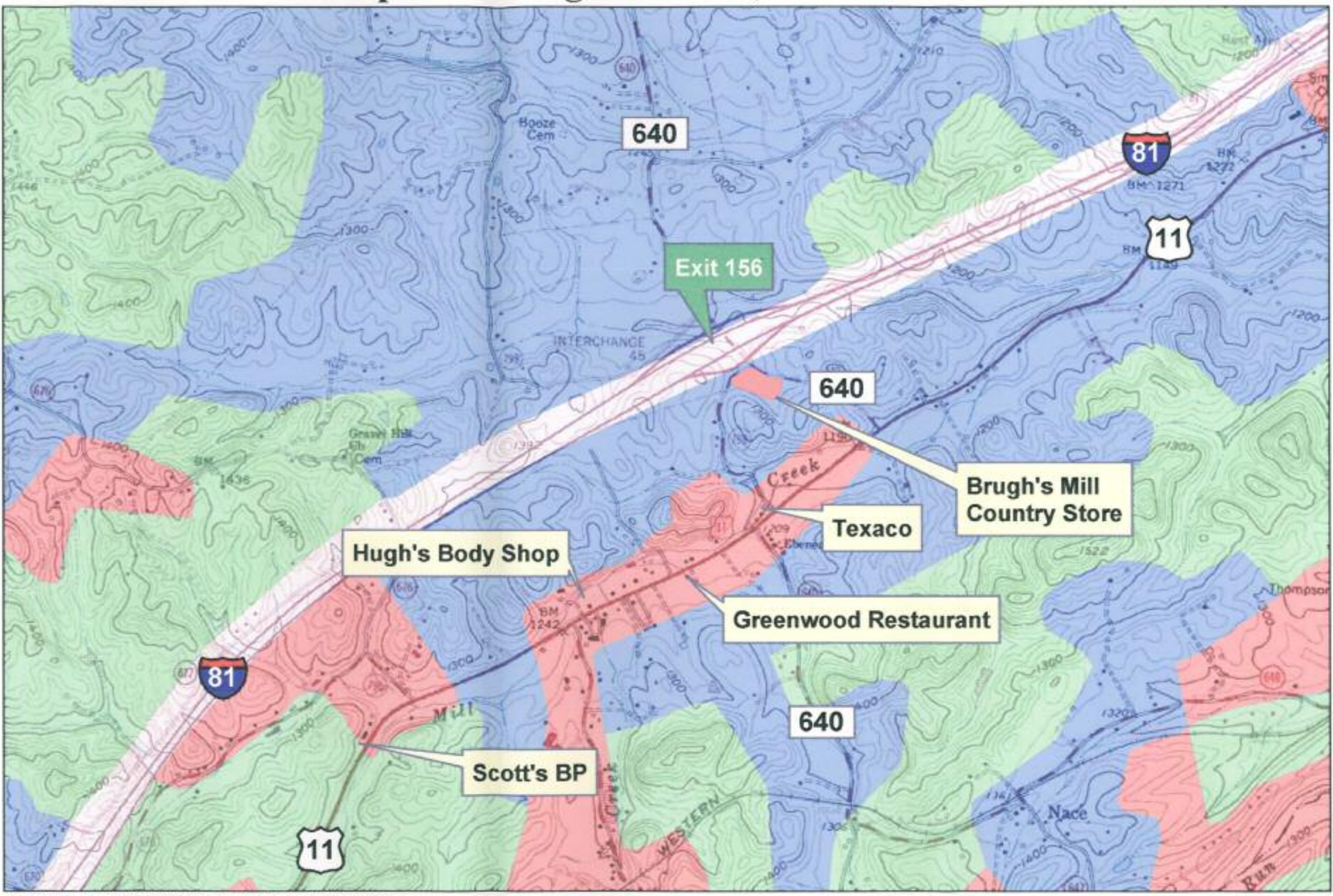
Map 4 also illustrates land use around Exit 168. The map shows large stretches of relatively-developed land but this may be somewhat misleading. The large tract of trade/service land southeast of the exit is occupied mostly by the grounds and lawn of the Wattstull Motel and nearby restaurant. While technically this land is part of the motel operations, it is not intrinsically needed for this use and can be considered essentially undeveloped. A smaller trade/service area at the northeast corner of the interchange is occupied by the Shell service station. The remainder of the land use east of the interchange consists of scattered single-family dwellings, interspersed with agricultural and undeveloped land.



To the west of the exit, land use is mostly in the agricultural/undeveloped category as well. A few residences border Frontage Road 054, as do two small commercial establishments to the southwest of the interchange (a church and an antiques store). As at Exit 167, all of these uses appear to be no more than one lot deep.

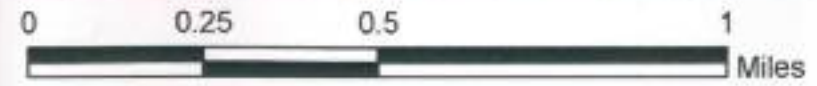
Map 2 Existing Land Use, Exit 156

- Developed
- Agriculture/Rural
- Forest



Prepared by the Roanoke Valley-Alleghany Regional Commission, June 2003.

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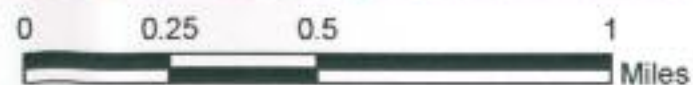
Map 3 Existing Land Use, Exit 162

- Developed
- Agriculture/Rural
- Forest

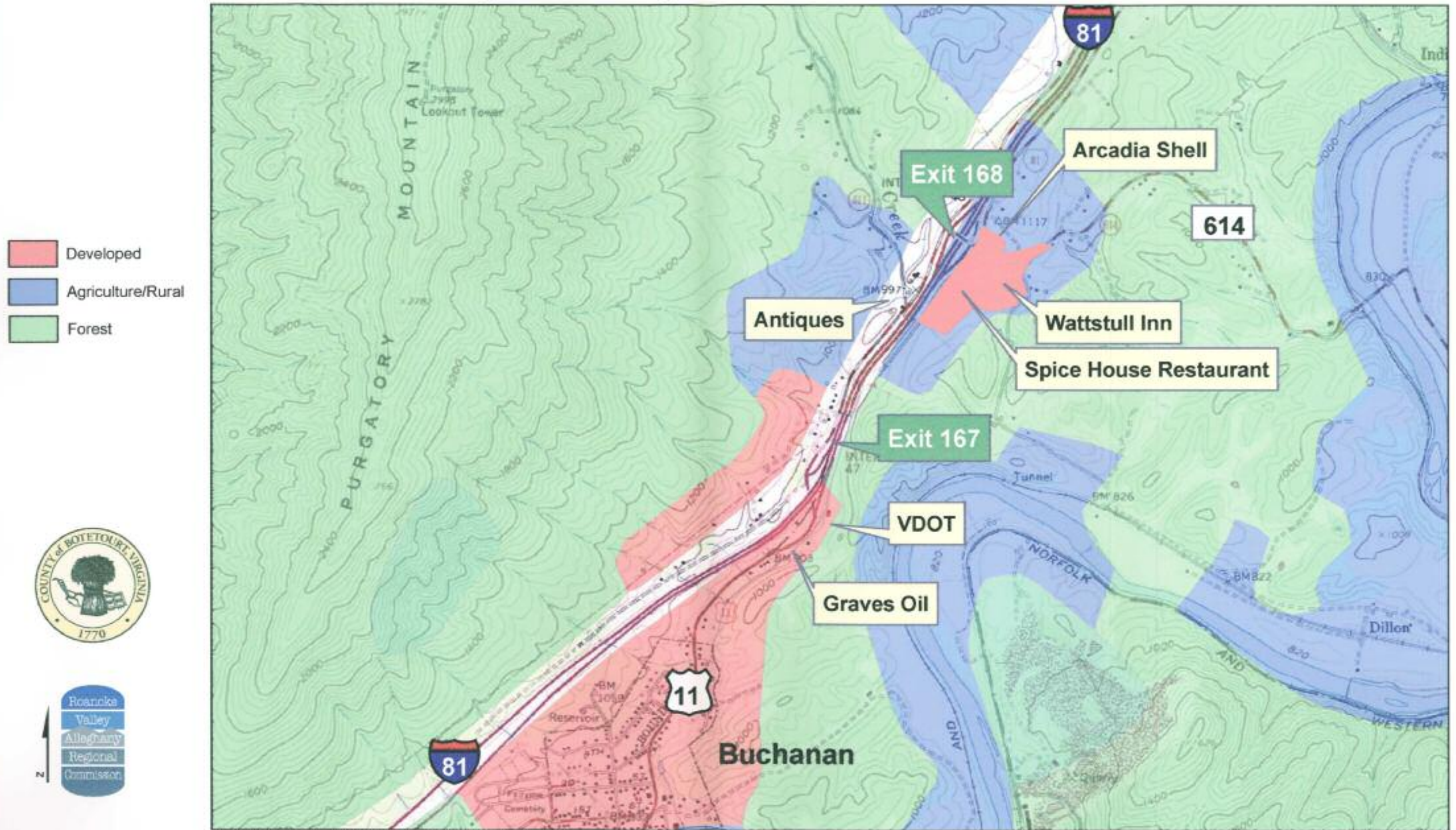


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Map 4 Existing Land Use, Exits 167 and 168

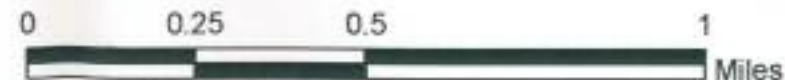


- Developed
- Agriculture/Rural
- Forest



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ZONING

Zoning in the study areas corresponds with existing land use on the whole. Zoning information is taken from the Botetourt County GIS and tax parcel map books.

Exit 156

All parcels adjacent to Exit 156 (Map 5) are zoned A-1 agricultural except the parcel occupied by Brugh's Mill Country Store. Along U.S. Route 11 is primarily A-1 Agricultural with Business B-1 (Texaco), Business B-2 (Hughs Body Shop and Scott's BP), Business B-3 (vacant) and Rural Residential areas.

Exit 162

Map 6 presents existing zoning in the Exit 162 study area. With the exception of six small parcels close to the interchange, all parcels in the study area are zoned A-1 Agricultural. Three of these parcels correspond to the three service stations noted in the Land Use section. Two of these, occupied by the Texaco and real estate offices, are zoned B-1 Business, while the Exxon station and funeral home (2 parcels) are zoned B-2 Business. The machine shop/service station is zoned Industrial M-2.

Another zoning district which deserves mention at this point is the 100-year floodplain overlay district that encompasses portions of Mill Creek. This is discussed more extensively in the Floodplain Section. It is sufficient to note here that the regulations of the County's Flood Hazard zoning apply in this zone and limit development around the Exit 162 interchange on the south side adjacent to Mill Creek.

Exit 167

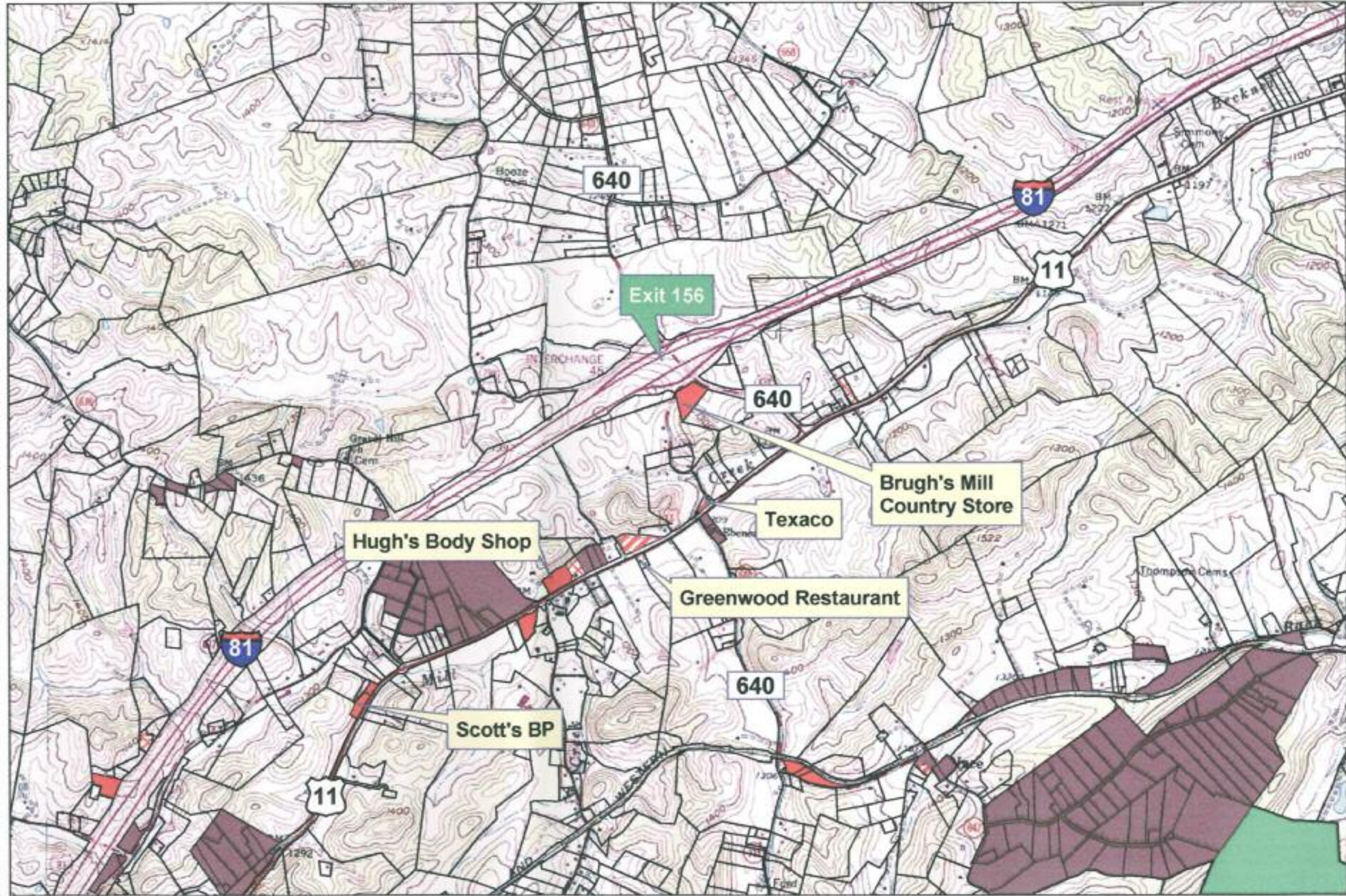
Exit 167 (Map 7) contains the only land in the study areas zoned FC Forest/Conservation. This category, more restrictive than the A-1 Agricultural zone, occupies nearly all land west of the Interstate, except for the area between Interstate 81 and Frontage Road 054 south of the interchange, which is zoned A-1 Agricultural. East of the interstate, the majority of land is zoned A-1 Agricultural as well. Two major exceptions are several parcels zoned M-2 industrial, occupied by the Virginia Department of Transportation facility and the site of Graves oil dealership, which is zoned Industrial M-3.

Exit 168

As illustrated on Map 7 the major zoning category here is A-1 Agricultural. The only exceptions are the tracts of land occupied by the Wattstull Motel and restaurant (zoned B-2 Business) and the small parcel on which the antique store is located and an undeveloped property on Route 611, both zoned Business B-1.

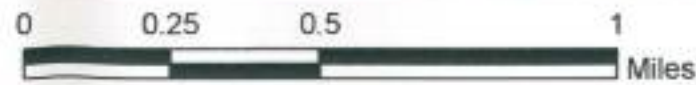
Map 5 Existing Zoning, Exit 156

-  Agriculture A1
-  Rural Residential
-  Business B1
-  Business B2
-  Business B3
-  Forest Conservation
-  Industrial M1
-  Industrial M3
-  Industrial M2
-  Residential R3



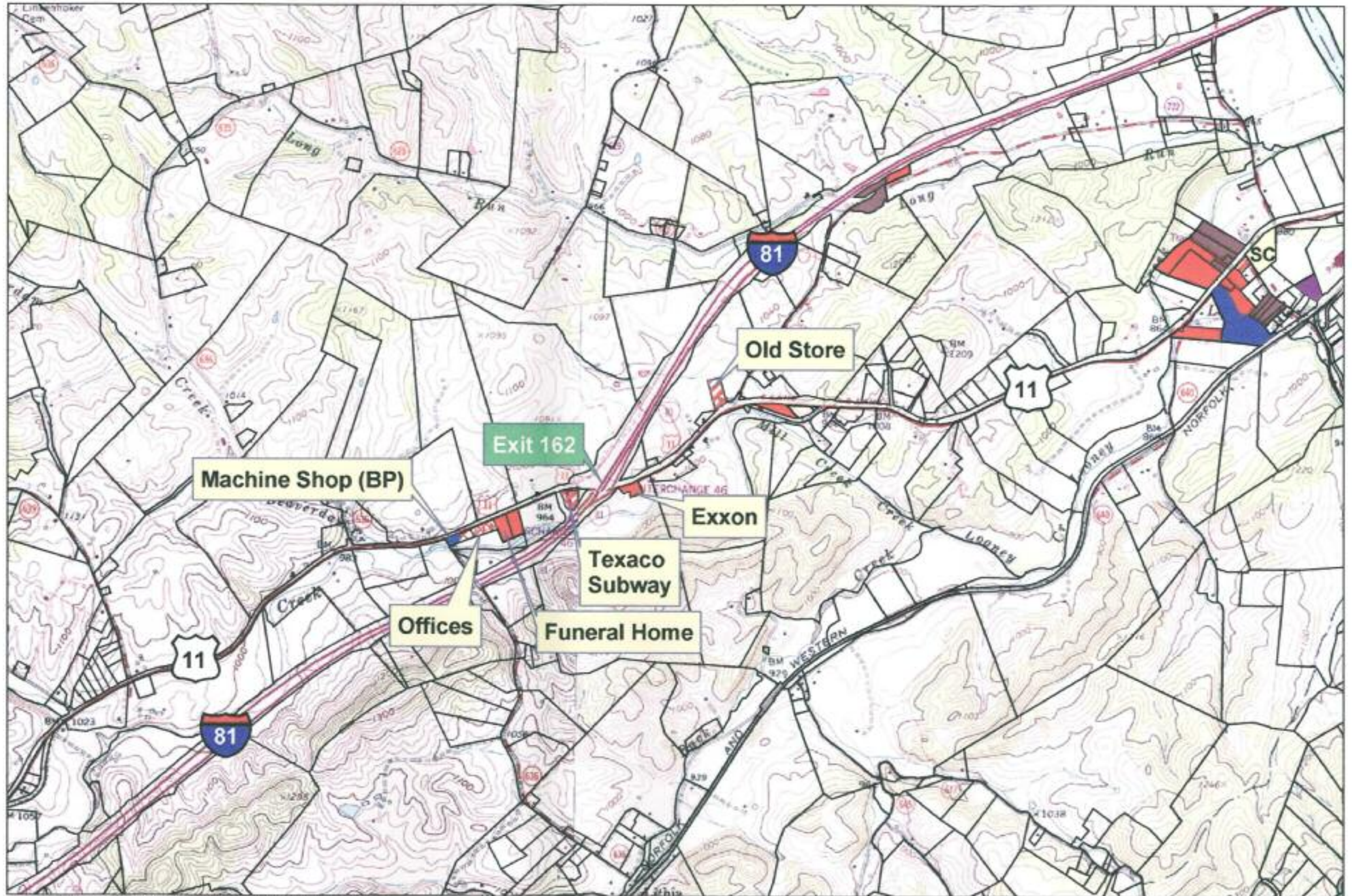
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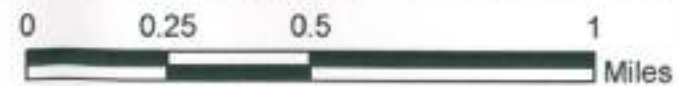
Map 6 Existing Zoning, Exit 162

-  Agriculture A1
-  Business B1
-  Business B2
-  Business B3
-  Shopping Center
-  Forest Conservation
-  Industrial M1
-  Industrial M3
-  Industrial M2
-  Residential R3



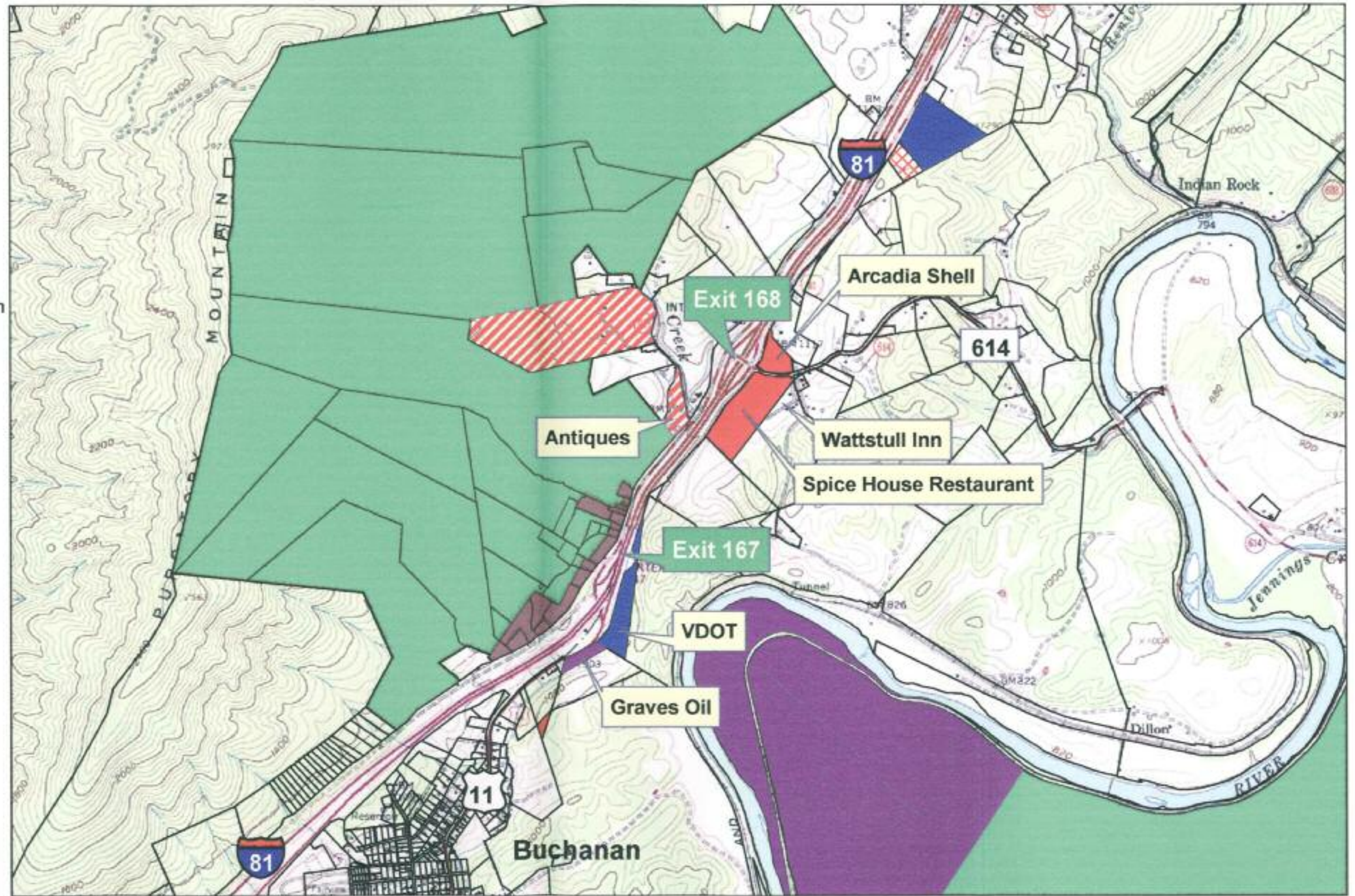
Prepared by the Roanoke Valley-Alleghany Regional Commission, June 2003.

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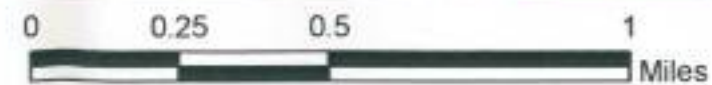
Map 7 Existing Zoning, Exits 167 and 168

-  Agriculture A1
-  Rural Residential
-  Business B1
-  Business B2
-  Business B3
-  Forest Conservation
-  Industrial M1
-  Industrial M3
-  Industrial M2
-  Residential R3



Prepared by the Roanoke Valley-Alleghany Regional Commission, June 2003.

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LAND USE RECOMMENDATIONS **DEVELOPMENT SUITABILITY**

The purpose of this study is to provide a broad view of transportation and land use factors at each interchange, so that the Botetourt County Comprehensive Plan may be updated. Three categories of recommended land use are proposed: (1) Primary - most suitable; (2) Secondary-suitable with limitations; and (3) Restricted-unsuitable based on existing limitations.



It should be noted that the categories are based on conditions as they currently exist, rather than conditions that might exist after engineering modifications to the site or highway at a specific location. The categories should be considered only as a guideline, not as a final determination of suitability for development.

General Recommendations

Some differences in suitability are common to all four study areas. Geologic structure and formation present challenges to development in the limestone composed lands of Botetourt County. Sinkholes and underground caverns can make placement of heavy structures difficult. The same may be said of the various soil types in the county. In either case, a site-specific geological and soil evaluation should be performed prior to development. Floodplain areas always represent a hindrance to development. The County Zoning Ordinance is designed to alleviate the problem of future development taking place in the floodplain.

The level of development in the interchange study areas is dependent of availability of water and wastewater systems. Little or no dense residential or commercial development can be recommended at the interchanges until water and wastewater service is provided to the study areas. **Low density residential and commercial uses should be considered on a site by site basis.**

Three of the four interchange study areas - 156, 162 and 168 - contain land that could be developed or redeveloped at a higher density if water and wastewater service were provided. Exits 162 and 168 have the most potential for development due to already existing commercial development. Although Interchange 156 is closer to the Roanoke metropolitan area the area is limited due to its surrounding residential development. Interchange 167 is limited due to existing commercial development and the influence of Purgatory Creek and steep slopes.

Interchanges in rural areas attract development that serve local residents and through travelers. Interchanges 156, 162 and, to a lesser degree 167, are likely to see more pressure for development of commercial services to serve travelers such as service stations, convenience stores and restaurants. As demand for services at Exit 150 continue to rise and the transportation network's ability to meet the increasing level of traffic diminishes, similar commercial services will be needed elsewhere along I-81. Developers and service providers might then look at the northern interchanges in the County as potential locations for hotels, restaurants and possibly a truck stop. However, development at this density level **will** **should** not occur without water and wastewater service.

More intensive development should be directed toward the Primary areas designated on the ~~Recommended Land Use~~ **Development Suitability** maps. Commercial and industrial development should only be considered in the Primary areas, subject to a site suitability study. It is expected that development in the Primary areas would present fewer problems than elsewhere.

Secondary areas do not preclude development, but limitations described in the Study suggest a more thorough site suitability study prior to development. Engineering and construction methods can be used to

overcome many of the natural obstacles to development and could make Secondary areas more suitable for development.

Development in Restricted areas should be avoided if possible. Limitations due to soils, geology, slopes, or flood plains may severely limit the type of development that can occur in these areas. Extensive site review studies should be undertaken and the results carefully weighed before any land use more intense than what currently exists is allowed.

Development in the floodplain should be avoided, although it is possible to elevated structures above the 100-year floodplain. Any development proposed within the flood plain of Mill Creek (Exit 162) or Purgatory Creek (Exit 167) should include an engineering study to determine the best building placement and methods for alleviating any potential flood damage. Development restrictions in the Flood Hazard District of the Botetourt County Zoning Ordinance should continue to be strictly enforced.

A number of ~~land use~~ limitations in the Secondary and Restricted areas are related to siting of septic systems. It is recommended that until wastewater service is provided to the study areas, package sewage treatment systems be used for any commercial or dense residential development in these areas to avoid groundwater contamination.

Interchange Recommendations

Exit 156 Interchange

Exit 156 is the least developed of the four interchange study areas. There is one commercial establishment on the southwest corner of the interchange and some scattered residential development nearby. The proximity of Interchange 156 to the Roanoke metropolitan area, combined with easy access to U.S. Route 11 and Interstate 81, will produce demand for additional residential development at this interchange.

Map 8 shows recommended land use suitability at Exit 156. Primary areas are located adjacent to the existing gas station/convenience store. A large area of Primary land, currently used for agriculture, also exists west of the interchange. Areas of Secondary land, suitable for residential development are designated on the west and northeast corner of the interchange. These areas are limited to a certain degree by slope. The Restricted areas shown for this interchange are constrained by steep slopes.

AADT and peak hour are projected to increase by 55-60% by 2010 and 93-100% by 2020 with only a slight decrease in level of service (LOS) from A to B on I-81 at this interchange. Route 640 on the south side of the interchange is projected to increase 100% while traffic on the north side is projected to increase 75% by 2020. There is no projected decrease in LOS for the exit ramps or Route 640. The additional traffic at the interchange may attract additional interest from commercial developers for a restaurant or additional service station.

Large parcels to the north of the interchange - one of more than 160 acres - with access from Route 640 could attract development, in particular commercial auto-oriented development, to serve motorist traveling to residential developments off of Route 640 north. The County should give careful consideration to how this area could be developed and the impact that development would have on surrounding residential areas.

Development taking place adjacent to the interchange should be required to demonstrate that adequate design of access to the property will be provided and will not negatively impact the flow of traffic at the interchange.

Limiting factors for development in the Secondary and Restricted areas are soil type, streams and slopes. Engineering studies should be required to demonstrate that the soils will support the proposed type of development along with its necessary infrastructure (septic systems and wells).

The interchange provides direct access to U.S. Route 11 via U.S. Route 640 and thus provides for potential future development on U.S. Route 11. Further study should be given to the U.S. Route 11 corridor to determine what types of development would be most appropriate for this area. While not as likely as development at the interchange, it is possible that sites along U.S. Route 11 might be as suitable for development as those at the interchange.

Exit 162 Interchange

There are areas of Primary land use adjacent to the interchange and a number of other factors including presence of commercial properties, proximity to the Town of Buchanan, and direct access to U.S. Route 11 that make this interchange attractive to developers.

Map 9 shows a Primary area located adjacent to the existing development on the northeast and southwest corners of the interchange. There is also a Primary area extending north along U.S. Route 11 that may be suitable for commercial or residential development. A large area of Secondary classification to the west of the interchange could be developed as commercial or residential with some site improvements to reduce the existing slopes and provision of better access from I-81 or U.S. Route 11. The Restricted areas shown to the east of the interchange are limited by steep slopes and the floodplain along Mill Creek.

Projected AADT increase on I-81 from 1997 to 2010 is 55% while the increase from 1997 to 2020 is 93%. The additional traffic at the interchange may attract additional interest from commercial developers.

This interchange is most likely to receive public water and wastewater service due to its proximity to the Town of Buchanan. Provision of water and wastewater service would certainly attract developers to this interchange area. These services would allow for the development of restaurants and lodging facilities that are not currently possible.

The area along the south side of U.S. Route 11 between the interchange and Route 636 is the best-suited part of the study area for future development. There is potential for development on the north side of Route 11 where there is an existing farm. This could be accessed by the existing frontage road (F-054) or new access from Route 11.

The VDOT I-81 Improvement Study proposal recommends relocation of the frontage road entrance to a point directly across from exit/entrance ramp intersection with Route 11. This will improve the traffic flow at this intersection and at the interchange itself. Development taking place adjacent to the interchange should be required to demonstrate that adequate design of access to the property will be provided and will not negatively impact the flow of traffic at the interchange.

Exit 167 Interchange

The VDOT I-81 Improvement Study discusses the potential closing of Exit 167. The analysis for this consideration shows that the elimination of Exit 167 ramps improves operation of traffic on this section of I-81 while having no negative impact on traffic flow at Exit 168. The option for leaving the existing interchange ramps, with modification to the alignment of Interstate 81 to improve traffic flow, has also been presented by VDOT. For the purpose of this study, it is assumed that the interchange *will* remain open.

Map 10 shows no Primary land classification for this interchange due to slopes, the location of Purgatory Creek and the existing development that occupies the only available flat land at this interchange. Existing commercial and industrial sites, if vacated in the future, could be considered as Primary areas for commercial development. The west side of the interchange is limited by slopes and is unsuitable for commercial or industrial development.

While significant increases in traffic over the next 20 years will make the area more attractive to commercial development such as gas stations and convenience stores, the existing ramp design and lack

of a full diamond interchange will severely limit future development. There is very little level land available for development. The interchange has limited development opportunities due to slope and the winding roadway on the north side. Development is limited to the south of the interchange by Purgatory Creek and existing development on both sides of Route 11 towards the Town of Buchanan including a VDOT facility and fuel oil company.

Limitations at this interchange will probably mean that any additional development will be small scale and locally oriented.

Exit 168 Interchange

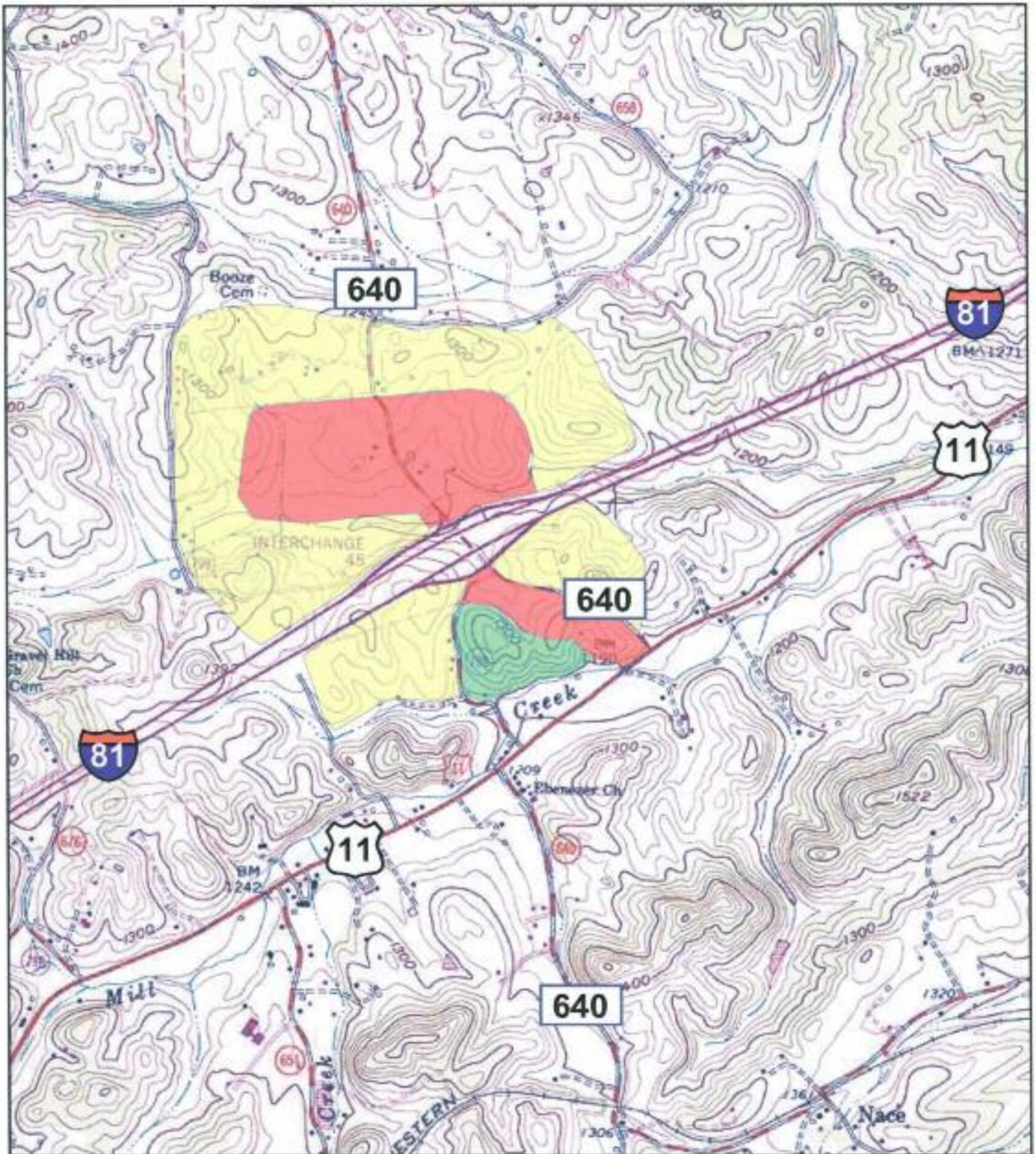
The existing level of services - a service station, hotel and restaurant - available at the interchange is high and will act as a magnet for travelers to stop here. This could also attract other developers of commercial services to this interchange. Although the amount of Primary area is limited, with enough demand, properties could be redeveloped to a higher density level, particularly if water and wastewater service is provided in the future.

Map 10 shows Primary land areas adjacent to existing development on the east side of the interchange. A small Secondary area is located along Route 611 south of the interchange that could be suitable for residential development. The Restricted areas at the interchange are limited by steep slopes and existing residential development.

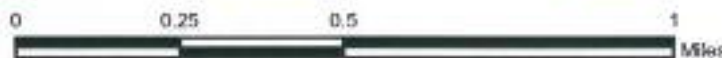
Traffic on I-81 in this area is expected to increase 25% by 2010 and almost double by 2020 with or without truck lane restrictions. This significant increase will make the area more attractive to commercial developers of gas stations and convenience stores.

Extension and/or improvement to the access road that goes past the Spice House restaurant could open up large area of primary land south of the interchange for development. There are also possible development areas along the frontage road north of interchange, on the south side of I-81. Development along the frontage road on northwest is limited due to existing residential development and steep slopes.

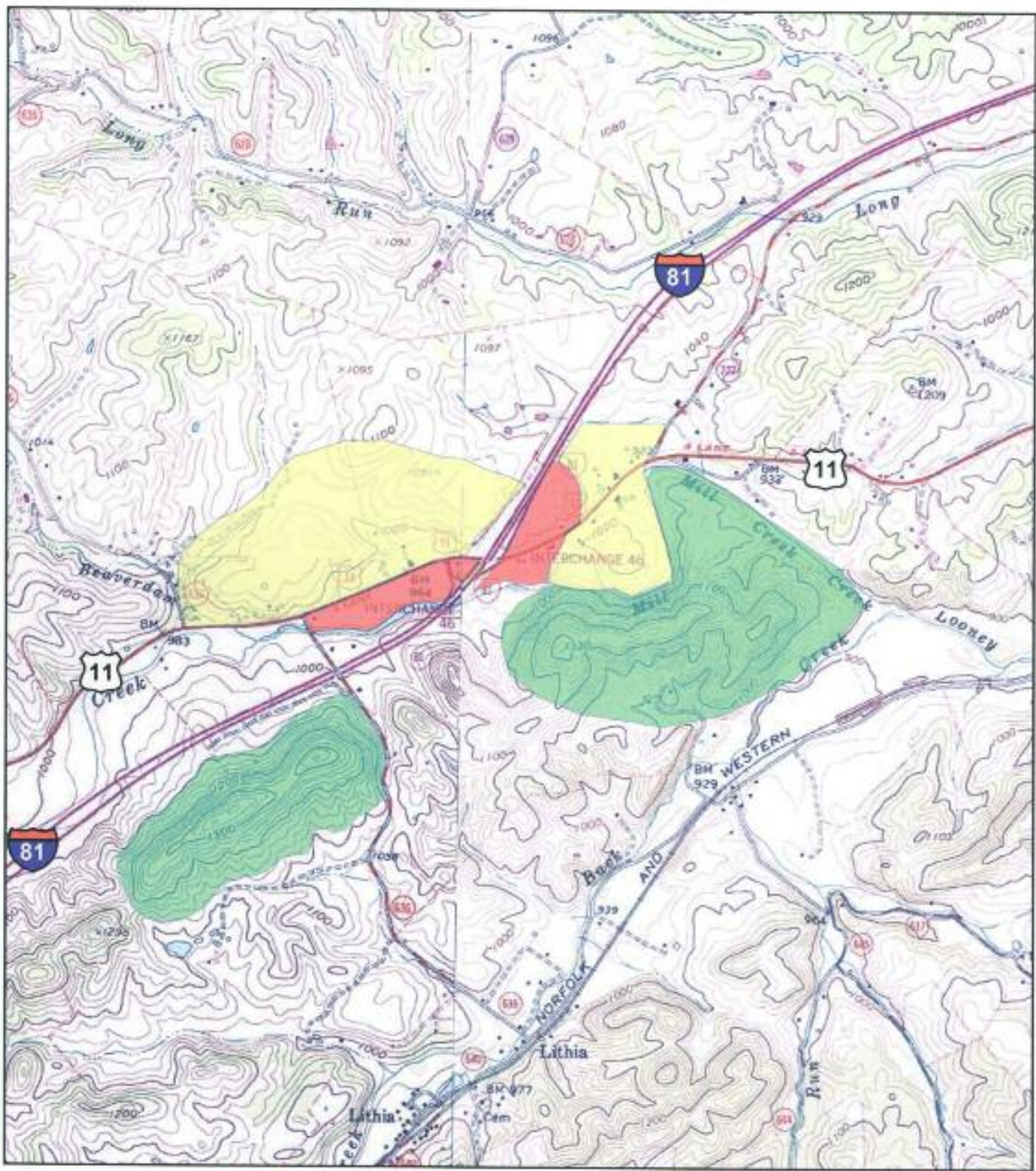
Map 8 Development Suitability Areas, Exit 156



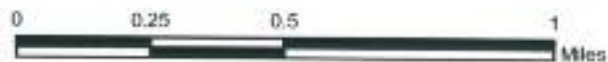
 **Primary**  **Secondary**  **Restricted**



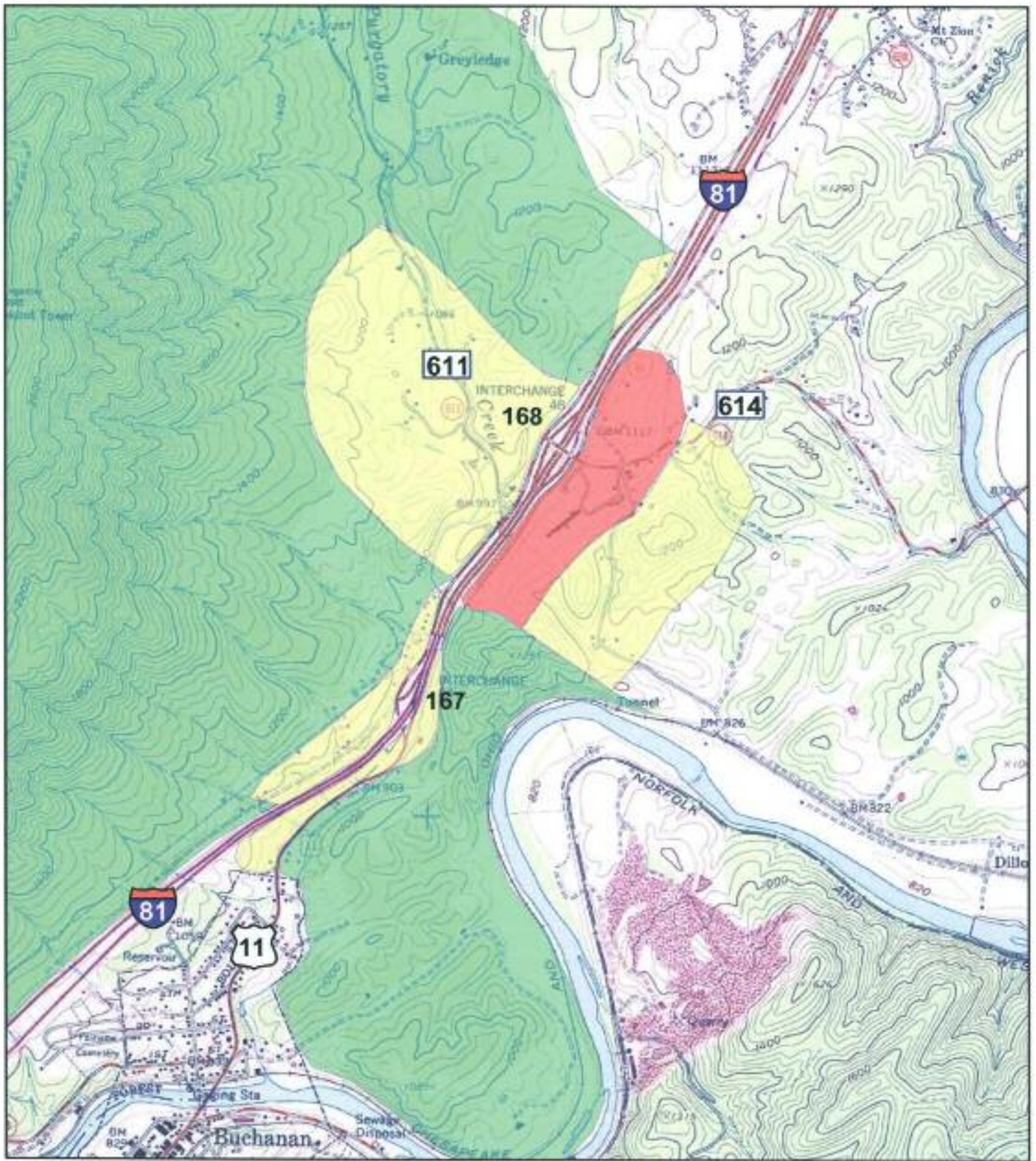
Map 9 Development Suitability Areas, Exit 162



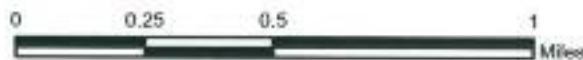
Primary
 Secondary
 Restricted



Map 10 Development Suitability Areas, Exits 167 and 168



 **Primary**  **Secondary**  **Restricted**



Appendix A

References

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