

Chapter 4

Environmental Consequences

4.0 ENVIRONMENTAL CONSEQUENCES

The purpose of this chapter is to describe the anticipated community, cultural resource, natural resource, environmental quality, and other effects of the five Build Alternatives described in Chapter 2: the Preferred Alternative (Widening Alternative) and Bypass Alternatives 1A, 1B, 4A, and 4B. Where appropriate, the text contrasts these alternatives with the No-Build Alternative. In general, however, the No-Build Alternative would have no impact on the natural and man-made environment of the project area.

The chapter is divided into topical discussions in a manner similar to Chapter 3, “Affected Environment.” These sections address the following issues:

- Community Impacts, beginning on page 4-2 and including Community Impacts, Relocation, Economic Impacts, Farmlands, Neighborhoods and Community Cohesion, and Community Facilities and Resources;
- Minority and Low-Income Populations, beginning on page 4-30;
- Visual and Aesthetic Quality, beginning on page 4-30;
- Air Quality, beginning on page 4-62;
- Noise and Vibration, beginning on page 4-66;
- Historic and Archaeological Resources, beginning on page 4-77;
- Parks and Recreation Areas, beginning on page 4-91;
- Fog, beginning on page 4-101;
- Ecological Resources, beginning on page 4-102 and including Physical Resource Impacts, Terrestrial Resource Impacts, Jurisdictional Area Impacts, and Threatened or Endangered Species;
- Floodplains and Regulatory Floodways, beginning on page 4-119;
- Hazardous Material Sites and Underground Storage Tanks, beginning on page 4-120;
- Energy, beginning on page 4-121;
- Mineral Resources, beginning on page 4-121;
- Utilities, beginning on page 4-121;
- Secondary and Cumulative Impacts, beginning on page 4-123;
- Construction Impacts, beginning on page 4-141

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- The Relationship Between Local Short-Term Uses of Man’s Environment and the Maintenance and Enhancement of Long-Term Productivity, beginning on page 4-157; and
 - Irreversible and Irretrievable Commitments of Resources, beginning on page4-160.

The preliminary designs upon which the impact assessment is based are presented in Appendix D. In order to identify the location of specific impacts, the text occasionally refers to “station” numbers. The drawings in Appendix D show these numbers along the alignment of each alternative. The station numbers indicate roadway length in hundreds of feet. For example, the distance between stations 635 and 640 is 500 feet (along the roadway’s alignment). The distance between stations 635 and 640+50 is 550 feet.

4.1 Community Impacts

This section addresses the direct impacts on the Town of Blowing Rock and the surrounding rural communities of each Build Alternative. Secondary and cumulative impacts to the community are addressed in Section 4.15. The types of impacts addressed are: the relocation of homes and businesses, long-term and short-term economic impacts, compatibility with Blowing Rock and county land use plans and zoning, farmlands, changes in neighborhood and community cohesion, and impacts to community facilities and resources. The community impacts of the No-Build Alternative and the five Build Alternatives can be summarized as follows:

No-Build Alternative. The No-Build Alternative would not relocate homes or businesses. It generally would be consistent with area land use plans except where they call for improvements to US 321. Its effects on community cohesion and community facilities would be limited to the effects on local circulation of congested traffic that would occur on US 321 during peak periods.

Preferred Alternative. The Preferred Alternative would displace 12 residences and five businesses. The Preferred Alternative generally would be compatible with area land use plans. In Blowing Rock, however, the Preferred Alternative would alter the existing topography, remove vegetation, and affect historic resources, including the displacement of one contributing structure to the Green Park Historic District, (one additional contributing structure that was to be displaced by the Widening Alternative collapsed since the publication of the DEIS). Blowing Rock’s comprehensive plan calls for the preservation of these features. Citizen representatives have indicated that the Preferred Alternative would adversely affect the highly valued village character of Blowing Rock that is evident along US 321. Road improvements would reduce congestion and facilitate movement of local traffic, school buses, AppalCART vans, and emergency vehicles. Persons choosing to cross US 321 on foot would have more pavement to cross. Additional traffic signals would aid pedestrians crossing US 321.

Bypass Alternative 1A. Bypass Alternative 1A would displace 24 residences and one business. Bypass Alternative 1A would pass through a developing residential area of Blowing Rock. As such, this alternative is incompatible with the Blowing Rock plan and is the least desirable alternative (along with Bypass Alternative 1B) from the perspective of land use plan compatibility. Bypass Alternative 1A would introduce a thoroughfare to a developing residential area with resulting substantial negative noise, community cohesion, and visual impacts. On existing US 321, lower traffic volumes would make local traffic and pedestrian movement easier. Reductions in traffic growth on existing US 321 would offer modest travel time savings to school buses, AppalCART vans, and emergency vehicles.

Bypass Alternative 1B. The impact of this alternative would be virtually the same as Bypass Alternative 1A with the exception of the added displacement and community impacts associated with a deep cut in Gideon Ridge. Although with Bypass Alternative 1A, 24 residences and one business would be taken, the cut into Gideon Ridge additionally would displace three homes on the ridge and seven vacant lots with spectacular views of the surrounding valley. Access to the Blackberry Condominiums would be changed, which could be viewed by residents as a positive effect on the complex by helping to isolate it from US 321.

Bypass Alternative 4A. Bypass Alternative 4A would displace eight residences and one business. Since Bypass Alternative 4A would make rural land more accessible for development, it would not be compatible with the goals in the Caldwell County plan since the plan was developed with the expectation that the lands along Bypass Alternative 4A would remain rural. This bypass also would not be compatible with Watauga County's goals of preserving and improving the physical environment, and protecting and maintaining the rural atmosphere and visual quality of the county. The bypass in some locations could introduce the potential for additional development into the rural countryside. Bypass Alternative 4A, which would place all improvements outside the town limits of Blowing Rock, would meet the Town of Blowing Rock's Comprehensive Plan's goal of preserving historic features and natural vegetation. Bypass Alternative 4A would introduce a thoroughfare, with associated visual and noise impacts, to wooded, rural areas of isolated homes at its southern and northern ends. The quality of life sought by those who reside in the rural portion of the community would be affected, particularly for those who would live near the new or improved facility. Reductions in traffic growth on existing US 321 would offer modest travel time savings to school buses, AppalCART vans, and emergency vehicles.

Bypass Alternative 4B. Bypass Alternative 4B would displace six residences and one business. Its compatibility with area land use plans and benefits to community services would be the same as Bypass Alternative 4A. The impacts of Bypass Alternative 4B on neighborhood and community cohesion in the rural communities would be similar to those of Bypass Alternative 4A.

4.1.1 Relocation

It is the practice of the North Carolina Department of Transportation (NCDOT) to try to keep the number of relocated homes, businesses, and other land uses to a minimum. However, with any of the Build Alternatives, relocation would occur. Each of the Build Alternatives would displace a different number of homes and businesses. Alternative 1A or 1B would displace the most residences (24), and Alternative 4B would displace the least (six). The Preferred Alternative would displace the most businesses (five), while the other Build Alternatives would displace one business. The NCDOT's Division of Highways Relocation Program is summarized below. It outlines the process by which replacement housing or business units would be provided to those who must be relocated.

Relocations

The relocations would vary by alternative and range from six to 24 homes and one to five businesses. The Preferred Alternative would displace 12 residences and five businesses. Both Alternative 1A and 1B would displace 24 residences and one business. Alternative 4A would displace eight residences and one business, while Alternative 4 B would displace six residences

and one business. No schools or churches would be displaced. The relocations by alternative are shown in Table 4-1. Detail related to value and replacement dwelling availability with the Preferred Alternative is shown in Table 4-2. The same information is shown for all alternatives in the preliminary Relocation Reports in Appendix C.

Table 4-1. Estimated Maximum Displacees

Alternative	Dwellings/Households	Businesses	Other
Preferred Alternative	12	5	0
Bypass Alternative 1A	24	1	0
Bypass Alternative 1B	24	1	0
Bypass Alternative 4A	8	1	0
Bypass Alternative 4B	6	1	0

Table 4-2. Preferred Alternative Relocation Summary

Number of Displaced Dwellings			
By Value of Owner-Occupied Homes (000)		By Monthly Rental Rate	
\$0-20	0	\$0-150	0
\$20-40	0	\$150-250	0
\$40-70	0	\$250-400	0
\$70-100	0	\$400-600	0
\$100 up	<u>12</u>	\$600 up	<u>0</u>
Total	12	Total	0
Number of Decent, Safe, and Sanitary Dwellings Available			
By Value of Owner-Occupied Homes (000)		By Monthly Rental Rate	
\$0-20	0	\$0-150	0
\$20-40	0	\$150-250	0
\$40-70	0	\$250-400	0
\$70-100	0	\$400-600	0
\$100 up	<u>20+</u>	\$600 up	<u>0</u>
Total	20+	Total	0

As shown in Table 4-2, dwellings of comparable value are available for the relocations associated with the Preferred Alternative. With the Bypass Alternatives, relocation studies found that sufficient housing may not be available for the four to seven displaced homes in the \$40,000 to \$100,000 range. Comparable rental housing is available where rental households would be displaced with the Bypass Alternatives.

Minorities, large families, disabled persons, or others who would have special problems relocating would not be encountered.

None of the potentially displaced businesses is known to be minority owned. They employ one to 10 persons. Businesses similar to those displaced would remain in the area. The relocation study found that there appear to be sufficient business properties and sites available to relocate those that would be displaced.

North Carolina Department of Transportation (NCDOT) Relocation Program

It is the policy of the NCDOT to ensure that comparable replacement housing will be available prior to the construction of state projects. Furthermore, the North Carolina Board of Transportation has the following three programs to minimize the inconvenience of relocation:

- Relocation Assistance,
- Relocation Moving Payments, and
- Relocation Replacement Housing Payments or Rent Supplement.

With the Relocation Assistance Program, experienced NCDOT staff will be available to assist displacees with information such as availability and prices of homes, apartments, or businesses for sale or rent and financing or other housing programs. The Relocation Moving Payments Program, in general, provides for payment of actual moving expenses encountered in relocation. Where displacement will force an owner or tenant to purchase or rent property of higher cost or to lose a favorable financing arrangement (in cases of ownership), the Relocation Replacement Housing Payments or Rent Supplement Program will compensate up to \$22,500 to owners who are eligible and qualify and up to \$5,250 to tenants who are eligible and qualify.

The relocation program for the proposed action will be conducted in accordance with the North Carolina Relocation Assistance Act (GS-133-5 through 133-17). The program is designed to provide assistance to displaced persons in relocating to a replacement site in which to live or do business. At least one relocation officer is assigned to each highway project for this purpose.

The relocation officer will determine the needs of the displaced families, individuals, businesses, non-profit organizations, and farm operations for relocation assistance advisory services without regard to race, color, religion, sex, or national origin. The NCDOT will schedule its work to allow ample time, prior to displacement, for negotiations and possession of replacement housing that meets decent, safe, and sanitary standards. The displacees are given at least a 90-day written notice after NCDOT purchases the property. Relocation of displaced persons will be offered in areas not generally less desirable in regard to public utilities and commercial facilities. Rent and sale prices of replacement property will be within the financial means of the families and individuals displaced, and will be reasonably accessible to their places of employment. The relocation officer will also assist owners of displaced businesses, non-profit organizations, and farm operations in searching for and moving to replacement property.

All tenant and owner residential occupants who may be displaced would receive an explanation regarding all available options, such as (1) purchase of replacement housing, (2) rental of replacement housing, either private or public, or (3) moving existing owner-occupant housing to another site (if possible). The relocation officer will also supply information concerning other state or federal programs offering assistance to displaced persons and will provide other advisory services as needed in order to minimize hardships to displaced persons in adjusting to a new location.

The Moving Expenses Payment Program is designed to compensate the displacee for the costs of moving personal property from homes, businesses, non-profit organizations, and farm operations acquired for a highway project. Under the Replacement Program for Owners, NCDOT will participate in reasonable incidental purchase payments for replacement dwellings, such as attorney's fees, surveys, appraisals, and other closing costs and, if applicable, make a payment for any increased interest expenses for replacement dwellings. Reimbursement to owner-occupants for replacement housing payments, increased interest payments, and incidental purchase expenses may not exceed \$22,500 (combined total), except under the Last Resort Housing provision.

A displaced tenant may be eligible to receive payment, not to exceed \$5,250, to rent a replacement dwelling or to make a down payment, including incidental expenses, on the purchase of a replacement dwelling. The down payment is based upon what the state determines is required when the rent supplement exceeds \$5,250.

It is a policy of the state that no person will be displaced by NCDOT's state construction projects unless and until comparable replacement housing has been offered or provided each displacee within a reasonable period of time prior to displacement. No relocation payment received will be considered as income for the purposes of the Internal Revenue Code of 1954 or for the purposes of determining eligibility or the extent of eligibility of any person for assistance under the Social Security Act or any other federal law.

Last resort housing is a program used when comparable replacement housing is not available, or when it is unavailable within the displacee's financial means, and the replacement payment exceeds the federal/state legal limitation. The purpose of the program is to allow broad latitudes in methods of implementation by the state so that decent, safe, and sanitary replacement housing can be provided. This program would be implemented, if necessary, as mandated by state law.

4.1.2 Economic Impacts

For each Build Alternative, this section addresses:

- Near-term impacts on established business districts, including impacts on retail sales and the viability of existing businesses during construction and for several years after the improvements are in place, and
- Longer term local and regional economic impacts on the commercial character and potential of the area, business development, and residential markets resulting from changes in traffic patterns and accessibility.

The analysis is based on existing statistical data, characteristics of businesses in Blowing Rock derived from site visits, interviews, and surveys, past similar economic studies, and available literature addressing the effects of transportation facilities on the economy of an area.

The assessment of the impacts on established business/commercial districts focuses on businesses in the US 321 project area. The analysis considers impacts during the construction phase (i.e., would construction of the Preferred Alternative have a substantial negative impact on existing businesses along US 321 because loss of access and reductions in pass-by traffic), as well as impacts over time, once one of the Build Alternatives is in place. The assessment begins with observations of local business persons and realtors, and followed by an analysis of potential commercial impacts.

Observations of Local Business Persons and Realtors

In order to incorporate the various perspectives of local business persons on the economic impact of the proposed project, over 20 interviews were conducted with business owners and realtors in Blowing Rock in Fall 2000.

Comments and concerns gathered through interviews with local business owners and realtors provided a wide and useful spectrum of opinions on the Build Alternatives. By definition, however, interviews with existing businesses reflect the specific perspective of each particular business establishment. Such perspectives tend not to reflect long-term effects on the commercial

potential of the location in question, nor do they necessarily reflect the “common good.” For example, some businesses along US 321 that cater primarily to a drive-by market could be negatively affected by the bypass alternatives, and they could lose enough customers to make that particular business non-viable at its present location. Other commercial activities catering to destination shoppers and tourists (i.e., shoppers who make their trip with the intent of visiting that particular store or business) however, could replace businesses catering to the drive-by market and be quite successful, if overall access to the area is improved because of an alternative. These points of view were reflected in the interview results.

No particular pattern emerged to tie individual preferences to types or locations of businesses, but a number of common themes surfaced throughout the interviews. These themes were:

- Limited Turning Access Because of the Preferred Alternative. Nearly every business surveyed along US 321 expressed concern for the potential turning limitations of the landscaped median of the Preferred Alternative. Fearing that business would decline if vehicles on the opposite side of US 321 were denied immediate turning access, most interviewees would rather forego the aesthetic benefits of the median for a four-lane road without a median.
- Altering the Small Town Image by Expanding US 321 to Four Lanes. There was a common concern, particularly among Realtors, that Blowing Rock would lose its appeal as a quaint mountain hamlet if US 321 were widened to four lanes. They argued that tourists would take their business to other, less developed destination towns, which would adversely affect the local economy.
- Aggravating the Parking Shortage by Wider US 321. Many, interviewees cited parking as a primary concern with the Preferred Alternative. Blowing Rock is already short on parking spaces, particularly during the peak tourist season. Some interviewees believe that devoting more space to the roadway could increase traffic on US 321 and the number of visitors to Blowing Rock. Additional visitors would generate more traffic on Main Street in downtown Blowing Rock during peak seasons. While that is a positive in terms of increased economic activity, there is insufficient parking to accommodate additional visitors. Blowing Rock will need to address this parking issue, perhaps as part of an overall parking management strategy.
- Diversion of Business Because of a Bypass Alternative. Many businesses along US 321, particularly those that rely heavily on drive-by traffic, are opposed to a new bypass because of the perceived loss of customers who would use the alternative route. Furthermore, several people suggested that businesses in the downtown also would suffer were traffic to be diverted around Blowing Rock.
- Detrimental Effects of a Bypass Alternative through a Residential Area. Use of the Bypass Alternative 1 corridor (Bypass Alternatives 1A and 1B) incited opposition from people concerned that a residential community would be destroyed and that valuable property would depreciate.
- Implementation Time for Each Alternative. A general remark that was voiced repeatedly was that the Bypass Alternatives would not solve the immediate problem of traffic congestion. In particular, a project in the Bypass Alternative 4 corridor would take years to open because of the complicated engineering and environmental permitting involved.

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- Desire for a Resolution. Regardless of their preferred alternative, most interviewees expressed a certain amount of frustration with the history of this project and the circular nature of the discussion. There was an overwhelming desire for a decision to be made, putting an end to what many see as a state of limbo.

As noted above, while interview results are valuable and instructive, they lack sufficient objectivity to provide a solid foundation for economic impact assessment. The next two sections employ analytic methods to assess first the short-term impacts on existing businesses in the US 321 travel corridor and second the longer term impacts of the alternatives on the overall commercial climate and character of Blowing Rock. Short-term impacts first consider the construction phase, and then consider the first few years after completion, when many of the same businesses that are present now would still be present.

Existing Business Impacts Because of Construction Activity

For purposes of this analysis, short-term impacts on business activity in the corridor are assumed to be largely a consequence of reductions in access because of construction activity (e.g., road closures and construction equipment on the road, etc.) on US 321. This analysis applies only to the Preferred Alternative. For the most part, the Bypass Alternatives would have far less impact on US 321 itself during the construction period; with the exception of the proposed intersections of US 321 with a bypass, construction would not greatly affect access to tourist facilities, retail stores, or other businesses along US 321.

Studies in research journals and other publications addressing the economic impacts of highway construction on businesses focus on case studies that ask business owners and operators about the effects of construction after construction is complete. Buffington *et al.* (1992) concluded “short-term business losses ... can be significant but are difficult to document reliably.” Their article includes a summary of abutting business gross sales impact as reported in their review of the results of economic studies presented in research journals and other publications. This summary indicates that the percent change in business at traffic servicing businesses during abutting construction was – 45 percent to +16 percent or a weighted mean of –11 percent. For other retail/service businesses, the change was –35 percent to +31 percent or a weighted mean of five percent. Their article acknowledges the considerable variation in effects among comparable studies. They conclude, however, that “because the studies were not all closely comparable” that “the weighted comparative mean value was an appropriate measure to use in calculating the estimated gross sales change.” A study commissioned by the Wisconsin State Legislature in 1987 and reported by Ward and McCullough (1993) examined both businesses bypassed by highway construction and businesses adjacent to construction. It concluded that in either case the impact on business was negative. Overall business activity was found to decline an average of 10.8 percent. By business category, the declines were: retail, 17 percent; gas and convenient stores, 13 percent; restaurants and taverns, 16 percent; professional services, two percent; and wholesale, three percent. The first three business types correspond most closely to the types of businesses on US 321 in Blowing Rock. While these numbers from different settings and project types do not represent something that can be directly applied to the US 321 project to produce a definitive extent of business sales loss during construction of the Preferred Alternative, two observations can be made:

10. Construction of the Preferred Alternative would result in business loss; therefore, construction strategies to minimize business disruption during project construction, as summarized below and discussed in Section 2.4.1, are important.

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11. The percent temporary loss of business during construction presented above does not differ substantially from the percent permanent loss of sales associated with the Bypass Alternatives that is presented in the next section. One can reach the conclusion that when contrasting the Preferred Alternative with the Bypass Alternatives that both will result in sales loss at existing businesses along US 321 and to select one over the other is to trade-off one type of potential loss for another (temporary for permanent).

Section 2.4.1 in Chapter 2, under “Construction Period Procedures and Options,” indicates that construction of the Preferred Alternative would occur over three to four construction seasons (two to three if utilities are not placed underground). During that time, customers would be inconvenienced by construction-related effects on traffic and business access. It can be assumed that in the case of at least some customers, construction-related inconvenience would not cause them to forego a trip to one or more businesses in the construction zone. Consequently, efforts would be made to minimize customer inconvenience using approaches described in Section 4.1.6.

US 321 would not be fully closed in any section, except for short periods for blasting and other critical operations. For a project of this complexity and because of sensitive community issues, additional contract controls would be imposed by the NCDOT on the construction contractor. The controls would be developed in association with the community officials, and the controls would consider daily, weekly, and seasonal peak periods. They could include requirements through the contract specifications such as keeping a minimum number of lanes open during certain periods of the day and “no disruption of traffic” days for specific community events. They could provide contractor incentives to complete critical operations within a defined window of time. Access to residences and business during construction would be a strict contract requirement. Temporary access to businesses would be marked with signs. The contractor would maintain access on a smooth graveled surface during business and delivery hours. There would be, however, periods of time during which only one lane would be in operation between US 321’s intersection with Pinnacle Avenue and Ransom Street. A single business is at Pinnacle Avenue and several businesses are between US 321 Business and Ransom Street. Access would be ensured by means of flaggers.

Near-Term Impacts on Existing Business Following Completion of the Alternatives

Once the alternatives are completed, existing businesses along US 321 could continue to be affected because of both changes in access directly from the highway (e.g., turning restrictions) and changes in levels and flows of traffic.

Over time, changes in overall accessibility to and within the region could create the potential for a new hierarchy of commercial uses within the corridor itself and the larger area of Blowing Rock. These changes would result in enhanced business activity in some locations and perhaps reductions in the desirability of some other locations, both as commercial areas and as choice residential locations. These longer-term effects are discussed below under “Long Term Impacts on Business Activity and Business Climate.”

While the Preferred Alternative’s landscaped median would limit left turns, none of the Bypass Alternatives would affect access from US 321 to adjacent business. In the near-term after completion, the Bypass Alternatives, however, would substantially lower the amount of traffic flowing along US 321 and the levels of congestion, while increasing the speed at which traffic moves. As shown in Table 2-12 in Chapter 2, traffic volumes would not reach current (1998) levels between US 321 Business and US 221 even by 2025. The impacts of these changes in traffic volume and flow on the sales revenues of existing business could be important if, as a

result, substantial losses in sales reduce business earnings. In the worst case, reduced sales could result in business failure if the losses are substantial enough.

To assess this impact, methodologies developed for new highway improvements and bypass alternatives for a similar (although larger) commercial corridor in Maryland were utilized (Parsons Brinckerhoff Quade & Douglas, Inc, August 2000).

This method involves estimation of the potential losses in business/sales activity for various types of business, both when they are made less directly accessible and when traffic volumes along the highway are changed.

A fundamental concept in this approach is the extent to which individual businesses are “destination” versus “opportunity-oriented.” “Destination” businesses are those to which consumers plan to travel in advance. Travelers plan a destination stop because a particular business provides a special product or attraction, or because of plans to meet a particular appointment or receive a particular service. “Opportunity” businesses, or traffic-serving establishments, are those to which consumers do not plan to travel in advance. The opportunity stop might be made to purchase a convenience good (like gasoline or a soda) or to browse comparison goods, but in all cases the stop would not have been made if the business were not easy to access. The opportunity shopper would likely have purchased the same or a similar product at another business if the chosen establishment were not so visible and/or easy to access.

Of course, no establishment is entirely a destination or opportunity business; most businesses experience healthy portions of both types of visits. The approximate proportion of opportunity versus destination customers depends on the characteristics of individual business types. Certain categories of business are more dependent on opportunity shoppers, relying on visibility and access from pass-by traffic, whereas others are more dependent on destination shoppers.

As part of the Maryland analysis, (Parsons Brinckerhoff Quade & Douglas, Inc, August 2000) business and customer intercept surveys, which supplemented by reviews of journals and other relevant publications, were conducted within the highway corridor in order to ascertain approximate shares of sales that could be characterized as either destination or opportunity based. The survey responses entailed a certain amount of judgment on the part of those surveyed. A sufficient number of surveys were conducted, however, that for given categories of businesses, average tendencies emerged and clustered within acceptable ranges. These results can be generalized to other highway corridors, such as the US 321 corridor.

The results of the various surveys and analyses are summarized in Table 4-3. Business types are grouped into general categories. As shown, no type of business surveyed relies on opportunistic type shopping visits for more than half of its sales. Convenience stores, gas stations, and auto sales businesses ranked at the top in terms of the share of opportunity sales. In general, the majority of business sales for each business type are destination sales, rather than impulse or opportunity sales. Even convenience stores make only about half of their sales to opportunity, or impulse, buyers, according to the survey data.

By applying the data in Table 4-3 to the US 321 corridor, potential losses of opportunity sales along US 321 as a consequence of reductions in access and drive-by traffic were estimated for the Build Alternatives. In the case of the Preferred Alternative, changed access is the issue. In the case of the Bypass Alternatives, reductions in drive-by traffic are the issue. This application was done using the following formula:

Table 4-3. Maryland Business and Customer Survey Results

Type of Business	Destination	Opportunity	Description of Businesses Contained
Big Business	95%	5%	Large supermarket and/or big-box retail (Wal-Mart, Giant, etc.)
Small Business. - Other Durable Goods	95%	5%	Home wares, construction materials, clothing, other durable goods
Hobby Shop	95%	5%	Musical instrument store, collectables, gardening, arts and crafts, etc.
Professional Services	95%	5%	Lawyers, doctors, human services, banks, contractors, insurance, engineers, consultants, etc.
Small Business - Services	85%	15%	Hair cutlery, nails, Realty, non-retail/non-wholesale/non-food small businesses
Restaurant/Bar	75%	25%	Sit-down restaurants and bars
Hotel/Motel	70%	30%	Hotels and motels
Small Business-Specialty Goods	60%	40%	Liquor, tobacco, hardware, sporting goods, etc.
Small Grocer / Baker	55%	45%	Small grocery stores, specialty foods, convenience foods (e.g., 7-11 stores)
Gas Station	55%	45%	Gas stations
Auto Sales	50%	50%	Auto sales
Small Business - Convenience Goods	50%	50%	Dollar stores, gifts, greeting cards, videos, tourist stores, fast food restaurants

Note: Destination and Opportunity proportions of business sales were compiled from a combination of sources including literature reviews, business interviews, and customer intercept surveys.

Source: Parsons Brinckerhoff Quade & Douglas, Inc, August 2000

$$\text{Percent Change in Sales} = (((A \times (1-B)) + (1-A)) - 1) \times 100$$

A = Share of revenues dependent on opportunity sales

B = Percentage change in opportunity sales because of access restrictions and less traffic

The formula assumes that destination sales are assumed to remain unchanged, as by definition, shoppers of this type plan their trips in advance, and are not substantially affected by modest reductions in access from a roadway.

The results of the assessment of relative impacts on sales for businesses along US 321 are shown in Table 4-4. The first step in estimating sales effects was to use the traffic forecasts for the Build Alternatives to estimate the relative changes in opportunity sales attributable to projected reductions in drive-by traffic for each type of business. This is shown in the columns labeled “percentage change in opportunity sales because less traffic in 2025.” A second factor, in addition to reductions in drive-by traffic, is the reduction in direct access to businesses because of the Preferred Alternative’s landscaped median, which would restrict (but not eliminate) left turn access. Left turns still could be made at intersections, particularly signalized intersections at

Table 4-4. Percent Change in Sales by Alternative and Business Type

Business Type	Opportunity Sales as Percentage of Total Sales	Percentage Change in Opportunity Sales Because of Less Traffic in 2025 ¹	Percentage Change in Opportunity Sales Because Access Restrictions ²	Percentage Change in Overall Sales, By Business Type		
		Bypass Alternatives	Preferred Alternative	Preferred Alternative	Preferred Alternative Without Landscaped Median	Bypass Alternatives
Restaurant/Bar	25%	-60%	-15%	-3.75%	0%	-15%
Hotel/Motel	30%	-60%	-15%	-4.50%	0%	-18%
Small Specialty Business	45%	-60%	-15%	-6.75%	0%	-27%
Gas Station/Auto Sales	45%	-60%	-15%	-6.75%	0%	-27%
Convenience Store	50%	-60%	-15%	-7.50%	0%	-30%
All Other Businesses	5%	-60%	-15%	-0.75%	0%	-3%

¹ Percent reduction in traffic along US 321 in 2025 compared to the No-Build Alternative between US 321 Business and Sunset Drive (applies to the Bypass alternatives only).

² Applies only to the Preferred Alternative with its center median alternative. Based on background literature survey.

US 321 Business, Sunset Drive, and US 221, but customers of mid-block businesses would have reduced access. No data is available to determine precisely the extent of the loss of business. It was assumed, based on a review of previous literature, that the landscaped median could reduce opportunity sales by a conservative 15 percent. (This estimate is conservative on the high side, and thus produces results that may modestly overstate the negative impacts of the Preferred Alternative.)

Combining the percentage of reductions in traffic with the assumed percentage change in opportunity sales because of access restrictions, it is possible to compute a percentage change in overall sales by business type, according to the formula indicated previously, for each alternative. These percentages, or relative changes in overall business sales, are shown in the three right-most columns of Table 4-4.

As seen in Table 4-4, the effects of the Bypass Alternatives on sales activity could be substantial, 15 to 30 percent for the business types along US 321 that depend the most on opportunity customers.

The overall effects on commercial activity along US 321 can be determined using the findings in Table 4-4 and the number of businesses of the various types present within the corridor. That

assessment is presented in Table 4-5. There, a weighted average of the overall US 321 corridor effects is obtained, where the weights represent the number of businesses of each type along US 321 in the project area.

Table 4-5. Change in Sales for US 321 Businesses by Alternative

Business Type	Number of Businesses in Corridor ¹	US 321 Corridor-Wide Percentage Change in Sales by Business Type		
		Preferred Alternative	Preferred Alternative Without Landscaped Median	Bypass Alternatives
Restaurants/Bars	7	-3.75%	0%	-15.0%
Hotels/Motels	4	-4.50%	0%	-18.0%
Small Specialty Business	4	-6.75%	0%	-27.0%
Gas Stations/auto sales	3	-6.75%	0%	-27.0%
Convenience Stores	1	-7.50%	0%	-30.0%
All Other Businesses ²	20	-0.75%	0%	-3.0%
TOTAL IN US 321 CORRIDOR	39	-2.90%	0%	-11.7%

¹ Based on the results of US 321 Business/Property Owner Survey, March 7, 2000.

² Includes Shoppes on the Parkway

Table 4-5 shows that the Bypass Alternatives would have more substantial impacts on existing businesses along US 321 than would the Preferred Alternative. It also indicates that the majority of businesses would not be greatly affected, as only a small share of many businesses' sales (about five percent as shown in Table 4-4) are made to drive-by customers. The overall reductions in sales activity of businesses along 321 would probably never exceed 10 to 15 percent of the total business sales within the corridor. However, the businesses relying on immediate access and catering to heavy drive-by traffic (e.g., convenience stores and fast food restaurants) could be adversely affected, and some could indeed be out of business in a year or two after a Bypass Alternative is opened to traffic.

While the preceding analysis is instructive, an important caveat must be added. As a resort area, the hotels in Blowing Rock (especially the Green Park Inn, which is nationally advertised) are probably less dependent on opportunity or drive by business than the typical hotel or motel. For example, while the manager of the Days Inn, during interview sessions, estimated that 25 percent of her business was drive-by (close to the 30 percent found in the Maryland surveys), the Green Park Inn almost certainly obtains far fewer of its customers in this way. Thus, the impacts on well-known tourist destinations in the corridor would probably be much less substantial than Table 4-5 would suggest. The important tourist-serving businesses in the corridor, and the overall touristy nature of the historic section of US 321, probably would not be substantially affected if any of the Bypass Alternatives are implemented.

Long Term Impacts on Business Activity and Business Climate

The Build Alternatives would have a long-term impact on commercial and residential development patterns. The exact nature of these effects would depend on many factors, such as changes in traffic volumes, ease of access from US 321, consumers' travel times, and competing businesses. Unique characteristics of individual businesses, such as sensitivity to opportunity traffic and site location, would be integral in determining the long-term economic impact. Other specific factors, such as the management of a particular business or its cost structure, also would be important, but this assessment assumes that these factors would not vary among the No-Build Alternative and the Build Alternatives.

Generally speaking, each of the Build Alternatives would improve overall accessibility to, from, and within the Town of Blowing Rock and its immediate environs. Over the long run, it could be expected that these improvements would have a positive impact on the viability of existing and new commercial areas. Some changes in the specific character of certain business areas, including those along US 321, however, could be expected. In particular, each of the Build Alternatives, for slightly different reasons, could be expected to reduce the viability of businesses that cater to drive-by traffic. US 321, however, could become a more desirable location for destination-type business activity, including those businesses catering to tourists and shopping areas that have a regional draw, such as the Shoppes on the Parkway. These positive effects could more than compensate over time for the negative impacts to drive-by oriented businesses on US 321.

Business Viability/Changes in the Character of Business Areas. The potential long-term impacts of the Build Alternatives can be inferred, at least in part, from the results of the short-term impact analysis above. As shown, the principal types of businesses to be affected would be those that rely in large measure on opportunity sales. US 321 could become over time less of a harbor for transient, drive by businesses, while destination activities could become more solidly anchored in the corridor. The following items discuss long-term changes that could be associated with the Preferred Alternative and the Build Alternatives.

- Preferred Alternative. The Preferred Alternative would improve access throughout the project area, since the additional lanes would offer a less congested, safer route for both commercial and passenger vehicles. Access to selected commercial locations would improve. In particular, access to the Shoppes on the Parkway mall would be improved for those customers coming from the south, so it might become a more attractive site for destination retailing.

While overall access would improve, the landscaped median included with the Preferred Alternative would restrict turning access, and could limit, therefore, some of the expected growth in opportunity sales for the existing establishments. Additionally, the landscaped median would serve as a deterrent to new strip (opportunity) commercial development with multiple access points and frequent arrivals and departures by through travelers.

- Bypass Alternatives. If a Bypass Alternative were implemented, opportunity sales could be expected to drop, and the commercial character of the US 321 corridor could shift toward businesses catering to destination sales. Because the through traffic that now patronizes the businesses along US 321 would be detoured out of town, those potential customers would take their opportunity business somewhere more convenient along their travel route.

Impacts on Tourist-Oriented Businesses. Based on the results of the interviews and surveys, a principal concern of business owners in Blowing Rock is that any highway improvement would

have a negative impact on the area's tourism-based economy. In particular, local citizens fear that such improvements would draw more through traffic, thereby destroying the appeal of the town as a rural mountain hamlet. With only 1,500 permanent residents, Blowing Rock relies heavily on out-of-towners for its economic well-being.

The merits of the argument that four lanes will attract more through traffic are not supported by the results of the travel demand forecasts. The improvements project is not planned to serve specific land development. The travel demand forecasts presented in Section 1.5.5 of Chapter 1 and in Table 2-12 in Chapter 2 are based on regional population and employment forecasts and objectives and associated travel demand trends estimated independent of road capacity. The improvements project is proposed to serve that forecast and expected travel demand. As discussed, in Sections 4.15.3 and 4.15.4 under "Development Trends and Change," the potential exists for some shifting of development patterns with the Bypass Alternatives.

Second Home Market/Residential Property Values. No empirical techniques or models could be identified during the background literature review that would enable a projection of impacts on residential property values. As a result, interviews with Realtors were regarded as the best available marker for what could happen in this area of economic impact. The major flaw associated with Realtor input is the inherent bias in realtor responses against any change that would affect the current, profitable status quo. The market for second homes and summer rentals is extremely active in Blowing Rock, and any change affecting this market could be viewed with suspicion by realtors who have an interest in maintaining the current status.

There was a majority opinion among those Realtors surveyed that the Bypass Alternatives would be more disruptive to traditional residential markets and market values in Blowing Rock than the Preferred Alternative. This was by no means, however, a complete consensus. Opinions expressed by Realtors were:

- Current traffic problems render US 321 unsafe and the Preferred Alternative would directly address this. A Bypass Alternative could do more damage to the residential areas of Blowing Rock, varying depending on the alignment selected.
- Depending on the alignment selected, a Bypass Alternative could cause a decline in property value in residential areas, as the environmental impacts of a Bypass Alternatives would be greater than any negative impacts of the Preferred Alternative.
- A wider US 321 would take away from the charm of Blowing Rock, which is the main selling point for vacationers and summer residents. Property values along US 321 would depreciate if the road were to be widened, but negative impacts on property values could be less than the Bypass Alternatives, depending on the alignment selected.
- Bypass Alternative 1 incited the most opposition from people concerned that a residential community would be destroyed and that valuable property would depreciate.

None of these views are empirically testable, but the mixed viewpoints among Realtors and lack of consensus could be viewed as an indication that the negative impacts may not be substantial. Landscape design elements (see Section 2.4.4 of Chapter 2) to minimize adverse environmental impacts of the Bypass Alternatives would help mitigate the negative impacts on residential values.

Economic Impacts of Construction Expenditures

This section presents an analysis of the impacts of construction activity on local employment and income. The results of this analysis are important in part to the extent that they contrast with the observations under “Existing Business Impacts Because of Construction Activity.”

This analysis utilizes RIMS II multipliers, which are applied to the direct estimates of capital/construction costs. The Bureau of Economic Analysis (BEA) of the US Department of Commerce maintains the national input-output accounts, from which it derives region-specific, final demand multipliers for output, earnings, and employment by industry/economic sector, using its Regional Input-Output Modeling System (RIMS II). Economists use input-output models to analyze how changes in the production of a specific firm or industry alter the flow of funds into and out of all other industries as well as households. By tracing how production in one economic sector consumes the output of other sectors as production inputs and how each of these other sectors in turn influences the demand for the output of yet other sectors, input-output analysis facilitates the calculation of multipliers. These multipliers provide a quantitative estimate of the total employment and income impacts within the local economy (state or region) that compound from initial new expenditures, such as a road improvement project.

The capital costs for the Build Alternatives are shown in Table 4-6. (The capital costs primarily reflect costs for construction, landscaping, and other physical attributes of the alternatives, but also include some engineering and other mobilization expenditures and contingency.) Applying the most recent set of RIMS II multipliers (1997) for the State of North Carolina results in the direct, indirect, and induced economic impacts from construction spending shown in Table 4-7. Employment impacts are expressed in person-years of employment.

Table 4-6. Build Alternative Capital Costs

Evaluation Category	Build Alternatives				
	Preferred Alternative	Bypass Alternative 1		Bypass Alternative 4	
		A	B	A	B
Right-of-Way	\$23,400,000	\$24,500,000	\$25,200,000	\$9,400,000	\$8,900,000
Construction	\$22,500,000	\$50,600,000	\$67,000,000	\$161,100,000	\$241,400,000
Total	\$45,900,000	\$75,100,000	\$92,200,000	\$170,500,000	\$250,300,000

Table 4-7. Employment and Earnings Impacts of Construction

	Construction Employment ¹ (person-years)	Total Employment Including Indirect And Induced Multiplier Impacts (person-years)	Total Earnings, including Indirect and Induced Multiplier Impacts (millions of dollars)
Preferred Alternative	281	1,345	\$33.2
Bypass Alternative 1A	633	2,200	\$54.3
Bypass Alternative 1B	838	2,701	\$66.7
Bypass Alternative 4A	2,013	4,996	\$123.3
Bypass Alternative 4B	3,018	7,334	\$181.0

¹ Based on typical highway project cost estimates, assumes construction labor is approximately 50 percent of total highway construction cost, not including right-of-way acquisition, and an average burdened construction wage of \$40,000 per year. Multiplier effects are applied against the total construction cost, including right-of-way acquisition costs. Lower multipliers apply to the right of way acquisition, as only induced (income) effects occur. Right-of-way acquisition does not involve production of a good or service.

These results assume the project is financed entirely with federal funds; they do not reflect the normal 80 percent federal funds/20 percent state funds ratio used with federally funded highway projects. Financing from state or local sources would result in a lower multiplier, as the taxes used to derive the non-federal share would represent a reduction in state or local household income. The NCDOT would use state funds exclusively to build the Preferred Alternative. As such, the numbers in Table 4-7 are higher than what might actually occur. The relative differences between alternatives reflected in Table 4-7 would be the same irrespective of the source of construction funds.

The results in Table 4-7 show that the short-term economic benefit of construction of a US 321 improvement would rise with project cost and, as such, the greatest construction-related benefit would be achieved with Bypass Alternative 4B and the least would be achieved with the Preferred Alternative.

Transportation System Benefits

Fundamental to the economics of a transportation investment is the direct impacts on the transportation system, its users, and those who may experience external costs because of transportation system use. This section of the analysis estimates the transportation system benefits (often in the form of avoided costs) associated with the Build Alternatives. The methodology has the following steps:

1. Determination of changes in travel parameters, including savings or increases in vehicle-miles and vehicle-hours traveled. These values were derived from the traffic forecasts and the length and travel speed associated with each alternative;
2. Annualization of the travel parameters and application of unit cost savings to the travel parameters;
3. Summation of totals to yield an annual net economic impact; and
4. Computation of a net present value for a stream of benefits, for example, over 30 years, and comparison with the net present value of the project's direct costs, including capital costs for initial construction, periodic rehabilitation, and annual maintenance.

The results of the first of these steps, changes in system wide travel parameters, are presented in Table 4-8. All of the Build Alternatives would result in travel time and distance savings for travelers in the project area. The greatest savings would be associated with Bypass Alternatives 4A and 4B, primarily because these alternatives are shorter than either the existing road or the Bypass Alternative 1 (1A and 1B) corridor.

The next steps are to annualize these values, and then to apply "fully loaded" unit costs per vehicle-hour and vehicle-mile. Those steps and results are shown in Table 4-9. For purposes of this analysis, the average weekday changes in travel parameters were annualized using a factor of 320 – slightly higher than industry standards but one that is reasonable for a tourist-oriented area.

Table 4-8. Average Weekday Changes in System Travel Parameters

Alternative	2010				2018				2025			
	VMT ¹	Change in VMT	VHT ²	Change in VHT	VMT	Change in VMT	VHT	Change in VHT	VMT	Change in VMT	VHT	Change in VHT
No-Build Alternative	83,197		2,246		95,717		2,612		106,673		2,932	
Preferred Alternative	83,715	518	2,191	-55	96,314	596	2,548	-64	107,338	665	2,860	-72
Bypass Alternatives 1A and 1B	82,399	-798	1,870	-376	94,800	-918	2,175	-437	105,651	-1,023	2,442	-490
Bypass Alternatives 4A and 4B	75,185	-8,011	1,670	-576	86,501	-9,217	1,942	-670	96,402	-10,272	2,180	-752

¹ VMT = vehicle-miles traveled

² VHT = vehicle-hours traveled

Table 4-9. Annual Transportation System Cost Savings, Selected Build Years

Alternative	Cost per VMT	Cost per VHT	2010 (in thousands)			2025 (in thousands)		
			Change in Annual VMT vs. No-Build	Change in Annual VHT vs. No-Build	Total Annual Saving (in thousands of 2001 dollars)	Change in Annual VMT vs. No-Build	Change in Annual VHT vs. No-Build	Total Annual Saving (in thousands of 2001 dollars)
Preferred Alternative	\$0.68	\$15.40	166	-18	\$164	213	-23	\$209
Bypass Alternatives 1A and 1B	\$0.68	\$15.40	-255	-120	\$2,022	-327	-157	\$2,641
Bypass Alternatives 4A and 4B	\$0.68	\$15.40	-2,564	-184	\$4,584	-3,287	-241	\$5,956

Note: Negative values indicate savings relative to the No-Build. With the Preferred Alternative, there would be a small increase in VMT, because of the minor realignments of the roadway. Traffic volumes would be the same as the No-Build Alternative.

Unit cost values are derived from previous research by the economic analyst into the fully loaded costs of highway travel. That research yielded the following summary values for automobiles and commercial vehicles:

<u>Per Vehicle-Mile Traveled</u>	Auto	Commercial
Vehicle operations	\$0.16	\$0.21
Crashes	0.17	0.37
Municipal services	0.02	0.16
Roadway maintenance	0.02	0.15
Environmental impact of travel	<u>0.26</u>	<u>0.40</u>
<i>Total</i>	\$0.63	\$1.29

<u>Per Vehicle-Hour Traveled</u>		
Travel time	\$15.00	\$20.00

The commercial values were applied to the eight percent trucks included in the traffic forecasts. The blended rates are shown in Table 4-9. All values are in constant 2001 dollars.

Transportation System User Benefits vs. Costs

With these single year estimates of benefits in hand, the net present value of a 30-year stream of transportation system benefits can be derived. Values for intermediate years are arrived at by interpolation. These are then compared with the capital costs of each alternative. A net present value and a benefit/cost ratio have been determined based on these data. The results are shown in Table 4-10.

As shown in Table 4-10, using this method of analysis, none of the alternatives would generate a positive net present value or benefit/cost ratio greater than one. The cost of all alternatives would be greater than the travel benefits they would offer. Thus, none of the alternative would warrant travel distance and time savings sufficient to justify their cost. The two indicators produce somewhat conflicting results, in that the Preferred Alternative, for example, with the lowest or poorest benefit/cost ratio displays the least negative or best net present value. Bypass Alternative 1A has the second best present value combined with almost the highest or best benefit-cost ratio. In this case, the net present value is probably a better indicator of merit (or non-merit) than the benefit-cost ratio. Had the alternatives generated positive net present value findings, the benefit/cost ratio can be a good tool for decision making, where investment decisions are made within a constrained budget.

Table 4-10. Transportation System Benefits and Costs ¹

Alternative	Net Present Value (thousands of dollars)	Benefit/Cost
Preferred Alternative	-41,000	0.04
Bypass Alternative 1A	-45,000	0.33
Bypass Alternative 1B	-61,000	0.27
Bypass Alternative 4A	-101,000	0.34
Bypass Alternative 4B	-176,000	0.23

¹ Over a period of 30 years.

Combined Benefits and Costs

Table 4-11 provides a summary of the various economic benefits and costs associated with the Build Alternatives. The findings presented in Table 4-11 are supported by the analysis and data presented above. No attempt is made to reduce the results to a single benefit/cost number. Instead, this matrix is designed to highlight key tradeoffs, such as potential benefits for owners of commercial property versus the disadvantages for existing second/summer homeowners.

The trade-offs presented in Table 4-11 can be summarized as follows:

- The Preferred Alternative would have its greatest impact on business during the construction period in terms of businesses relocated and business disruption during construction. The Bypass Alternatives would have a minimal impact on businesses during the construction period.
- The Preferred Alternative's landscaped median from US 321 Business north to the end of the project would affect "opportunity" businesses, but in a minor way, particularly compared with the Bypass Alternatives. The Bypass Alternatives would have their greatest impact on "opportunity" businesses by taking through traffic around Blowing Rock. The businesses relying on immediate access and catering to heavy drive-by traffic could be negatively impacted, and some could be out of business in a year or two after a Bypass Alternative is opened to traffic.
- Bypass Alternatives 1A and 1B would have the greatest potential to lower property values.
- The more money spent on US 321 improvements, the greater the short-term economic benefit in terms of jobs generated in the region. However, the travel cost benefits of all alternatives do not offset their construction costs. Using this partial measure of economic impact, all of the Build Alternatives would have a negative net present value, with the more expensive alternatives having lowest net present value.

4.1.3 Land Use Plan Compatibility

Caldwell County, Watauga County, and the Town of Blowing Rock all have comprehensive land use plans that guide development within the project area. Caldwell County and Blowing Rock have zoning ordinances, while Watauga County has not adopted a zoning ordinance. The compatibility with land use plans of the alternatives under consideration varies by alternative and by jurisdiction. All the plans seek to maintain the character of the existing rural or resort landscape. As such, the Preferred Alternative is more compatible with county plans because landscape changes would occur along the existing highway corridor and Bypass Alternatives 4A and 4B, which are outside of Blowing Rock, are more compatible with the Blowing Rock plan. Bypass Alternatives 1A and 1B, which would pass through a developing residential area of Blowing Rock, are wholly incompatible with the Blowing Rock plan and are the least desirable alternative from the perspective of land use plan compatibility.

Caldwell County

None of the five Build Alternatives would adversely affect the enforcement of Caldwell County's policy goal of keeping US 321 uncluttered and free from new commercial development since that goal was adopted with the improvement of US 321 in mind. This goal also would be supported by the No-Build Alternative.

Table 4-11. Summary of Economic Benefits and Costs

Alternatives	Relocation	Business Losses During Construction	Near Term Business Losses Following Construction	Impacts on Tourist-Oriented Businesses	Impacts on Existing Residential and Second Home Values	Total Employment from Construction (person years)	Total Capital Cost (\$ millions)	Net Present Value (millions of dollars)
Preferred Alternative	12 homes, 5 businesses	Yes but efforts will be made to mitigate	Some business losses, but generally minor	Minimal	Minimal	1,345	\$45.9	-\$41.0
Preferred Alternative without landscaped median	12 homes, 5 businesses	Yes but efforts will be made to mitigate	Minimal	Minimal	Minimal	Similar to the Preferred Alternative	Similar to the Preferred Alternative	Similar to the Preferred Alternative
Bypass Alternative 1A	24 homes, 1 business	Limited	Potentially substantial losses for opportunity-based businesses	Minimal	Moderate potential impacts	2,200	\$75.1	-\$45.0
Bypass Alternative 1B	24 homes, 1 business	Limited	Potentially substantial losses for opportunity-based businesses	Minimal	Moderate potential impacts	2,701	\$92.2	-\$61.0
Bypass Alternative 4A	8 homes, 1 business	Limited	Potentially substantial losses for opportunity-based businesses	Minimal	Minimal	4,996	\$170.5	-\$101.2
Bypass Alternative 4B	6 homes, 1 business	Limited	Potentially substantial losses for opportunity-based businesses	Minimal	Minimal	7,334	\$250.3	-\$175.8

The US 321 corridor is zoned R-20, Residential District. The regulations of this district are intended to discourage any use that, because of its character, would substantially interfere with the development of single family residences in the district and that would be detrimental to the quiet residential nature of the areas included within this district. Because this zoning classification is restrictive, neither the Preferred Alternative nor the No-Build Alternative would encourage development of inappropriate uses along this section of the roadway. The R-20 zone is focused on existing US 321. If Bypass Alternative 4A or 4B were built, this classification also would need to be expanded to encompass the bypass from where it leaves US 321 to the Caldwell County line in order for Caldwell County to achieve the same objectives along the bypass as along existing US 321. The current zoning in the area along Bypass 4 is RA-20 (Residential – Agricultural District). In general, more types of residential or agricultural uses are permitted in this district than in the R-20 district.

The plan also encourages a comprehensive approach to addressing opportunities and constraints of the County’s physical development that will promote the general welfare of the residents of Caldwell County and a comprehensive system of streets and highways coordinated with the pattern of land use. Since Bypass Alternatives 4A and 4B would make rural land more accessible for development, they would not be compatible with these goals to the extent that the Caldwell County plan was developed with the expectation that the lands along Bypass Alternatives 4A and 4B would remain rural.

Watauga County

The purpose of the Watauga County plan is “to stimulate actions which will improve or enhance the overall quality of life in Watauga County.” To achieve the plan’s purpose, goals were set to help guide the plan so that the community would retain its strengths, as identified by its citizens, and combat its weaknesses. The Build Alternatives would be compatible with some of the plan’s goals but not compatible with others. All of the Build Alternatives would improve transportation in the county, which is one of the goals of the plan. The No-Build Alternative would not be compatible with this goal. Bypass Alternatives 4A and 4B, however, would not be compatible with the plan’s goals of preserving and improving the physical environment, and protecting and maintaining the rural atmosphere and visual quality of the county. The natural resource, rural community, and visual quality impacts of these two bypass alternatives in unincorporated Watauga County are discussed in Sections 4.9, 4.1.5, and 4.3, respectively.

Blowing Rock

The overall emphasis of the Blowing Rock Comprehensive Plan is the preservation of the resort village character of Blowing Rock, including preservation of historic features, characteristic natural vegetation, and the need for commercial development with an upscale appearance. The plan also calls for improvements to US 321 from US 321 Business to US 221, but not to four lanes. Zoning calls for commercial uses along US 321 between US 321 Business and the northern town limits. Other parts of the project area are zoned residential.

The No-Build Alternative, which would involve no construction, and Bypass Alternatives 4A and 4B, which would place all improvements outside the town limits of Blowing Rock, would meet the goal of preserving historic features and natural vegetation. None of these alternatives would offer any improvement to the existing road as defined by the plan, but such improvements would not be precluded as a part of another project or projects. None of these alternatives should affect the Town’s efforts to seek an upscale appearance for new commercial development.

The Preferred Alternative in some ways would be compatible with the goals of Blowing Rock plan and in other ways would be incompatible. It would include improvements to US 321 as

identified in the plan, but it would go still further by constructing a four-lane road with alignment improvements between Pinnacle Avenue and US 321 Business. The Preferred Alternative would alter the existing topography, remove vegetation, and affect historic resources, including the displacement of one contributing structure to the Green Park Historic District. Blowing Rock's plan calls for the preservation of these features. The alignment and the typical sections of the Preferred Alternative, however, were developed keeping in mind the need to balance traffic capacity and safety needs with the objective of promoting Blowing Rock's village character. In order to reduce impacts of widening the existing highway through town, the NCDOT conducted post-hearing mitigation discussions with the Town of Blowing Rock and with Section 106 consulting parties (interested people who wished to consult on ways to mitigate the project's adverse affect on the Green Park Historic District, see Section 4.6.1). The objective of these discussions were to develop a Memorandum of Understanding (MOU) and Section 106 Memorandum of Agreement (MOA) (see Appendix G). The agreements call for continued mitigations discussions with the Town officials, other community stakeholders, and the State Historic Preservation Office as design progresses.

It is not expected that the combination of the Preferred Alternative and the commercial zoning between US 321 Business and the northern end of the project area would attract inappropriate land uses for the following reasons:

- The Blowing Rock plan calls for the administration of land use codes in a manner that supports the village character of the community;
- The project is not expected to attract traffic volumes beyond what would occur without the project improvements;
- The 16-foot raised landscaped median strip proposed in this area would serve as a deterrent to new strip commercial development that would require multiple access points and that would promote frequent arrivals and departures by through travelers; and
- The landscape plan proposed for this area would complement efforts to bring an upscale appearance to this area.

Bypass Alternatives 1A and 1B would be incompatible with the Blowing Rock plan. Neither alternative would involve construction along the existing road, but both would involve the introduction of a thoroughfare to a developing residential area with resulting substantial negative noise, community, and visual impacts, including the loss of natural vegetation. The impact of Bypass Alternative 1B would be the greatest since it includes a large cut into Gideon Ridge. These impacts are discussed in Sections 4.5, 4.1.5, and 4.3, respectively. This alternative should not affect the Town's efforts to seek an upscale appearance for new commercial development.

4.1.4 Farmlands

As discussed in Chapter 3, Section 3.1.6, there is no prime, statewide, or locally important farmland in the project area.

4.1.5 Neighborhoods and Community Cohesion

With any of the Build Alternatives, homes near the new roadway could suffer a reduced quality of life or a loss of valued community character because of the introduction of a wider roadway or

a new through roadway into the community. The Town of Blowing Rock and rural surrounding communities value their way of life and the setting and character of their communities. Any of the Build Alternatives would cause a reduction in that community value. The Preferred Alternative, with its four-lanes, additional traffic signals, and shallower curves, particularly south of US 321 Business, would give the Town of Blowing Rock a more urban feel, reducing the small town atmosphere that the resort community has now. Bypass Alternatives 1A and 1B would introduce a thoroughfare to an area of local streets and single-family homes, in some cases dividing neighborhoods. Bypass Alternatives 4A and 4B would introduce a thoroughfare to a wooded-rural area of isolated homes, particularly at their southern and northern ends. The quality of life sought by those who reside in the community would be affected, particularly for those who live near the new or improved facility. Additional impacts to the community are discussed under secondary and cumulative impacts in Section 4.15.

No-Build Alternative

The No-Build alternative would not change the characteristics of the existing road nor the communities that surround it. No additional lanes, turn lanes, or traffic signals would be added. As shown in Figure 1-3 of Chapter 1, traffic volumes on the existing road would continue to rise. In 1998, the average daily traffic (ADT) on US 321 ranged from 8,325 to 15,350 vehicles per day (vpd) through Blowing Rock and was 7,525 vpd south of the town limits. In 2025 with the No-Build alternative, the ADT would range between 15,000 and 27,450 vpd through Blowing Rock, depending upon the location, and would be about 14,100 vpd south of the town limits. During the peak hour, all two-lane sections of US 321 would be highly congested (level-of-service [LOS] F). By 2025, even the typical weekday peak hour would be congested (at LOS E). The Sunset Drive signalized intersection would be highly congested during the peak hour. Wait times for persons trying to exit driveways and unsignalized side streets would be long during the peak hour (LOS F). At the unsignalized side street intersections, there would not be enough gaps in US 321 traffic during the peak hour to accommodate every driver that wants to enter US 321 from a side street. This could result in waits longer than 15 minutes (a level of service worse than F as indicated in Table 2-14 of Chapter 2) or changes in driver behavior, such as making turns during shorter than otherwise desirable gaps in traffic.

Thus, congestion would make it difficult for local traffic, who must travel on or cross US 321 to move from one part of Blowing Rock to another.

Sharp curves and short site distances in the Norwood Circle and Country Club Drive area would remain. For example, a driver coming out of Norwood Circle can only see US 321 traffic for approximately 260 feet to the north and 280 feet to the south. A vehicle can travel those distances in about five seconds at 35 mph. A person turning out of Norwood Circle thus is limited to that amount of time to make safely his/her turn. A similar situation would continue to exist at County Club Drive. Short sight distances also affect persons turning onto these roads.

Specific locations of pedestrian and bicycle travel or opportunities for pedestrian or bicycle travel across US 321 are described below in the discussion of the “Preferred Alternative.”

Preferred Alternative

US 321 is already a feature of the existing communities along the corridor. The Bailey Camp community in Blackberry Valley is located away from US 321. The road currently bisects the Town of Blowing Rock, carrying a mixture of local traffic, visitor traffic, and regional through traffic. The Preferred Alternative would reduce community cohesion in Blowing Rock because it would leave growing traffic volumes on US 321 and introduce a wider pavement. It, however, would also offer some benefits to community cohesion.

Neighborhood Impacts. Because the alternative would be along the existing highway corridor, it would not pass through the midst of any Blowing Rock neighborhoods or rural communities, but rather along their edges. As such, it would not harm patterns of social relationships or interaction, e.g., residents moving between their homes and those of their neighbors, patterns already inhibited by traffic on the existing road. Noise levels at homes along US 321 would rise and in some cases fall slightly compared to existing conditions, as discussed in Section 4.5. These changes would result from rising traffic volumes and changes in the location of the road in relation to homes. All increases would be less than 10 dBA (decibels on an A-weighted scale). The Preferred Alternative would adversely affect, however, the highly valued village character of Blowing Rock that is evident along US 321, particularly between the town limits and US 321 Business, as discussed in Section 4.3.

Local Traffic Movement. Although traffic volumes would continue to grow on US 321, the Preferred Alternative would reduce peak hour congestion to desirable levels, LOS C or better except in the area of the Food Lion where an acceptable LOS D would occur. Both signalized and unsignalized intersections would operate at acceptable levels of service. The better LOS at unsignalized intersections would occur in part because new traffic signals would tend to group or platoon vehicles traveling on US 321, creating gaps in the traffic. Thus, the Preferred Alternative would make it easier for residents to move around Blowing Rock in their cars and trucks.

In addition, sight distances would be improved in the Norwood Circle and Country Club Drive areas. For example, for drivers on Norwood Circle at US 321, sight distances would increase to approximately 620 feet to the north and over 1,200 feet to the south. This would provide a driver turning from Norwood Circle 12 seconds before encountering an unseen southbound vehicle traveling at 35 mph and over 23 seconds for a northbound vehicle. Even for a speeding vehicle traveling at 45 mph (10 mph over the posted speed limit), one would have at least 9 seconds before being reached by an unseen southbound vehicle and about 18 seconds for a northbound vehicle. A person stopping or slowing on US 321 to turn onto Norwood Circle would receive the same sight distance benefit. Similar sight distance improvements are proposed at Country Club Drive. The sight distance improvements also would reduce the risk of rear-end collisions for people stopping on US 321 to turn onto Norwood Circle and Country Club Drive.

Pedestrian and Bicycle Movement. A primary impact associated with community cohesion would relate to pedestrian and bicycle access at the locations in Blowing Rock where opportunities exist for pedestrians and bicyclists to pass from one side of US 321 to another, and pedestrian and bicycle travel into the central business district for such tasks as picking up daily mail, shopping and visiting the city park. No formal bicycle paths or pedestrian ways cross US 321.

Persons choosing to cross US 321 on foot (with or without a bicycle) would have more pavement to cross. Two locations now appear to generate a significant amount of pedestrian travel. Four other locations would offer opportunities for people to cross US 321. Concentrations of pedestrians traveling across US 321 occur at two points in Blowing Rock – the Green Park Inn and Sunset Drive. At the Green Park Inn, pedestrians cross the highway to reach the Inn from a parking lot on the opposite side of US 321. An increase in road width along this section would mean an increase in the roadway distance that pedestrians must cross. However, as a part of this project the parking lot would be removed and not replaced. The removal of the parking lot would eliminate the need for pedestrians to cross the street at the Inn. A traffic signal would be placed at the intersection of US 321 with Rock Road/Green Hill Road. The signal would ease movements of any pedestrians wanting to cross US 321 at Green Hill Road/Rock Road. A proposed sidewalk on the east side of US 321 would facilitate pedestrian movement to the Green

Hill Road/Rock Road intersection from the Green Park Inn and other land uses north of the intersection.

Near US 321's intersection with Sunset Drive in Blowing Rock, a collection of highway oriented commercial uses has developed, and a traffic signal is currently in place at this intersection. It now helps pedestrians to cross the highway safely. According to town officials, permanent and seasonal residents living in the Echo Park neighborhood, east of US 321, cross the road at this intersection frequently on foot to travel into the central business district for such tasks as picking up daily mail, shopping, and visiting the city park. Most residents in town pick up their mail at the post office, which is on Morris Street in the central business district. With the Preferred Alternative, the amount of pavement would more than double, with the addition of the two extra lanes and a left turn lane. The traffic signal at this intersection would remain, and it would be timed to allow pedestrians ample time to cross US 321 in a single cycle.

The other locations where pedestrians might desire to cross US 321 are: the realigned Skyland Drive/US 321 Business intersection, the realigned Church Street/New River Lake Drive intersection, the realigned Westview Drive/US 221 intersection, and the Possum Hollow Road intersection. All except the Church Street/New River Lake Drive intersection would be signalized, aiding pedestrian crossing. Currently, neither Skyland Drive nor Westview Drive is signalized. The new signals and the realigned intersections would create opportunities for pedestrians to cross US 321 that do not exist today. Crossing US 321 at New River Lake Drive and Church Street where a signal is not proposed, would require crossing a wider pavement against more traffic than exists today, making pedestrian crossings more difficult. The signals at Skyland Drive/US 321 Business and Sunset Drive would tend to create platoons of vehicles, which would create gaps and open more opportunities to cross US 321.

The Preferred Alternative would include sidewalks on both sides of US 321 between US 321 Business and Possum Hollow Road and on the east side of US 321 from Green Hill/Rock Road to US 321 Business. These sidewalks would facilitate pedestrian movement along US 321 and between signalized crossings included in the Preferred Alternative.

Bypass Alternative 1A

With Bypass Alternative 1A, existing US 321 would be unchanged. Traffic on existing US 321 in Blowing Rock in the year 2025 would be less than it is today between the southern starting point of the new alignment and US 321 Business, as discussed in Chapter 2. Traffic volumes between US 321 Business and US 221 in 2025 would be similar to what they are today. Traffic would continue to rise north of US 221.

Along Existing US 321. Because through traffic would be diverted to the bypass, design hour levels of service would be better at the unsignalized intersections from US 321 Business south. It would be easier to enter US 321 from driveways and side streets in this area than it is currently. Short site distances described above in the Norwood Circle and Club Drive areas would remain. Pedestrians and bicyclists would face less traffic when trying to cross US 321, and they would only have to cross two lanes. Benefits to pedestrians associated with the several road realignments would not occur. No changes to the highly valued village character of Blowing Rock would occur.

Along the Bypass at Fairview Court and Green Hill Road. From Green Hill Road to its terminus at existing US 321, Bypass Alternative 1A would have substantial impacts on several neighborhoods and their cohesion. This includes both existing neighborhoods and developing neighborhoods. This section and the ones that follow discuss these impacts by neighborhood.

Thirteen homes and several lots near the intersection of Fairview Court and Green Hill Road would be displaced, including the entire eastern half of the Fairview Court subdivision. Access between remaining homes would be altered. Green Hill Road would bridge the bypass. Residents in the remaining homes in the neighborhood could have a reduced quality of life because of the noise and visual impacts. Noise levels would increase 15 to 29 dBA at remaining homes because existing noise levels are very low. The Federal Highway Administration's (FHWA) noise abatement criteria as applied by the NCDOT for all highway improvement impact assessments would be exceeded. Visual and noise impacts, as well as associated mitigation opportunities, are discussed in Sections 4.3 and 4.5, respectively.

Wonderland Wood and Heritage Lane are two developing subdivisions. As noted in Figures D2-e and Figure D2-f, Bypass Alternative 1A would cross Wonderland Wood Drive at two locations; at the first crossing Wonderland Wood Drive would be turned into a cul-de-sac on either side of the bypass, and at the second one, it would be crossed via an overpass. Heritage Lane to the north of Wonderland Drive would be split with two cul-de-sacs. Bypass Alternative 1A would split both subdivisions into two parts. These roadway alterations would take approximately 14 lots, including nine with homes, leaving approximately 34 lots remaining in the two neighborhoods. The Wonderland Wood neighborhood would remain connected by a single street internal to the neighborhood (part of Wonderland Wood Drive). Residents of Heritage Lane would have to leave the neighborhood and use Wonderland Drive to move between the two remaining parts of their subdivision.

The bypass would pass through the Wonderland Wood subdivision in a deep cut except at the neighborhood's northern end of the neighborhood where it would be briefly at grade and then cross Wonderland Wood Drive, Wonderland Drive, and Middle Fork on a bridge as high as 55 feet above the existing ground. It would be 36 feet high as it crosses Wonderland Wood Drive. The bypass would pass across Heritage Lane roughly at the current grade. Noise levels in 2025 would be 23 to 34 dBA greater than what they are today and would exceed the FHWA's noise abatement criteria. (See Sections 4.3 and 4.5 for a fuller discussion of these impacts and mitigation opportunities.)

The two neighborhoods would be divided. Neighbors would be displaced and many who remain would lose direct access to neighbors. The alternatives would introduce a thoroughfare to the rural setting with associated visual and noise impacts. Although the bypass would alter the circulation patterns within the neighborhood, circulation patterns between neighborhoods would not be changed in this area for motor vehicles, pedestrians, and bicycles.

Goforth Road Area. This alternative would take homes in this area, including a cluster of three homes at one end of a small neighborhood. The bypass would create a deep cut (as deep as 40 feet) through this area. As shown in Figure D-2f, Goforth Road would cross the bypass on a bridge to maintain continuity for travel between this area and homes farther north on Goforth Road. Noise levels would rise 13 to 30 dBA in this area. The FHWA noise abatement criteria would be exceeded. The alternatives would introduce a thoroughfare to the rural setting with associated visual and noise impacts. (See Sections 4.3 and 4.5 for a fuller discussion of these impacts and mitigation opportunities.)

Possum Hollow Road. The three homes along Possum Hollow Road west of Forest Lane all would be displaced. The proposed corridor is shown in Figure D-2g.

Bypass Alternative 1B

The impacts to neighborhood and community cohesion both along the existing road and along the bypass would be virtually identical to Bypass Alternative 1A, with one major exception. Bypass Alternative 1B also would eliminate the sharp curves in the existing road near the Blackberry Condominiums south of the Blowing Rock town limits as shown in Figure D-3c. A deep cut (up to 250 feet on the west side of the road) would be made in Gideon Ridge to straighten the bypass. Four homes and six lots (as of 2001) with spectacular views of the surrounding valley would be lost. These lots are highly valued in the area, although only their owners and not the community as a whole receive the direct benefit of enjoying the views. The homes and lots are all at the end of a road (Gideon Ridge Lane), and the existing homes are isolated from other homes in the area by terrain and distance; thus, no impact to community cohesion would occur. Changes in noise levels would not be substantial. Neighborhood-related visual impacts would primarily occur as the bypass emerges from the cut on the north. (See Section 4.3 for a fuller discussion of visual impacts and mitigation opportunities.)

Access to the Blackberry Condominiums would be changed. At the north end of the cut, the bypass would cross the old US 321 roadbed approximately 20 feet below. The northbound access to the condominiums would be eliminated. As shown in Figure D-3c, a portion of existing US 321 would be maintained to connect the condominiums' south entrance with the new US 321. These changes would isolate the condominiums from US 321 traffic, which could be viewed as a benefit given the number of no trespassing signs posted at the condominium's entrances to discourage nonresidents from entering the property. Visual impacts on views from the condominiums are discussed in Section 4.3.

Bypass Alternative 4A

The impacts to neighborhoods along the existing road would be virtually the same as those for Bypass Alternative 1A. Because a bypass in the Bypass Alternative 4 corridor would attract less traffic than one in the Bypass Alternative 1 corridor, benefits to motorists turning from driveways and local side streets along existing US 321 would be slightly less.

Bypass Alternative 4A would substantially affect two rural communities by displacing residences. As shown in Figure D-4a and Figure D-4b, Bypass Alternative 4A would first introduce a thoroughfare to a rural community of mostly isolated homes between its starting point on its south end (Station 580) and where the bypass begins to follow the Blue Ridge escarpment in the Green Hill area (Station 620). Five of the seven homes in this area would be displaced. One remaining home would be approximately 100 feet from a cut into the terrain associated with the bypass. The other home would be adjacent to a bridge structure 190 feet high. Noise levels would increase 16 to 23 dBA in 2025 over existing levels.

For almost its full length north of the Blue Ridge Parkway, Bypass Alternative 4A would divide a large parcel of land that has a single owner. Two families live in the associated valley. The home of one of the families would be displaced. Noise levels would increase approximately 31 dBA 2025 over the existing levels. The road would be a substantial visual presence.

In both of the above locations, the bypass would provide at least some access to lands that are currently isolated, potentially encouraging additional development. Purchase of control of access could limit to a few locations direct access to the bypass. More specifics on development of secondary impacts, visual, and noise are presented in Sections 4.1, 4.3, and 4.5, respectively.

A mobile home park is at the northern end of Bypass Alternative 4 corridor. The park would not be directly affected by the bypass as shown in Figure D-4i.

Bypass Alternative 4B

The impacts of Bypass Alternative 4B from the perspectives of neighborhood and community cohesion would be virtually identical to Bypass Alternative 4A north of the Blue Ridge Parkway, both on the existing road and along the bypass. The primary difference would occur at the south end of the alternative, between Stations 580 and 625, where the alignment is different from Bypass Alternative 4A. Three of seven homes would be displaced. The four remaining homes would have views of the bypass and its associated fills and bridge. Like Bypass Alternative 4A, this bypass would not directly affect the mobile home park near the corridor's northern end (Figure D-5i).

4.1.6 Community Facilities and Resources

None of the alternatives would adversely affect community facilities or resources. Any of the Build Alternatives would offer modest travel time savings to school buses, AppalCART vans, and emergency vehicles. The Bypass Alternatives would accomplish this by reducing traffic growth on existing US 321, while the Preferred Alternative would accomplish this by increasing road capacity and by providing other improvements.

Schools

The Preferred Alternative would provide left turn lanes and wider shoulders on which buses could pull off the road. These design features would increase the safety of school children traveling on US 321. The provision of an additional lane in each direction also would decrease travel times. Intersection improvements and signals would make it easier for buses to enter US 321 during peak traffic periods. The Bypass Alternatives would reduce the growth of traffic on US 321, which would provide similar benefits. These changes would not occur with the No-Build Alternative.

Public Transportation

Users of the van service (provided by AppalCART and the Human Service agency and described in Chapter 3, Section 3.2.2) between Boone and Blowing Rock would be less affected by growing US 321 traffic volumes within Blowing Rock because of the implementation of any of the five Build Alternatives. This modest benefit would not occur with the No-Build Alternative.

Emergency Service

With the additional lane in each direction (Preferred Alternative) or the reduction of traffic on existing US 321 (Bypass Alternatives), ambulance, fire, and other emergency vehicle travel times would be reduced during peak periods. This benefit would not occur with the No-Build Alternative. An emergency medical service (EMS) representative in Blowing Rock indicated it would take an EMS vehicle longer to reach a traffic related emergency along a bypass than it would to reach one along existing US 321.

NCDOT proposes an emergency crossover (with pavers that will allow grass to grow through them) at the planned Fire/EMS station on US 321 between US 321 Business and Sunset Drive. This crossover would permit volunteer fire fighters to turn left into the station and fire trucks to turn left out of the station. The crossover would be signed for emergency use only. The Town of Blowing Rock, during the 2003 to 2004 mitigation discussions with NCDOT, requested that this crossover be provided.

National Forest

None of the alternatives would affect Pisgah National Forest lands.

4.2 Minority and Low-Income Populations

As documented in Chapter 3, Section 3.3, there are no concentrations of any one racial or ethnic group or low-income populations within the three project corridors. Thus, there is no evidence that any of the alternatives under consideration would disproportionately affect low-income or minority households.

4.3 Visual and Aesthetic Quality

This section describes the visual and aesthetic impacts of the alternatives. The landscape units referenced are shown in Figure 3-3 and described in Section 3.4.2 in Chapter 3. The No-Build Alternative would have no impact on visual or aesthetic resources in the project area. The principal impacts of the five Build Alternatives can be summarized as follows:

Preferred Alternative. The most substantial visual impacts would occur in Landscape Units Two and Three, which include the Green Park Historic District and the mostly residential area between the Green Park Historic District and US 321 Business. Here the Preferred Alternative would pass through a landscape that has historic value and that contributes to the traditional village resort character of the Town of Blowing Rock. This is the only location where this character is visible to the through traveler. The changes would reduce the intimacy, unity, and intactness of the setting. As mitigation along this alternative, a landscaping plan would be developed and implemented. New slopes would be re-vegetated. In Blowing Rock, existing stone walls removed would be replaced in kind. A median would be included in the road between US 321 Business and Possum Hollow Road. It would be either vegetated or decorative concrete (Town of Blowing Rock's choice). Decorative pedestrian lamps would be placed along the road at selected locations in Blowing Rock. Broader areas of landscaping would be included along the road where right-of-way, roadway elements, terrain, and safety conditions allow. Efforts would be made to preserve trees of particular value identified by the Town of Blowing Rock. When guard rail is required, a wood-faced guard rail would be used. The project would include development of a park in the unused right-of-way left from the relocation of the US 221/US 321 intersection. Visual impact mitigation is addressed in both a MOA with US Army Corps of Engineers (USACE) and the State Historic Preservation Office for the Green Park Historic District and a Memorandum of Understanding (MOU) with the Town of Blowing Rock (see Appendix G).

Bypass Alternative 1A. The most substantial visual impacts would occur in Landscape Unit Five where the bypass would pass through several subdivisions. The intactness of the rolling landscape in the unit would be broken by the comparatively level highway and the need to cut, fill, retain, and bridge the landscape to maintain its design criteria. Substantial visual impacts would occur in the Fairview Court/Green Hill Road area, the Wonderland Drive area, Goforth Road area and the Possum Hollow Road area west of Forest Lane. Deep cuts and a tall bridge would be adjacent to homes. Exposed slopes would be re-vegetated, although deep cuts could not be fully re-vegetated because of a lack of topsoil.

Bypass Alternative 1B. The impacts described above for Bypass Alternative 1A also would occur with Bypass Alternative 1B. In addition, a deep cut would be made in Gideon Ridge that would affect views in Landscape Units One and Six. The primary viewers of the change would be residents on Green Hill and at the Blackberry Condominiums.

Bypass Alternative 4A. The most substantial visual impacts of this alternative would be to rural residents in Landscape Unit One, viewers at Thunderhill overlook on the Blue Ridge Parkway in Landscape Unit Six and rural residents in Landscape Unit Seven. In Landscape Unit One, Bypass

Alternative 4A would introduce a thoroughfare into a rural community of mostly isolated homes (Station 580 to Station 620). Although slopes would be re-vegetated, this bypass would be a substantial visual presence that could not be hidden from its viewers. It would damage the intactness of the landscape. In Landscape Unit Six, the combination of the extensive changes in the terrain along the escarpment, proximity to the Parkway and the high value placed on natural views from Thunderhill overlook would combine to create a substantial visual impact in this area. In Landscape Unit Seven, the road would be a substantial visual presence in what is now an isolated rural valley.

Bypass Alternative 4B. This bypass would be in a location similar to Bypass Alternative 4A, but would use more bridges. Its most substantial impacts would occur in the same landscape units as with Bypass Alternative 4A. In Landscape Units One and Seven, the impacts would be different but still substantial for rural residents. Along the Blue Ridge escarpment, most of the large fills that would be a part of Bypass Alternative 4A would be replaced by four bridges. The bypass would still change the landscape as viewed from the Parkway and Thunderhill overlook, but with the bridges the changes would be less extensive than with Bypass Alternative 4A. The bypass, however, would be an obvious imposition on the landscape

Other visual impacts would occur along each of these alternatives. They are described in detail along with those noted above in the sections that follow.

4.3.1 Assessment Factors

The FHWA documents “Visual Impact Assessment for Highway Projects” (FHWA, 1983) and “Visual Impact Discussion” (FHWA, undated) describe procedures for visual impact assessment. These procedures are commonly used in the assessment of the visual impacts of proposed highway projects and were used in this assessment of visual impacts. Based on this guidance, the following questions were considered in evaluating visual impacts:

1. What would be the views of the project and from the project? Who are the viewers?
2. Which of the seven landscape units in the project area would be affected? The characteristics of the landscape units were described in Chapter 3, Section 3.4 and their location is shown on Figure 3-3.
3. The changes to the existing landscape, including, as applicable, examining the following questions:
 - a. What features would be introduced, e.g., cut slopes, fill slopes, pavement surface, retaining walls, and vegetation clearing?
 - b. Which landscape units would be affected by which alternative?
 - c. Would any existing views be blocked, partially opened, or fully opened?
 - d. What existing landscape features would be lost?
 - e. What new lines, textures, colors, or shapes would be introduced to the landscape?
 - f. Would spatial relationships between the components of the landscape changed or are new interrelationships introduced?

introduced at two locations. The primary landscape feature lost would be forest cover. Two homes also would be displaced.

The scale, shape, lines, and texture of views would change with the wider pavement surface, the flatter adjoining slopes, the straighter road, and the loss of tree cover. Therefore, the intactness and unity of the landscape would be reduced by the introduction of project features, particularly in the area of large cuts in the southern half of the unit.

Views from Landscape Unit One would consist of new cut slopes and the new alignment of Rocky Knob Road, which includes two retaining walls approximately 8 to 12 feet high. The primary viewers of these changes would be the residents of four homes and commuters, residents, and tourists on the road. Cut slopes also could be viewed from homes on Gideon Ridge and, in a very limited manner, through dense forest cover adjacent to *The Blowing Rock* attraction parking lot. The ridge on the west side of the road would continue to block views to the west. The sizable rock outcrop that partially shields the Blackberry Condominiums from views of US 321 would be reduced substantially, exposing the nearby road to condominium residents.

The three large fills on the east side of the road would be visible; one would be viewed from nearby homes, two the former Valley View Motel (now condominiums), and one from the Blackberry Condominiums. For the two condominium complexes, which have broad, high quality views, the fills would represent an intrusion into a portion of the foreground of those views. The fills also would open views of the adjoining Blackberry Valley to drivers on the road, views that are currently limited by vegetation.

As mitigation, plantings, consisting of deciduous and evergreen trees native to the area, would be placed on the slopes adjacent to both sides of the proposed roadway where the existing landscape would be altered. Such planting would begin approximately 20 feet from the roadway edge. Both cut and fill slopes would be planted. However, cut slopes would be less conducive to plant growth. It is likely to require greater effort and time to achieve vegetated cover on the cut slopes than the fill slopes. In addition, the cut slopes could not be planted where topsoil and subsoil are insufficient to provide a suitable plant-growing medium. Proposed landscape plans assume this is true for cuts or portions of cuts greater than 20 feet deep. Thus, for much of the deep cut slopes in the southern half of Landscape Unit One, exposed rock would remain in view of drivers, creating a substantial long-term change in views.

Landscape Unit Two

Landscape Unit Two begins at the project's entry into the Green Park Historic District near the town limits of Blowing Rock and ends at the northern limit of the District. Features introduced in this unit by the Preferred Alternative would consist of a wider pavement surface, cut and fill slopes, two retaining walls, and vegetation clearing. A landscaping plan would be developed and implemented.

The Preferred Alternative would continue to have a 52-foot wide curb and gutter roadway section for a short distance in Landscape Unit Two and then gradually widen to accommodate turn lanes at the Green Hill Road/Rock Road intersection. It would then narrow to 48 feet as the road lane width would narrow from 12 feet to 11 feet through the Green Park Historic District. The increased road width would occur on the west side of the road only. Cuts and fills on the west side of the road would be made to accommodate the increased road width. Neither cuts nor fills would be greater than 8 feet in height. Trees and, in three locations, low stone walls on the west side of US 321 would be removed. One home on the west side of US 321, which is a contributing structure to the historic district, would be displaced. Retaining

walls would be introduced between US 321 and the Blowing Rock Country Club property line to accommodate an 8-foot wide flat berm between the curb, as well as in front of the A.G. Jonas Cottage to reduce loss of vegetation.

As mitigation, plantings, consisting of deciduous and evergreen trees native to the area, would be placed on the slopes adjacent to both sides of the proposed roadway where the existing landscape would be altered on both cut and fill slopes. Such planting would begin approximately 20 feet from the roadway edge. Currently trees often are within only a few feet of the edge of pavement. Plantings would soften the edges of the new cuts and fills. Efforts would be made to preserve trees of particular value identified by the Town of Blowing Rock. Existing low stone walls would be replaced in kind. Retaining walls would be of formed concrete with a simulated masonry surface treatment designed to simulate the existing stone walls. Decorative pedestrian lamps would be placed along the road at selected locations. Existing overhead power and telephone lines would be placed underground. When guard rail is required, a wood-faced guard rail would be used.

The primary viewers of these changes would be the residents of several homes on Pinnacle Avenue, Gideon Ridge Lane, and Tarry Acres, residents of the condominiums on Goforth Road, guests of Green Park Inn, Blowing Rock Country Club members playing golf at the fourth hole (the course's signature hole), and road users.

Although trees would be replaced on cut and fill slopes, the scale of views of the road would change with the wider road and the loss of tree cover near the road. The changes would make views of paved surfaces broader and reduce the intimacy, unity, and intactness of the setting. The retaining wall (approximately 6 feet tall) along the golf course and at the A.G. Jonas Cottage (approximately 4 feet tall) would change the shape, lines, and texture of views of the road. The A.G. Jonas Cottage is a contributing structure to the historic district.

The retaining wall along the golf course would be the primary alteration in the view of users of the golf course's signature fourth hole. In order to avoid affecting use of the golf course hole, new vegetation is not proposed to hide the wall. The NCDOT would continue to work with golf course officials regarding the look of the wall and any associated landscaping to complement the existing scene and minimize the effect of the change. A potential landscape plan in the Green Park Inn area is illustrated in Figure 4-1.

The depth of vegetation blocking views of US 321 from the A. G. Jonas Cottage would be reduced from the existing 65 feet to approximately 25 feet,. The impact of this loss of vegetation was reduced from what was depicted in the DEIS by the inclusion of a retaining wall approximately four feet high at the western proposed right-of-way line rather than use of a cut slope. A fence approximately 12 feet high would be placed along and just inside the property line (along US 321 and a short distance perpendicular to US 321) of the A.G. Jonas Cottage, blocking the view of the road from the home and the view of the home from the road. The description of the A.G. Jonas Cottage can be found in the historic district discussion in Section 3.7.1 of Chapter 3. The location of the fence is illustrated in Figure D-1e in Appendix D.

Overall, the visual changes in this area would not be large; however, they, along with the loss of a contributing structure, are considered an Adverse Effect on the Green Park Historic District per Section 106 of the National Historic Preservation Act. (See the introduction to Section 3.7 in Chapter 3 for a description of Section 106 and its applicability to this project.)

Figure 4-1. Preferred Alternative with Landscape Plan in the Green Park Inn Area

Landscape Unit Three

Landscape Unit Three begins at the northern limit of the Green Park Historic District along US 321 and ends at the US 321/US 321 Business intersection. Features introduced in Landscape Unit Three by the Preferred Alternative would consist of increased paved surface, two structural retaining walls, vegetation clearing and cut-and-fill slopes. Several curves would be straightened. As with Landscape Unit Two, a landscaping plan would be developed and implemented.

Here, the widened roadway would widen to 52 feet wide and would gradually widen to 68 feet to accommodate a left turn lane at the US 321 Business intersection. The Preferred Alternative would involve cuts and fills on the west and east sides of the road to accommodate the increased road width and the straightening of the horizontal alignment. Low stone walls and associated short stairways would be removed in front of four existing homes; two of the homes would be displaced.

Two areas would see substantial change. From Pinnacle Avenue to Norwood Circle, US 321 would be straightened, leaving shallow curves. Several homes on the east side of the road would be displaced. The road would be placed farther away from homes on the west. Between Pinnacle Drive and US 321 Business, a large cut would occur on the east. Here a vertical rock cut approximately 20 feet high is currently adjacent to US 321. The widened road would cut into this existing cut and a shallower cut (rising 1 vertical foot for every 2 feet of horizontal distance) would replace the existing vertical cut, affecting an area as wide as 140 feet. The primary landscape feature lost would be vegetative cover. A retaining wall approximately 24 feet high would hold a fill at the revised Norwood Circle intersection.

The scale, shape, lines, and texture of views would change with the wider pavement surface, the flatter adjoining slopes, the straighter road, and the loss of tree cover. As in Landscape Unit Two, these changes would reduce the intimacy, unity, and intactness of the setting. The extent of the change would be greater than in Landscape Unit Two. Although not within the Green Park Historic District, the existing features of this area also reflect the highly valued village character of Blowing Rock. Landscape Units Two and Three are the only locations along existing US 321 where this character dominates and where it is in view of those using US 321. The Preferred Alternative, while meeting both the standards of a contemporary roadway with shallow curves and improved sight distances and the needs of increasing traffic, would not retain the character of the existing road.

As mitigation, plantings consisting of deciduous and evergreen trees native to the area would be placed on the slopes adjacent to both sides of the proposed roadway where the existing landscape would be altered. Such plantings would begin approximately 20 feet from the roadway edge. Both cut and fill slopes would be planted, but cut slopes would be less conducive to plant growth. For a portion of the cut slope between Norwood Circle and US 321 Business, exposed rock would remain in view of drivers. Exposed rock exists here today. Efforts would be made to preserve trees of particular value identified by the Town of Blowing Rock. Existing low stone walls would be replaced in kind. A 200-foot retaining wall would be introduced on the west between Country Club Drive and Norwood Circle. Retaining walls would be of formed concrete with a simulated masonry surface treatment designed to simulate the existing stone walls. Decorative pedestrian lamps would be placed along the road at selected locations. Existing overhead power and telephone lines would be placed underground. When guard rail is required, a wood-faced guard rail would be used.

The primary viewers of these changes would be the residents of homes along US 321 and adjacent streets and US 321 users. The most substantial change for viewers of the road would be

from homes along the Pines, Norwood Circle, and Trillium Lane. Views that do not now exist of US 321 from several homes would be opened by cuts, vegetation loss and displacement of other homes. This impact would be mitigated by re-vegetation. Re-vegetation would block existing views of US 321 from homes on the left (west) between Country Club Lane and Norwood Circle. The 24-foot high retaining wall at Norwood Circle would be introduced to the northern-most of these homes where a vegetated slope now exists.

Landscape Unit Four

Landscape Unit Four begins at the US 321/US 321 Business intersection and ends at Possum Hollow Road at the northern end of the project area. Features introduced in Landscape Unit Four by the Preferred Alternative would consist of increased pavement surface, new sidewalks on both sides of the road, reconfiguration of three roads that intersect US 321, (Church Street, Skyland Drive, and US 321 Business), four structural retaining walls, vegetation clearing, and cut and fill slopes. As with Landscape Units Two and Three, a landscaping plan would be developed and implemented.

The widened roadway would be 68 feet wide and would include left turn lanes or a raised median within this unit. For most of its length through the unit, the new pavement would be placed on the east side of the existing road. Beginning approximately 500 feet north of Sunset Drive, new pavement would be placed on both sides of the existing road. The most substantial changes to the existing terrain would occur between Ransom Street and a point approximately 1,200 feet north of Ransom Street; between West Cornish Road and a point approximately 1,100 feet north of West Cornish Road; at the National Register of Historic Places-listed Bollinger-Hartley House; and in the area of the Westview Drive and US 221 intersections. In the Ransom Drive area, an existing cut into the hillside would be moved back to accommodate the wider pavement, displacing several homes on nearby Skyland Drive. The slope of the new cut would be similar to the existing cut. The same type of change also would occur in the West Cornish Road area; one cut would be as high as approximately 45 feet and as wide as approximately 110 feet. The slope of these cuts would be similar to the existing hillside. The Bollinger-Hartley House is below the existing road. A steep vegetated slope rises from the home to the existing road. Here, a portion of the widening would occur adjacent to the home. A retaining wall would be built to hold the widened road and replace a portion of the slope. The wall would be as high as 12 feet and would be approximately 40 feet from the home within the existing right-of-way. A portion of the vegetated slope would remain between the home and the wall. The US 221 intersection would be realigned to the same location as the existing Westview Drive intersection with US 321. Existing US 221 is currently lower in elevation than US 321 at this point. US 221 would be raised to create the intersection. A retaining wall as high as 18 feet would be used to retain the raised road on its north side where it is adjacent to Lake Chetola.

To mitigate impacts, plantings, consisting of deciduous and evergreen trees native to the area, would be placed on both sides of the proposed roadway and in the median. Such plantings would begin approximately 20 feet from the roadway edge. Both cut and fill slopes would be planted, but cut slopes are likely to require greater effort and time to achieve vegetated cover. Existing overhead power and telephone lines would be placed underground. Retaining walls would be of formed concrete with a simulated masonry surface treatment designed to simulate the existing stone walls. Decorative pedestrian lamps would be placed along the road at selected locations. When guard rail is required, a wood-faced guard rail would be used. A potential landscape plan for this area is illustrated in Figure 4-2.

Figure 4-2. Preferred Alternative with Landscape Plan in the Sunset Drive Area

In general, the changes would not adversely affect the area from a visual perspective. The changes would not contrast sharply with the area's existing visual features and character. Street trees proposed in the median and on the west side of the road would add vegetation to the setting.

The primary viewers of the changes would be road users, owners, and patrons of businesses along US 321, and residents of homes on Skyland Drive and in the West Cornish Road and Sunset Drive area. The quality of views would be reduced from the Bollinger-Hartley House and from the Chetola Resort across Lake Chetola, with the introduction of retaining walls into their views. Pedestrians walking between downtown Blowing Rock and the Shoppes on the Parkway would walk adjacent to the US 221 retaining wall, but their views of Lake Chetola would be unimpeded. The relocation of the US 221 intersection would create a wider area of former right-of-way (an uneconomic right-of-way remnant) for walkers between the new intersection and the Shoppes on the Parkway. Pedestrians would no longer walk adjacent to US 221 in this area. The Preferred Alternative would include development of a park in this former right-of-way, and the NCDOT would convey its interest in this property to the Town. The Town would assume maintenance for the park.

Landscape Unit Six

Landscape Unit Six differs substantially from Landscape Units One through Five in that it consists primarily of views of Blackberry Valley. Whereas previous discussions addressed places in the landscape into which the widened road would be introduced and how the corridor would be viewed, this unit is concerned with how the alternative would be seen from fixed features in the landscape such as existing homes in surrounding areas.

Blackberry Valley constitutes all of the area on the east side of US 321 roadway to the Blue Ridge Parkway. The large fill north of the Blackberry Condominiums would be seen by residents of homes on Green Hill. The fill also would be seen from homes on Gideon Ridge and from the Gideon Ridge Inn. The shape and texture of the landscape would be changed by the fill. The fill, however, would be re-vegetated with new trees.

It would also be possible to see glimpses of the Preferred Alternative from the Blue Ridge Parkway. Given that the Parkway is at least 1.5 miles away from the Preferred Alternative and that the cuts and fills of the Preferred Alternative would not change the profile of the terrain as viewed from the Parkway, the impact of the Preferred Alternative on Parkway views would be minimal.

4.3.3 Bypass Alternative 1A

Bypass Alternative 1A would follow existing US 321 until just south of the Blowing Rock town limits. From that point, it would follow along the side of Green Hill, then pass through several neighborhoods and wooded areas until it reaches existing US 321 at its intersection with Possum Hollow Road. It would affect Landscape Units One, Five, and Six. The preliminary design calls for a 52-foot-wide pavement for the entire length of the alternative. Except at bridges and sections with retaining walls, the road would have a drainage ditch. Figure 4-3 shows the cuts and fills and other features associated with Bypass Alternative 1A overlaid on an aerial photograph showing the bypass passing through Blowing Rock.

Figure 4-3. Bypass Alternative 1A at Blowing Rock

Landscape Unit One

Landscape Unit One extends from Blackberry Road at the south end of the project area to the project's entry into the Green Park Historic District near the town limits of Blowing Rock. The impact to the unit by Bypass Alternative 1A is very similar to that of the Preferred Alternative.

Cut and fill slopes differ between the two alternatives. In the Rocky Knob Road area, the Preferred Alternative has larger and deeper cuts into the slope on the west. Bypass Alternative 1A relies on a combination of lower cuts on the left and larger fills on the east.

Features introduced to Landscape Unit One by Bypass Alternative 1A would consist of increased pavement surface, cut and fill slopes, retaining walls, and vegetation clearing. The horizontal alignment of Alternative 1A is straighter than that of the Preferred Alternative. A re-vegetation plan (described in Section 2.4.4 of Chapter 2) would be used as mitigation.

In the southern portion of the unit, the alternative would involve cutting into the slope on the west side of the road to accommodate the increased road width. Cuts would be as high as 210 feet at one location. Large fill slopes would occur in the Blackberry Road area, at the former Valley View Motel, and between the Blackberry Condominiums and the Blowing Rock town limits. Cut slopes would occur around Rocky Knob Road and south of Gideon Ridge Lane. No cuts would occur into the hillside that includes a portion of the Green Park Historic District. Retaining walls would be at three locations. New approach alignments for roads that intersect US 321 would be built at Cricket Lane, Rocky Knob Road, and Cone Orchard Road. The primary landscape feature lost would be forest cover. Two homes would be displaced.

The scale, shape, lines, and texture of views would change. The wider pavement surface and straighter road would increase the scale of the roadway corridor and change the existing pattern and shapes of curving lines to straighter lines. Therefore, the intactness and unity of the landscape would be reduced by the introduction of project features, particularly in the area of large cuts in the southern half of the unit.

Views from Landscape Unit One would consist of new cut and fill slopes, and accompanying views of exposed rock, and new road configurations. The primary viewers of these changes would be the residents of two homes and the Blackberry Condominiums, and commuters, residents and tourists on the road. Cut slopes also could be viewed from homes on Gideon Ridge and, in a very limited manner, through dense forest cover adjacent to *The Blowing Rock* attraction parking lot. The ridge on the west side of the road would continue to block views to the west. The sizable rock outcrop that partially shields the Blackberry Condominiums from views of US 321 would be reduced substantially in size, exposing the nearby road to condominium residents.

The large fills on the right side of the road would be viewed from adjoining homes, the former Valley View Motel, and the Blackberry Condominiums. For the motel and condominiums, which have broad, high quality views, the fills would represent an intrusion into a portion of the foreground of those views. The fills also would open views, which are currently limited by vegetation, of the adjoining Blackberry Valley to drivers on the road. The view from the Blackberry Condominiums is illustrated in Figure 4-4.

Residents of the Blackberry Condominiums would view the bypass and its associated bridge and retaining walls as it passes along the side of Green Hill. Retaining walls on Green Hill (above and below the road) would generally be about 50 feet high and 1,915 feet in length. The bypass would disappear from view where it passes under Green Hill Road.

Figure 4-4. Bypass Alternative 1A Viewed from the Blackberry Condominiums

Plantings consisting of deciduous and evergreen trees native to the area would be placed on the slopes adjacent to both sides of the proposed roadway where the existing landscape would be altered. Such planting would begin approximately 20 feet from the roadway edge. Both cut and fill slopes would be planted, but as discussed under Landscape Unit One for the Preferred Alternative, cut slopes would be less conducive to plant growth. Thus, for much of the deep cut slopes in the southern part of this landscape unit, exposed rock would remain in view of drivers, thereby creating the most substantial long-term change in views in this landscape unit.

Landscape Unit Five

Landscape Unit Five is in the undulating terrain that lies on the east side of Blowing Rock. It begins as the project passes under Green Hill Road and continues to the project terminus at US 321 and Possum Hollow Road. At US 321, the intersection of US 221 would be relocated to intersect with Westview Drive. Green Hill Road and Goforth Road would pass over the bypass on a bridge. The bypass would bridge Wonderland Drive and one section of Wonderland Wood Drive, including Middle Fork of the New River.

Features introduced in this unit would include the pavement surface, cut-and-fill slopes, the bridges, vegetation clearing, and retaining walls. These features would markedly change the scale of existing views. New lines would be created by the roadway and by the demarcation between vegetated and non-vegetated slopes. New shapes and forms would be created by the introduction of flat paved surfaces and retaining walls. Clearing existing vegetation, exposing subsurface material, and waiting for replantings on slopes to achieve maturity would create new textures. Therefore, in general, the qualities of intactness and unity, described in Section 3.4.2 of Chapter 3, would be adversely affected by the introduction of project features.

Plantings consisting of deciduous and evergreen trees native to the area would be placed on the slopes adjacent to both sides of the proposed roadway where the existing landscape would be altered. As previously described, while both cut and fill slopes would be planted, cut slope plantings would require greater effort and time to achieve vegetated cover, than the fill slopes, and cut slopes could not be planted where topsoil and subsoil are insufficient to provide a suitable plant-growing medium. Thus, for much of the deep cut slopes in this landscape unit, exposed rock would remain in view of drivers and some viewers of the road.

The following paragraphs describe specific impacts at several locations along the unit.

Fairview Court/Green Hill Road Area. Thirteen homes and several lots near the intersection of Fairview Court and Green Hill Road would be displaced, including the entire eastern half of the Fairview Court subdivision. Access between remaining homes would be altered. Green Hill Road would bridge the bypass. A retaining wall up to 22 feet in height and 600 feet in length would be used on the east sides of the road as the road passes under Green Hill Road to lessen the impact on Green Hill Road. The retaining wall would introduce a new, flat, vertical texture to the landscape. The bypass would generally be in a cut in this area. It would be cut into a slope that goes downhill from Green Hill Road to the Blowing Rock Country Club's golf course. The intactness of the rolling landscape would be broken by the comparatively level highway and its need to cut, fill, retain, and bridge the landscape to maintain its design criteria. Remaining homes generally would not be immediately adjacent to the bypass. The bypass, however, would be a substantial visual presence for drivers on Green Hill Road and be constantly in view from homes on Green Hill with a view to the north. Drivers on the Green Hill Road bridge, traveling to and from their homes, would have a view of the bypass as it passes along the side of Green Hill and north along the road for approximately 4,000 feet. They would look down on the new road, making the change difficult to hide. Viewers from the golf course and homes downhill from the

bypass would generally see the tops of the retaining wall or cut slopes on the right (east) side of the road, looking through wood that varies in depth from zero (briefly) to 150 feet.

Wonderland Drive Area. The bypass would pass through Wonderland Wood subdivision in a deep cut (up to 54 feet deep) except at its northern end where it would be briefly at grade and then cross Wonderland Wood Drive, Wonderland Drive, and Middle Fork on a bridge as high as 55 feet above the existing ground. The bypass would be 36 feet high as it crosses Wonderland Wood Drive. The bypass would pass through the Heritage Lane subdivision roughly at the current grade. Nine homes would be displaced. The bypass would pass through the middle of these subdivisions. The bypass would be a substantial visual presence in the two subdivisions and not in keeping with the character of the area. The scale and lines of the bypass would conflict with those of the surrounding area, which are marked by woods, narrow roads that follow the undulating terrain and single-family homes. The deep cuts, high bridge, and the pavement at different locations would be immediately adjacent to homes and constantly in view. The 36-foot high bridge would tower over homes on adjacent lots. There would be little opportunity to absorb or hide the changes given their scale. The intactness of the rolling landscape would be broken by the comparatively level highway and its need to cut, fill, and bridge the landscape to maintain its design criteria.

Between Heritage Lane and Goforth Road. North of Heritage Lane, the bypass would not be a visual presence until it reaches Goforth Road as it moves into an undeveloped area. Here the bypass would be at-grade or on low fills. Slopes would be re-vegetated, further blocking potential views of the road.

Goforth Road Area. In the Goforth Road area, the road would again be in a deep cut (as deep as 40 feet). Homes would be taken in this area, including a cluster of three homes at one end of a small neighborhood. Goforth Road would cross the bypass on a bridge to maintain continuity for travel between this area and homes farther north on Goforth Road. Except for the crossing at Goforth Road, terrain and surrounding vegetation would shield the bypass from view. Drivers on the Goforth Road bridge, traveling to and from their homes, would have a view of the bypass for about 1,000 feet up and down the bypass. Here, as in other places on the bypass, the intactness of the rolling landscape would be broken by the comparatively level highway, with its straight lines and its need to cut, fill and bridge the landscape to maintain its design criteria.

Goforth Road to Possum Hollow Road. After Goforth Road, the bypass would enter another undeveloped area in a cut that is shallow on the west and deep on the east. Existing forest would generally block views of the bypass until its intersection with Possum Hollow Road.

Possum Hollow Road Area. For approximately 1,750 feet along Possum Hollow Road, the bypass would be cut into the hillside on the east side of the road with either a cut slope or retaining walls. On the west fill would be placed. The stream paralleling Possum Hollow Road would be unaffected. Retaining walls 17 to 40 feet high would be used in this area to reduce impacts on the existing features. Cut slopes would be as high as 130 feet. The three homes along Possum Hollow Road northwest of Forest Lane all would be displaced. The scale, shape, lines, and texture of the landscape would change substantially in this area. Again, the intactness of the natural landscape would be broken by the comparatively level highway, with its straight lines and its need to cut, fill, and retain the landscape to maintain its design criteria. Homes in the Echo Park subdivision, north of the bypass, and persons traveling along the bypass to and from their homes would view the change.

As with the Preferred Alternative, the US 221 intersection would be realigned to the same location as the existing Westview Drive intersection with US 321. Existing US 221 is currently lower in elevation than US 321 at this point. US 221 would be raised to create the intersection. A retaining wall as high as 18 feet would be used to retain the raised road on its north side where it is adjacent to Lake Chetola. The quality of views would be reduced for the Chetola Resort across Lake Chetola, with the introduction of a retaining wall into its views. Pedestrians walking between downtown Blowing Rock and the Shoppes on the Parkway would walk adjacent to the US 221 retaining wall, but their views of Lake Chetola would be unimpeded. The relocation of the US 221 intersection would create a wide park-like setting for walkers between the new intersection and Shoppes on the Parkway. Pedestrians would not longer walk adjacent to US 221 in this area. Trees are included in the re-vegetation plan to enhance this opportunity. As with the Preferred Alternative, a park could be developed at this location.

Landscape Unit Six

As noted for the Preferred Alternative, Landscape Unit Six consists primarily of views of Blackberry Valley.

The large fill north of the Blackberry Condominiums, the southern intersection of US 321 and the bypass, and the portion of the bypass south of Hemlock Lane would be seen by residents of homes on Green Hill. These features also would be seen from homes on Gideon Ridge and from the Gideon Ridge Inn. The shape and texture of the landscape would be changed by these features. The fill, however, would be re-vegetated with new trees. Between Hemlock Lane and Green Hill Road, trees, the retaining wall of the bypass and the slope of the hillside should hide the bypass from the views of residents on Green Hill.

It would also be possible to see glimpses of Bypass Alternative 1A from the Blue Ridge Parkway. Given that the Parkway is at least 1.5 miles away from the visible portions of the bypass and the cuts and fills of the bypass would not change the profile of the terrain as viewed from the Parkway, the impact of Bypass Alternative 1A on Parkway views would be minimal.

4.3.4 Bypass Alternative 1B

The features and visual impacts of Bypass Alternative 1B would be identical to those of Bypass Alternative 1A, except in the Gideon Ridge area where a deep cut into Gideon Ridge would affect views in Landscape Units One and Six. Figure 4-5 shows the cuts and fills and other features associated with Bypass Alternative 1A overlaid on an aerial photograph showing Blowing Rock.

Gideon Ridge is a prominent landscape feature that US 321 follows. Whereas Bypass Alternative 1A would follow the existing US 321 alignment and skirt the bottom of Gideon Ridge, Bypass Alternative 1B pass through Gideon Ridge in a deep cut (up to 250 feet on the west side of the road). Much of the slope that would be created would remain exposed rock because the amount of topsoil and subsoil removed would not allow the slope to be re-vegetated.

As the roadway would continue to curve to the left around Gideon Ridge, the roadway would become a bridge approximately 1,400 feet long and up to 200 feet high. Elevating the roadway here would reduce the impacts of cut and fill slopes and vegetation clearing on the surrounding landscape.

Figure 4-5. Bypass Alternative 1B at Blowing Rock

Landscape Unit One

Views from Landscape Unit One would consist of new cut and fill slopes, accompanying views of exposed rock, new road configurations of US 321 and new bridges. In this landscape unit, the primary viewers of these changes would be the residents of two homes and the Blackberry Condominiums, and commuters, residents and tourists on the road.

The primary landscape features lost in the Gideon Ridge area would be forest cover and the rock formation that is Gideon Ridge. Three homes and seven lots (one with construction of a home just beginning in early 2001) with spectacular views of the surrounding valley would be lost. These lots are highly valued in the area, although only their owners and not the community as a whole receive a direct benefit of enjoying the views. The scale, shape, lines, and texture of views would change. The wider pavement surface, the straighter road and the larger curve around Gideon Ridge would increase the scale of the roadway corridor and change the existing pattern and shapes of twisting and curving lines to straighter lines. The short-term loss of vegetation and tree cover and the addition of more pavement width would also make the surface texture of the corridor smoother. The long-term difficulty of re-vegetating the cut slopes would permanently change the landscape, and change its intactness and unity.

Most viewers on Gideon Ridge, including the guests of the Gideon Ridge Inn would not see much of the cut since they would be on the high side of the cut. The residents of Blackberry Condominiums would benefit from the alignment of this bypass because it would move the roadway away from the condominiums and retain the rock outcrop that partially shields the condominiums from view. They, however, would see the road emerge at the north end of the cut approximately 20 feet below the elevation of the existing road as well as the bridge that will span the gap between existing US 321 and Green Hill.

South of Gideon Ridge, the impacts in Landscape Unit One would be identical to those for Bypass Alternative 1A.

Landscape Unit Five

Impacts in Landscape Unit Five would be identical to those described for Bypass Alternative 1A.

Landscape Unit Six

The substantial cut into Gideon Ridge, the southern intersection of US 321 and the bypass, and the portion of the bypass south of Hemlock Lane would be seen by residents of homes on Green Hill. The intersection of US 321 and the bypass and the portion of the bypass south of Hemlock Lane would be seen from homes on Gideon Ridge and from the Gideon Ridge Inn. The shape and texture of the landscape would be changed by these features. Between Hemlock Lane and Green Hill Road, trees, the use of a retaining wall on the bypass, and the slope of the hillside should hide the bypass from view from homes on Green Hill.

It would also be possible to see glimpses of Bypass Alternative 1B from the Blue Ridge Parkway. Given that the Parkway is at least 1.5 miles away from the visible portions of the bypass, the impact would generally be small. However, the cut into Gideon Ridge would change the profile the terrain as viewed from the Parkway. The largest part of the cut (250 feet high, with a face as long as 440 feet vertically) would be exposed to parkway viewers. Thus, the impact of Bypass Alternative 1B on the Parkway would be greater than with Bypass Alternative 1A.

4.3.5 Bypass Alternative 4A

Bypass Alternative 4A would only briefly follow existing US 321 before passing across a valley to follow the Blue Ridge escarpment to a tunnel under the Blue Ridge Parkway and then to intersect US 321 at Aho Road. The area affected is mostly forested with some rural development at its south and north ends. It would affect Landscape Units One, Six, and Seven. The preliminary design calls for a 52-foot-wide pavement for the entire length of the alternative. Except at bridges and sections with retaining walls, the road would have a drainage ditch. Figure 4-6 shows the cuts and fills and other features associated with Bypass Alternative 4A overlaid on an aerial photograph showing the Blue Ridge escarpment.

A re-vegetation plan (described in Section 2.4.4 of Chapter 2) is proposed as mitigation. As described for other alternatives, plantings consisting of deciduous and evergreen trees native to the area would be placed on the slopes adjacent to both sides of the proposed roadway where the existing landscape would be altered. Such planting would begin approximately 20 feet from the roadway edge. Both cut and fill slopes would be planted, but cut slopes would be less conducive to plant growth. Thus, on deep cut slopes, exposed rock would remain in view.

Blue Ridge Parkway Viewshed Mapping

The assessment of impacts to Blue Ridge Parkway views relies on viewshed mapping developed for Blue Ridge Parkway officials by Design Research at North Carolina State University (NCSU). This mapping identifies and classifies visually sensitive lands adjacent to the Blue Ridge Parkway. The maps identify which lands are visible from the Blue Ridge Parkway and evaluate their varying degrees of visual sensitivity. The mapping was developed by combining three-dimensional digital terrain models, computer simulations of multiple viewpoints along the Parkway, and cartographic visualization techniques. The mapping considered only terrain, not vegetation that could obscure views. Vegetation is taken into account, however, in the assessment of visual impacts presented in this section.

The digital landscape model employed was assembled from digital elevation models produced and distributed by the US Geological Survey (USGS). Each point on the landscape or digital cell has an assigned elevation, latitude, and longitude. The alignment of Blue Ridge Parkway was manually digitized onto the USGS digital model. Overlooks were included; tunnels, underpasses, and entry/exit ramps were excluded. The digital Parkway cells served as the viewpoints used in mapping views.

The procedure for the mapping visual sensitivity of the terrain surrounding the Parkway was a cumulative application of a viewshed-mapping algorithm. The viewshed-mapping algorithm identified all terrain model cells visible from or to a given point or cell on the Parkway. This is accomplished by examining a large number of lines of sight constructed from each Parkway cell to the terrain model perimeter and testing each cell along each line of sight to determine whether it is obscured from the Parkway viewpoint by intervening cells (Fels 1991). Each terrain cell may be seen from one or more Parkway viewpoint cells. The interaction of multiple viewpoints determines visual sensitivity. The basic mapping algorithm assigns a score of one to visible cells while those not visible retain a score of zero. This procedure is repeated many times, once for each viewpoint cell associated with the Parkway, and scores of each terrain cell are continually summed. When the procedure is complete (typically 1,000 to 1,500 applications of the viewshed mapping algorithm), the total score in each terrain model cell indicates the number of Parkway cells from which it was found visible. This is interpreted as the degree of exposure or visual sensitivity of each terrain cell (Fels 1992a, 1992b).

Figure 4-6. Bypass Alternative 4A Following the Blue Ridge Escarpment

Visual sensitivity also can be expressed in terms of the length of Parkway exposed to each terrain cell. Parkway length was converted to an estimate of exposure time by assuming an average driving speed of 40 miles per hour. Thus, a total Parkway length of 4 miles is equivalent to 6 minutes of potential exposure for the Parkway traveler. The exposure time of a terrain cell to a traveler of 4 minutes or more indicates a portion of the terrain that is extremely sensitive. Less than 1 minute of exposure is considered low sensitivity. The classification system uses the following categories: none, low, moderate, high, very high, and extreme.

The model further took into account the idea that cells further away from the Parkway have less visual sensitivity than those near the Parkway. Both a 1-mile and a 3-mile weighting system were examined by modelers. This analysis of bypass impacts uses the 3-mile weighting system. Under this system, scores decrease linearly with increasing distance until they reach zero at 3 miles and beyond 3 miles the cells are not scored. For example, the scores of terrain cells 1-mile away and visible from the Parkway are multiplied by 0.67, while cells 2-miles away are multiplied by 0.33; and cells further than 3-miles are multiplied by zero.

The viewshed mapping for this analysis was used in two ways. For views from Thunderhill overlook, all locations with a score greater than zero are considered extremely sensitive because it was assumed that persons at the overlook would view the surrounding terrain for more than four minutes. For persons driving along the Parkway, the different classifications of the 3-mile mapping are discussed. Where applicable, field observations related to terrain and vegetation are included in the discussion.

Landscape Unit One

As shown in Figure 3-3 in Chapter 3, features introduced by Bypass Alternative 4A into Landscape Unit One would include the pavement surface, one bridge, vegetation clearing, cut and fill slopes, an intersection of US 321 and the bypass, and realignment of unpaved rural roads in four locations, including three roads that would intersect with the bypass.

In Landscape Unit One, Bypass Alternative 4A would introduce a thoroughfare into a rural community of mostly isolated homes. Five of the seven homes in this area would be displaced. One remaining home (Figure D-4b, Station 620) would be approximately 100 feet from a cut into the terrain about 75 feet deep and as wide as 500 feet. The residents of this home would look over the cut. Views of trees and neighboring homes (which would be displaced) would be replaced by a large hole in the terrain. The other home (Figure D-4b, Station 603) would be adjacent to a bridge structure 190 feet high. The bridge would loom over the adjacent home, being substantially taller, and block views of the sky. It would split the resident's property in two. Bridge piers would be another addition to the views of the home and property. The bridge also would be viewed from homes along Bolick Road, beginning approximately 1,500 feet south of the bridge. Two fills would be on either side of, and within the views of two homes just off US 321. The bridge, an adjoining fill as high as 180 feet and the cut noted above would be viewed from homes on Gideon Ridge, the former Valley View Motel and the Blackberry Condominiums.

Although slopes would be re-vegetated, the bypass would be a substantial visual presence that could not be hidden from its viewers. The introduction of the bridge and fill across a valley and the large cut would damage the intactness of the landscape by introducing new lines, shapes, and textures on a large scale. The value of the views of this area would be diminished. This alternative would cause substantial impacts to views in this area.

In addition, approximately 1,900 feet of the bypass, from Blackberry Road to approximately Station 600 (see the drawings in Appendix D to identify the design station numbers), cuts and fills and the southern end of the bridge structure would be in view from the Blue Ridge Parkway. The bypass would be over 2 miles away from the Parkway at this point, the roadway and its changes in the landscape would be roughly perpendicular to the Parkway viewer's sight line, and the profile of the terrain as created by the peaks of ridgelines would not be altered. From the perspective of vehicles moving along the Parkway, the visual sensitivity of this area as defined by NC State's visual sensitivity mapping is low to moderate. Given these factors, the visual impact of this portion of the bypass on the Parkway in this area would not be substantial. From approximately Station 600 to Station 620 near the Blackberry Condominiums and within Landscape Unit Six, the terrain would obscure views of the bypass.

Landscape Unit Six

Landscape Unit Six encompasses the views of Blackberry Valley from the Blue Ridge Parkway and from the Blue Ridge escarpment and Gideon Ridge. Features introduced to this unit by Bypass Alternative 4A would include the new pavement surface, two bridges, vegetation clearing, cut-and-fill slopes and four retaining walls measuring up to 60 feet in height and as long as 630 feet in length on the west side of the road. One home on Heather Ridge Lane would be displaced. The bypass would change the shape, lines, and texture of the landforms that make up current views. The impact of the introduction of the roadway in this unit would worsen as the bypass approaches the Blue Ridge Parkway. Bypass Alternative 4A as seen from the Thunderhill overlook is illustrated in Figure 4-7. Substantial visual impacts would occur to views from Thunderhill overlook on the Blue Ridge Parkway and to views from Green Hill, from the Blackberry Condominiums and from Gideon Ridge.

Views South from the Thunderhill Overlook Area. From this area, viewers would see three segments of Bypass Alternative 4A. The first was discussed above under Landscape Unit One.

The bypass, from Station 620 to approximately Station 655, a distance of approximately 3,500 feet, in the area of the Blackberry Condominiums would then be in view of the Parkway. This portion of the bypass would include several large cuts and fills. It would end at the beginning of the first bridge in the unit. The most prominent feature of the bypass in this area would be a fill that begins at Station 622 and continues to approximately Station 626, a distance of about 400 feet. At its longest point, the fill would show a face approximately 600 feet vertically. The vertical bypass would then enter an area where the road cuts into the terrain. Cut slopes would be on both sides of the road so only a portion of the cut would be exposed to views from the Parkway, but the exposed face would be as much as 240 feet high vertically. A retaining wall as high as 48 feet would be in view from Station 635 to 636+50, a distance of 150 feet. Two additional fills with exposed faces as long as 320 feet vertically would occur before the bypass would disappear again from view. The road alignment and the terrain changes generally would be perpendicular to the viewer's sight line. From the perspective of vehicles moving along the Parkway, the visual sensitivity of the location of the first fill is high. The other areas are low to moderate. This area is approximately 1.5 miles from Thunderhill overlook. Plantings would be placed on the slopes where the existing landscape is altered. Both cut and fill slopes would be planted. The most substantial changes to the landscape in this area are on the fill slopes where re-vegetation can be more extensive. Although the impact to Parkway views here is greater than when the bypass is within Landscape Unit One, the visual impact of this part of the bypass on the Parkway would not be substantial because of distance, the orientation to the Parkway, and re-vegetation opportunities.

**Figure 4-7. Bypass Alternative 4A View South from Thunderhill
Overlook on the Blue Ridge Parkway**

Terrain would again obscure Parkway views of the bypass from Station 655 to about Station 665, a distance of 1,000 feet. The bypass would then remain in view from the Parkway and Thunderhill overlook as it follows the Blue Ridge escarpment until vegetation on the hillside would obscure views beginning at about Station 689, a distance of about 2,400 feet. Without vegetation, views would remain until about Station 696, including views of a large fill. This segment of the bypass would contain substantial cuts and fills as it passes along the undulating terrain of the Blue Ridge escarpment. The change in the landscape as viewed from the Parkway and Thunderhill overlook would be extensive. The changes would be less than a mile from the Parkway and the cuts and fills would be seen at a 45-degree angle, which would make the alteration of the terrain more obvious than if they were viewed at a 90-degree angle (perpendicular to the viewer's sight line). Today when one looks at the Blue Ridge escarpment, one sees a steeply sloping terrain that undulates in and out as the ridges (high points) and swales (low points) that extend out at 90 degrees (perpendicular) from the escarpment rise and fall. Into that setting would be imposed new man-made shapes, including: the flat, linear plane of the roadway and a two-sided cut into perpendicular ridges at two locations, which would create unnatural gouges in the terrain as deep at the center as 130 feet for one and 80 feet for the other, respectively. The face of these two cuts as viewed from the Parkway would be 440 and 330 feet high vertically, respectively. Three swales would be filled, exposing a surface as high vertically as 620, 420, and 360 feet, respectively. From the perspective of vehicles moving along the Parkway, the visual sensitivity of the location of the first and deepest cut and of the first fill is high. The other areas are of low to moderate sensitivity. Nighttime viewers would see the headlights and taillights of motor vehicles moving along the escarpment. The extensive changes in the terrain along the escarpment, the proximity to the Parkway, and the high value placed by Parkway officials on natural views from Thunderhill overlook would combine to create a substantial visual impact in this area. Trees would be planted on the slopes where the existing landscape is altered. The plantings would soften the edges of the altered landforms and ultimately cover the large fills. However, because of the view angle and limits on planting in cuts, the bypass would remain an obvious imposition on the landscape, particularly in the two areas where deep cuts would be made into the ridgelines emanating from the escarpment.

Views from Homes Along the Blue Ridge Escarpment. In the Green Hill area, the bypass would be lower on the escarpment and farther way from the homes on Green Hill than Bypass Alternatives 1A and 1B. In addition, the bypass would generally be on fills or bridges taller than surrounding trees. The fills are often on both sides of the bypass, placing the bypass above the existing terrain. As such, the bypass would be visible from homes in the Green Hill area. Foreground views where the viewer looks down the escarpment would be changed with the introduction of the flat surface of the road and the fills. The fills, however, would be re-vegetated with trees.

Long distance views of Blackberry Valley from Green Hill would not be affected except to the southeast where the bypass would pass along the slope below the Blackberry Condominiums with the associated large cuts, fills, and retaining wall described above in the discussion of Thunderhill overlook views. As viewed from the Green Hill area, this part of the bypass would present a substantial change in the shape and texture of the landscape. The intactness of the natural landscape would be broken by the comparatively level highway and its need to cut, fill, and bridge the landscape to maintain its design criteria. This same change would be experienced by viewers from Gideon Ridge and the Blackberry Condominiums.

For the homes along Green Hill Road and Heather Ridge Lane that line the top of the Blue Ridge escarpment, the large cut in the area of Stations 665 to 671 would be introduced to foreground views. North of that point, the fills on the east could occasionally be visible, but generally the road and fills should be obscured by existing trees because fills are generally only on one side of

the road, helping to nestle the roadway into the mountainside instead of elevating it above the terrain. Therefore, the bypass is not perched high on the ridge. The cut at Stations 685 to 688 would be seen by viewers at the homes adjacent to the cut. This cut would rise high on the escarpment and displace an existing neighboring home. The final fill near the tunnel is near the top of the escarpment and includes a section where fill slopes are on both sides of the road, raising the bypass over the existing terrain. Here the bypass would be a substantial presence for viewers at the top edge of the escarpment. As of early 2001, no homes were at this location. The tunnel portal also would be seen from homes along the escarpment.

Views from the Bypass. Views from the bypass for bypass users would first include the cuts and fills of the bypass itself. Except for the locations where the bypass cuts through a ridge emanating from the escarpment, drivers would be able to enjoy long distance views of Blackberry Valley. These views generally would be seen through the replacement trees on the fill slopes and would eventually be obscured as vegetation establishes itself on the slope. Views of Blackberry Valley from the two bridges included in the bypass within this landscape unit would not be obscured except by guard rails.

Landscape Unit Seven

Bypass Alternative 4A would enter Landscape Unit Seven as it exits the north end of the tunnel under the Blue Ridge Parkway. It would follow the side of a ridge and would end at the intersection of US 321 and Aho Road. Features in this unit would continue to include the new pavement surface, two bridges over streams, vegetation clearing, cut and fill slopes, and two retaining walls. The largest retaining wall would be up to 60 feet in height and 845 feet long on the west side of the road. An additional feature would be the support facilities associated with the tunnel, including an administration building, emergency vehicle garage, parking, and a helipad. Cuts in the existing slope to accommodate the roadway would measure as high as 150 feet and fills (measured vertically from the proposed top of pavement to the existing elevation) up to 70 feet. A home would be displaced. Again, the intactness of the natural landscape would be broken by the comparatively level highway and its need to cut, fill, and bridge the landscape to maintain its design criteria.

Views North from the Blue Ridge Parkway. Parkway viewers could view the portion of the bypass north of the Parkway from two perspectives. First, the bypass would be in view for drivers on the Parkway looking to the northwest. Second, persons stopped at Thunderhill overlook could cross the Parkway on foot and either climb a small ridge or walk several hundred feet east to view the bypass from the same vantage point as those driving on the Parkway. From the perspective of drivers, the 3-mile visual sensitivity mapping for the Parkway generally classifies the area that would be occupied by the bypass as visible but of low sensitivity given the brief time that it would be viewed. Terrain would block views of the first approximately 800 feet of the bypass (to Station 724) after it emerges from the tunnel. Views of the bypass should for the most part disappear from Parkway views at Station 755. Thus, the bypass would be visible from the Parkway for about 3,100 feet. The tunnel administration building and emergency vehicle garage also would be seen. For the first 1,000 feet north of the tunnel, the bypass would be built on fill with a face 20 to 160 feet long vertically. The next 700 feet would involve a cut into the terrain with the longest part of the exposed vertical face being about 160 feet long. For 500 feet the bypass would again be on fill as high as 60 feet above the existing terrain and vertical face as long as 170 feet. The final 900 feet would include a large cut in the hillside with a vertical face as high as 250 feet. Existing terrain would likely obscure the lower portion of this cut. The views of these cuts and fills would be 2,000 to 3,800 feet away from the Parkway. The trees for the proposed re-vegetation plan would ultimately hide the fill areas from view. Both the cuts and fills of this section are much lower than those along the Blue Ridge escarpment. Although

considered a valuable view by Parkway officials, this view does not have the value or the opportunity for lingering viewers offered by the view to the south. Thus the portion of the bypass north of the Parkway alone would not have a substantial visual impact to the Parkway, but they would make a notable contribution to the overall visual impact when combined with the visual impacts south of the Parkway.

Views in the Thunder Mountain Road Area. For almost its full length north of the Blue Ridge Parkway, Bypass Alternative 4A would divide a large parcel of land. Two families live in the associated valley. The home of one of the families would be displaced. The road would be a substantial visual presence in what is now an isolated rural valley. The cut and fill slopes described above, which would continue almost to Aho Road, would occupy the slope that forms western side of the valley. Existing and proposed vegetation would obscure the presence of the bypass in part, but as elsewhere, the flat road and its associated cuts and fills would break the intactness of the landscape by introducing new shapes and textures. The tall fill described above would be immediately adjacent to the remaining homes along Thunder Mountain Road and would displace one home. The fill would be a substantial new visual presence for the remaining homes since the toe (bottom) of the fill slope would be only 50 feet way from the nearest home. The value of this area as a rural setting would be diminished with the presence of the bypass, a thoroughfare.

Views at Aho Road. A large cut into the hillside (as high as 150 feet) would be added to views from the mobile home park at the intersection of Aho Road and US 321. The hillside is currently forested and would be partially re-vegetated but lack of topsoil would prevent the cut from being fully re-vegetated.

Views from the Bypass. Views from the bypass for bypass users would first include the cuts and fills of the bypass itself. Drivers would be able to enjoy views across the shallow valley next to the bypass as it passes through the Thunder Mountain Road area.

4.3.6 Bypass Alternative 4B

Bypass Alternative 4B would be in approximately the location of Bypass Alternative 4A; however, Bypass Alternative 4B would include fewer cuts and fills and more bridge structure. The bypass alternative also would follow a slightly different alignment. Bypass Alternative 4B would only briefly follow existing US 321 before passing across a valley to follow the Blue Ridge escarpment to a tunnel under the Blue Ridge Parkway and on to intersecting US 321 at Aho Road. Like Bypass Alternative 4A, it would affect Landscape Units One, Six, and Seven. The preliminary design calls for a 52-foot-wide pavement for the entire length of the alternative. Except at bridges and sections with retaining walls, the road would have a drainage ditch. Figure 4-8 shows the cuts, fills, bridges and other features associated with Bypass Alternative 4B overlaid on an aerial photograph showing the Blue Ridge escarpment. A re-vegetation plan (described in Section 2.4.4 of Chapter 2) would be used as mitigation.

Landscape Unit One

Features introduced by Bypass Alternative 4B into Landscape Unit One would include the pavement surface, a bridge, vegetation clearing, cut and fill slopes, an intersection of US 321 and the bypass and realignment of one unpaved rural road, which would intersect with the bypass. In this landscape unit, this bypass differs from Bypass Alternative 4A in that it has a slightly different alignment, would use a longer bridge (1,800 feet rather than 1,000 feet), and would involve fewer changes in the existing terrain.

Figure 4-8. Bypass Alternative 4B Following the Blue Ridge Escarpment

Like Bypass Alternative 4A, this alternative would introduce a thoroughfare into a rural community of mostly isolated homes. Two of the seven homes in this area would be displaced. Four of the five remaining homes (located between Stations 610 and 625 - Figure D-5b) would be between 20 and 200 feet from a cut into the terrain as deep as 50 feet deep and as wide as 350 feet. Vegetation should block the view of the cut from one home. The residents of two homes would look over the cut. Residents of the fourth home would view the higher side of the cut. The fifth remaining home would be adjacent to the end of the bridge and the beginning of a fill. The home would be uphill from both the bridge and fill. The view of the woods from this home would be replaced by the bypass. The bridge also would be viewed from homes along Bolick Road, beginning approximately 1,500 feet south of the bridge. Two fills would be on either side of, and within the views of, two homes just off US 321. The bridge (as high as 200 feet), an adjoining fill, and the cut noted above would be viewed from homes on Gideon Ridge, the former Valley View Motel and the Blackberry Condominiums.

Although slopes would be re-vegetated, the bypass would be a substantial visual presence that could not be hidden from its viewers. The introduction of the bridges, fill and cut across a valley would reduce the intactness of the landscape by introducing new lines, shapes, and textures on a large scale. The value of the views of this area would be diminished. However, the impact here would not be as great as the corresponding portion of Bypass Alternative 4A because the disturbance to the existing terrain would be less. The cut and fills would be smaller in scale. The terrain would be virtually unchanged under the longer bridge. Trees lost during the construction could be replanted and equipment haul roads regraded to the lines of the original terrain. From the perspective of long distance viewers overlooking the valley, the long, tall bridge could be viewed as an interesting and attractive addition to the views.

In addition, like Bypass Alternative 4A, approximately 1,900 feet of the bypass, from Blackberry Road to approximately Station 600, including cuts, fills and the southern end of the bridge structure, (a distance of 1,900 feet) for the bypass would be in view from the Blue Ridge Parkway. As with Bypass Alternative 4A, the visual impact on the Parkway in this area would not be substantial. The terrain would obscure views of the bypass until approximately Station 620, near the Blackberry Condominiums and within Landscape Unit Six.

Landscape Unit Six

Landscape Unit Six encompasses the views of Blackberry Valley from the Blue Ridge Parkway and from the Blue Ridge escarpment and Gideon Ridge. Features introduced to this unit by Bypass Alternative 4B would include the new pavement surface, eight bridges, vegetation clearing, cut-and-fill slopes and four retaining walls measuring up to 60 feet in height and up to 700 feet in length on both the west and east sides of the road. One home on Heather Ridge Lane would be displaced. As in Landscape Unit One, this bypass differs from Bypass Alternative 4A in that it has a slightly different alignment, would use multiple bridges, and would involve fewer changes in the existing terrain.

The bypass would change the shape, lines, and texture of the landforms that make up current views. Like Bypass Alternative 4A, the impact of the introduction of the roadway in this unit would worsen as the roadway gets closer to the Blue Ridge Parkway. Bypass Alternative 4B as seen from the Thunderhill overlook is illustrated in Figure 4-9. Visual impacts would occur to views from Thunderhill overlook on the Blue Parkway and to views from Green Hill, from the Blackberry Condominiums and from Gideon Ridge. The impacts on views from Thunderhill overlook, however, would not be as substantial as with Bypass Alternative 4A.

**Figure 4-9. Bypass Alternative 4B View South from Thunderhill
Overlook on the Blue Ridge Parkway**

Views South from the Thunderhill Overlook Area. As with Bypass Alternative 4A, viewers looking south from Thunderhill overlook would see three segments of Bypass Alternative 4A. The first was discussed above under Landscape Unit One. The bypass, from Station 620 to approximately Station 655, a distance of approximately 3,500 feet, in the area of the Blackberry Condominiums would then be in view of the Parkway.

Most of the large fills that would be a part of Bypass Alternative 4A would be replaced by four bridges. The bridges would be approximately 750, 800, 400, and 600 feet long, respectively. Only part of the last bridge would be seen from the Parkway. The bridges would be as high as approximately 150, 120, 75, and 100 feet, respectively. The unit would include one large fill in this area. It would begin at Station 632 and continue to approximately Station 635, a distance of about 300 feet. At its longest point, the fill would show a face approximately 390 feet long vertically. A cut, showing a face as long as 240 feet, would be above the fill. The road alignment and the terrain changes generally would be perpendicular (90 degrees) to the viewer's line of sight. From the perspective of vehicles moving along the Parkway, the visual sensitivity of the location of the one large cut and fill is high. The other areas are low to moderate. This area is approximately 1.5 miles from Thunderhill overlook. Plantings would be placed on the slopes where the existing landscape is altered. Both cut and fill slopes would be planted. The visual impact of this part of the bypass on the parkway would not be substantial because of distance, the orientation to the Parkway, the use of bridges and re-vegetation opportunities. The impact that would occur would be less than that of Bypass Alternative 4A.

Like Bypass Alternative 4A, terrain would again obscure views from the Parkway from Station 655 to about Station 665, a distance of 1,000 feet. From this point to about Station 689 (a distance of about 2,400 feet), the bypass would remain in view as it follows the Bridge Ridge escarpment. Around Station 689, hillside vegetation would begin to obscure views. Without vegetation, views would remain until about Station 696.

This segment of the bypass, as it passes along the undulating terrain of the Blue Ridge escarpment, would contain one substantial cut and one large fills (although smaller than any of the fills in this area associated with Bypass Alternative 4A). Bridges would replace much of the cuts and fills associated with Bypass Alternative 4A. Like 4A, Bypass Alternative 4B would include several retaining walls in this section. The bypass would change the landscape as viewed from the Parkway and Thunderhill overlook, although the changes would be less extensive than Bypass Alternative 4A. The changes, however, would be less than a mile from the Parkway and the cuts and fills would be seen at a 45-degree angle, which would make the alteration of the terrain more obvious than if they were viewed at a 90-degree angle (perpendicular to the viewer's sight line). The vertical changes to the landscape in this area would include:

- A retaining wall above the road that is approximately 640 feet long and as high as 60 feet, for approximately 250 feet below the road would be a fill showing a face as long as 80 feet vertically.
- A bridge approximately 1,100 feet long and as high as 170 feet.
- A fill for approximately 450 feet showing a vertical face as high as 600 feet.
- A two-sided cut into a perpendicular ridge, which would create an unnatural gouge in the terrain as deep at the center as 90 feet. In the cut is a retaining wall as high as 60 feet, and above the wall, a cut showing a face as long as 290 feet vertically. Two homes at the top of

the escarpment would be displaced. It is at this point that the view of the bypass from the Parkway would begin to be obscured by trees.

The flat, linear plane of the roadway also would be introduced to views.

From the perspective of vehicles moving along the Parkway, the visual sensitivity of the location of the first fill is high. The other areas are of low to moderate sensitivity. Nighttime viewers would see the headlights and taillights of motor vehicles moving along the escarpment.

The combination of the changes in the terrain along the escarpment, proximity to the Parkway, and the high value placed on natural views from Thunderhill overlook would combine to create a visual impact in this area. The impact, however, would be less than the substantial impact associated with Bypass Alternative 4A. There would be fewer and shallower fills and only one deep cut into the ridges emanating from the escarpment instead of two. Thus, much of the existing slope emanating from the escarpment would be unchanged. Trees would be planted on the slopes where the existing landscape is altered. The plantings would soften the edges of the altered landforms and ultimately cover fills. Trees lost during the construction could be replanted and equipment haul roads regraded to the lines of the original terrain. The bypass, however, would create an obvious change to the landscape, particularly in the location where a deep cut would be made into a ridgeline emanating from the escarpment.

Views from Homes Along the Blue Ridge Escarpment. In the Green Hill area, the bypass would be lower on the escarpment and farther away from the homes on Green Hill than Bypass Alternatives 1A and 1B. In addition, the bypass would generally be on fills or bridges taller than surrounding trees. As such, like Bypass Alternative 4A, this bypass would be visible from homes in the Green Hill area. Foreground views where the viewer looks down the escarpment would be changed with the introduction of the flat surface of the road and the fills. The fills, however, would be re-vegetated with trees, and the changes in the terrain would be less than with Bypass Alternative 4A.

Long distance views of Blackberry Valley from Green Hill would not be affected except to the southeast where the bypass would pass along the slope below the Blackberry Condominiums with the associated bridges and one large fill described above in the discussion of Thunderhill overlook views. As viewed from the Green Hill area, this part of the bypass would present a change in the shape and texture of the landscape. The change would be substantial at the one large fill. The intactness of the natural landscape would be broken by the comparatively level highway, but as in other locations, the change would not be as great as with Bypass Alternative 4A. This change in views would be experienced by those with views from Gideon Ridge and from the Blackberry Condominiums.

For the homes along Green Hill Road and Heather Ridge Lane that line the top of the Blue Ridge escarpment, the long bridge in the area of Stations 665 to 683 would be introduced to foreground views. The cut at Stations 688 to 691 would be seen by viewers at the homes adjacent to the cut. This cut would rise high on the escarpment and displace two existing neighboring homes. This bypass would approach the tunnel near the top of the escarpment on a section of bridge and a section of retained fill. The bypass would be seen by viewers at the top edge of the escarpment. Currently no homes where the bypass approaches the southern tunnel portal are at this location. The tunnel portal also would be seen from homes along the escarpment.

Views from the Bypass. Views from the bypass for bypass users would first include the cuts, fills, and bridges of the bypass itself. Except for the single location where the bypass would cut

through a ridge emanating from the escarpment, drivers would be able to enjoy long distance views of Blackberry Valley. In some cases, these views would be seen through the replacement trees on the fill slopes and would eventually be obscured as vegetation establishes itself on the slope. Views from the bridges, which make up approximately 2,850 feet of the 3,900 feet (73 percent) of bypass between Station 665 and the tunnel portal, would generally remain unobscured except by guard rails. These views from the bridges likely would be considered an attractive viewer experience.

Landscape Unit Seven

Like 4A, Bypass Alternative 4B would enter Landscape Unit Seven as it exits the north end of the tunnel under the Blue Ridge Parkway. It would follow the side of a ridge and would end at the intersection of US 321 and Aho Road.

Features in this unit would continue to include the new pavement surface, four bridges, vegetation clearing, cut and fill slopes and a retaining wall near the tunnel portal. The retaining wall would be up to 60 feet in height and 730 feet long on the left (west) side of the road. An additional feature would be the support facilities associated with the tunnel, including an administration building, emergency vehicle garage, parking, and a helipad. Cuts in the existing slope to accommodate the roadway would measure as high as 170 feet and fills as high as 85 feet. A home would be displaced. The intactness of the natural landscape would be broken by the comparatively level highway and its need to cut, fill, and bridge the landscape to maintain its design criteria.

Views North from the Blue Ridge Parkway. Like Bypass Alternative 4A, viewers at the Parkway could view the portion of the bypass north of the Parkway by driving by or from Thunderhill overlook. From the perspective of drivers, the 3-mile visual sensitivity mapping for the Parkway generally classifies the area that would be occupied by the bypass as visible but of low sensitivity given the brief time that it would be viewed. Terrain would block views of approximately the first 800 feet of the bypass (to Station 727) as it emerges from the tunnel. The bypass should for the most part disappear from Parkway views at Station 758. Thus, like Bypass Alternative 4A, this bypass would be visible from the Parkway for about 3,100 feet between Stations 727 and 758. The tunnel administration building and emergency vehicle garage also would be seen. For the first 500 feet, the bypass would be built on fill with a face 30 to 160 feet long vertically. Unlike Bypass Alternative 4A, which would continue on fill, the next 500 feet of this bypass would be on a bridge as high as 70 feet. Approximately the next 600 feet would involve a cut into the terrain with the longest part of the exposed vertical face being about 160 feet, similar to Bypass Alternative 4A. For 500 feet the bypass would again be on fill as high as 85 feet above the existing terrain with a face as long as 180 feet vertically. The final 1,000 feet would be on a bridge as high as 65 feet. Existing terrain would likely obscure the final segment of this bridge. The views of these cuts, fills, and bridges would be 2,000 to 3,800 feet away from the Parkway. The trees for the proposed re-vegetation plan would ultimately hide the fill areas from view. The length of cut in view of the Parkway would be less with this bypass than with Bypass Alternative 4A (approximately 600 feet versus 1,600 feet). Although considered a valuable view by Parkway officials, this view does not have the value or the opportunity for lingering stays by viewers offered by the view to the south, as described in Section 3.4.2 of Chapter 3. Thus, alone the visual impacts to the Parkway of the portion of the bypass north of the Parkway would not be substantial, but they would make a contribution to the overall visual impact when combined with the visual impacts south of the Parkway. Overall, however, the impact to Parkway views would be much less with Bypass Alternative 4B when compared with Bypass Alternative 4A.

Views in the Thunder Mountain Road Area. Like Bypass Alternative 4A, this bypass, for almost its full length north of the Blue Ridge Parkway, would divide a large parcel of land that has a single owner. Two families live in the associated valley and one of their homes would be displaced. Despite the changes that would reduce the visual impact of the alternative as viewed from the Parkway, this bypass also would be a substantial visual presence in the more intimate setting of the valley. The cuts, fills, and bridges described above, which would continue almost to Aho Road, would occupy the slope that forms the western wall of the valley. Existing and proposed vegetation would obscure the presence of the bypass in part, but as elsewhere, the bypass would break the intactness of the landscape, by introducing new shapes and textures. The second fill and the second bridge described above would be immediately adjacent to the remaining homes along Thunder Mountain Road. They would be a substantial new visual presence for the remaining homes and the bridge would be only 50 feet away from the nearest home at a point where it would be 40 feet high. The value of this area as a rural setting would be diminished with the presence of the bypass, a thoroughfare.

Views at Aho Road. A large cut into the hillside (as high as 170 feet) would be added to views from the mobile home park at the intersection of Aho Road and US 321. The hillside is currently forested and would be partially re-vegetated, but the lack of topsoil would prevent the cut from being fully re-vegetated.

Views from the Bypass. Views from the bypass for bypass users would first include the cuts, fills, and bridges of the bypass itself. Drivers would be able to enjoy views across the shallow valley next to the bypass as it passes through the Thunder Mountain Road area.

4.4 Air Quality

The air quality analysis of the US 321 project was conducted at the microscale level. The microscale (project level) analysis was conducted for mobile source emissions and for estimating pollutant concentrations near roadway intersections. The maximum one-hour and eight-hour carbon monoxide (CO) levels predicted at the analysis site indicate that the project is not anticipated to cause or exacerbate a violation of the National Ambient Air Quality Standards (NAAQS) for CO. With the Preferred Alternative, Mobile Source Air Toxics (MSAT) emissions would be similar to the No-Build Alternative, and MSAT emissions would be lower with the Bypass Alternatives. The details of these analyses are provided in the discussion below.

4.4.1 Regional Air Quality

The proposed project is included as part of a regional transportation network. Projects included in this network are part of the State's *Transportation Improvement Program* (TIP). The TIP is the basis for the area's regional emissions analysis, which utilizes vehicle miles traveled (VMT) / vehicle kilometers traveled (VKT) and vehicle hours traveled (VHT) within the region to estimate daily pollutant burden levels. The results of this analysis determine whether an area is in conformity with regulations set forth in the Clean Air Act Final Conformity Rule.

The regional analysis performed for the TIP incorporates the effects of this project and, therefore, would satisfy the requirements set forth in the Final Conformity Rule. Thus, the potential for the proposed project to exceed NAAQS for localized CO concentrations and MSATs are the only air quality impact assessments needed. Analyses for hydrocarbons, nitrogen oxides, ozone, particulates (no increase in regional truck percentages are expected), sulfur dioxide, and lead are not needed for reasons presented in Section 3.5 in Chapter 3.

4.4.2 Microscale Air Quality Analysis

Project level or “microscale” air quality modeling for CO was performed using the EPA mobile source emission factor model (MOBILE 5B) for vehicular emissions and the CAL3QHC version 2 air quality dispersion model for estimating pollutant concentrations near roadway intersections. Following the guidelines set forth in *EPA’s Guidelines for Modeling Carbon Monoxide From Roadway Intersections* (EPA-454/R-92-005) and *North Carolina Department of Environment and Natural Resource’s (DENR) Guidelines for Evaluating the Air Quality Impacts of Transportation Facilities*, CO levels in the project area were estimated for the existing, No-Build, and Build Alternatives. These models and procedures are approved by the EPA for use in assessing the potential for CO impacts for proposed highway projects nationwide.

The microscale CO analysis was performed for the peak one-hour traffic period. This is the period when the greatest air quality effects of the proposed project are expected.

The CO levels resulting from motor vehicles using the proposed project and associated roadways were estimated at one traffic intersection, Sunset Drive/US 321. The site was selected through a screening process used to determine which sites were expected to demonstrate the greatest project-related air quality impacts. If NAAQS for CO are not exceeded at this one “worst case” location, assuming “worst case” meteorological conditions, it can be concluded that NAAQS for CO would not be exceeded at any other location in the project area. Signalized intersections are often the “worst case” locations in CO concentration analyses because high CO concentrations typically occur where vehicles are stopped and not where traffic is flowing freely. Sunset Drive is the “worst case” location with either the Preferred Alternative or the Bypass Alternatives since it is the intersection with the poorest level of service (longest vehicle waiting times) with the Preferred Alternative (level of service D), and it operates at level of service F with the Bypass Alternatives.

The Sunset Drive/US 321 analysis site is shown in Figure 4-10. Receptors were chosen at each intersection in accordance with the guidelines found in *EPA’s Guideline for Modeling Carbon Monoxide from Roadway Intersections* (EPA-454/R-92-005).

The transport and concentration of pollutants emitted from motor vehicles are influenced by three principal meteorological factors: wind direction, wind speed and the temperature profile of the atmosphere. The values for these parameters were chosen to maximize pollutant concentrations at each prediction site (i.e., to establish a conservative, worst-case situation).

The CO levels estimated by the model generally are the maximum concentrations which could be expected to occur at each air quality receptor site analyzed. This is because of the assumption of the simultaneous occurrence of all worst-case parameters (peak hour traffic conditions, conservative vehicular operating conditions, low wind speeds, low atmospheric temperature, neutral atmospheric conditions, and maximizing wind direction).

Peak 8-hour concentrations of CO were obtained by multiplying the highest peak hour CO estimates by 0.61. This factor, recommended by the DENR’s Division of Air Quality, takes account of the fact that over 8 hours (as distinct from a single hour) vehicle volumes will fluctuate downwards from the peak, vehicle speeds may vary, and meteorological conditions including wind speed and wind direction will vary as compared to the very conservative assumptions used for the single hour.

Figure 4-10. Air Quality Analysis Site

Project-level modeling is used to predict CO concentrations resulting from emissions from motor vehicles using roadways immediately adjacent to the location at which predictions are being made. A CO “background” level must be added to this value to account for CO entering the area from other sources upwind of the receptors. In consultation with the DENR’s Division of Air Quality, a 1-hour value of 1.8 ppm and an 8-hour value of 1.1 ppm were used as background levels for this analysis.

4.4.3 Potential Air Quality Impacts

Maximum 1-hour and 8-hour CO levels predicted at the analysis site are shown in Table 4-12. At the analysis site, CO levels were estimated at 28 receptor locations. The total predicted CO level at a receptor includes the contributions of the roadway links plus the background concentration. All predicted concentrations are below the applicable federal and state standards.

Table 4-12. Predicted Worst-Case 1-Hour and 8-Hour CO Levels (ppm)

Measurement	Description	Existing 1999	No-Build 2025	Preferred Alternative 2025	Bypass Alternatives 1A and 1B 2025	Bypass Alternatives 4A and 4B 2025
1-Hour	Sunset Drive & US 321	5.1	7.5	7.7	5.4	5.3
8-Hour	Sunset Drive & US 321	3.1	4.6	4.7	3.3	3.2

National and State 1-hour standard = 35 ppm
 One-hour values include 1-hour background = 1.8 ppm
 National and State 8-hour standard = 9 ppm
 Eight-hour values include 8-hour background = 1.1 ppm

The highest predicted 1-hour and 8-hour CO concentration, 7.7 ppm and 4.7 ppm respectively, occurs in the Preferred Alternative. Though the No-Build and Preferred Alternative have the same traffic volumes, widening the roadway increases the source strength slightly for the receptors near the intersection, resulting in the highest predicted CO levels for all the alternatives analyzed. The source strength increases for the receptors near the intersection in the Preferred Alternative because the widened road is closer to the receptors. Bypass Alternatives 1A, 1B, 4A and 4B have the lowest predicted CO levels. This is because of the large reduction in traffic along the existing US 321 bypass anticipated with each of these alternatives.

The project is not predicted to cause or exacerbate a violation of the NAAQS for CO.

4.4.4 Air Quality Conformance

Since the project comes from an approved TIP and it is not predicted to cause or exacerbate a violation of the CO standard, the project conforms to the State Implementation Plan (SIP) and the goals set forth in the Clean Air Act Amendments (CAAA) and the Final Conformity Rule.

4.4.5 Mobile Source Air Toxics

For each alternative in this FEIS, the amount of MSATs emitted would be proportional to the vehicle-miles traveled (VMT), assuming that other variables such as fleet mix are the same for each alternative. VMT is the total number of miles traveled in a year by all vehicles on US 321

within the project area. The VMT for the Preferred Alternative would be identical to the VMT for the No-Build Alternative since they would follow the same route. The VMT for the Bypass Alternatives would be lower than the VMT for the No-Build Alternative because the existing route is longer than the bypasses. Existing US 321 is approximately 5.8 miles long from the project's southern terminus at Blackberry Road (SR 1500) to Aho Road (SR 1533) north of Blowing Rock where Bypass Alternatives 4A and 4B would terminate. If US 321 was relocated along Bypass Alternatives 1A or 1B, the distance traveled for those using the bypass would drop 0.4 miles to 5.4 miles. If US 321 was relocated along Bypass Alternatives 4A or 4B, the distance traveled for those using the bypass would drop 1.9 miles to 3.9 miles.

Thus, with the Preferred Alternative, MSAT emissions would be similar to the No-Build Alternative, and MSAT emissions would be lower with the Bypass Alternatives. MSAT emissions also would be somewhat lower for the Build Alternatives because of increased peak period speeds. According to the US Environmental Protection Agency's (USEPA) MOBILE6 emissions model, emissions of all of the priority MSATs except for diesel particulate matter decrease as speed increases. The extent to which these speed-related emissions would reduce VMT-related emissions cannot be reliably projected because of the inherent deficiencies of current technical models.

Also, regardless of the alternative chosen, emissions would be lower in 2025 than present levels as a result of the USEPA's national control programs that are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures.

The Build Alternatives would move some traffic closer to nearby homes; therefore, there could be localized areas where ambient concentrations of MSATs could be higher. The localized increases in MSAT concentrations likely would be most pronounced along the Preferred Alternative and Bypass Alternatives 1A and 1B because they both pass through developed areas. However, as discussed above, the magnitude and the duration of these potential increases compared to the No-Build Alternative cannot be accurately quantified because of the inherent deficiencies of current models.

4.5 Noise and Vibration

4.5.1 Noise Standards and Criteria

The noise impacts for US 321 were assessed in accordance with FHWA procedures published in Title 12, Part 772 of the *Code of Federal Regulations* (23 CFR 772) for determining when traffic noise impacts will occur. The NCDOT uses FHWA procedures for noise impact assessment and abatement analysis for all its highway noise impact assessments. These procedures involve the following seven steps:

1. Identify existing land uses and activities, developed lands, and undeveloped lands for which development is planned, designed; and programmed and that could be affected by traffic-related noise;
2. Determine existing noise levels in the project area;

3. Predict future design year noise levels that would occur under No-Build and Build conditions;
4. Compare future noise levels with existing noise levels and with the FHWA’s Noise Abatement Criteria (NAC) to identify traffic noise impacts and the need for abatement;
5. Identify areas at which noise impacts would be anticipated;
6. Identify areas for which noise abatement must be considered; and
7. Investigate various noise abatement measures that might be used to reduce or eliminate traffic noise impacts.

As described in Section 3.6.1 of Chapter 3, FHWA noise assessment procedures identify noise levels in decibels (dBA) based on the $L_{eq}(h)$ noise descriptor and identify noise abatement criteria (NAC) levels at which abatement must be considered. The FHWA’s NAC are shown in Table 4-13. The NAC apply to areas having regular human use and where lower noise levels are desired. FHWA noise assessment procedures indicate that noise impacts occur when the predicted peak hour traffic noise levels approach or exceed the NAC levels, or when the predicted design year (2025 for this project) traffic noise levels substantially exceed the existing noise levels even though the predicted noise levels may not exceed the NAC.

Table 4-13. Noise Abatement Criteria for Highway Projects

Activity Category	$L_{eq}(h)$ (dBA)	Description of Activity
A	57 Exterior	Lands on which serenity and quietness of extraordinary significance serve an important public purpose and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 Exterior	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 Exterior	Developed lands, properties, or activities not included in Categories A or B.
D	–	Undeveloped lands.
E	52 Interior	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: FHWA 23 CFR Part 772, USDOT, April 1992.

The *NCDOT Traffic Noise Abatement Policy* defines the “approach” noise level as the level within 1 dBA of the NAC. For Activity Category B, which applies to most of the project area, this level is 66 dBA. The NCDOT defines a substantial increase in traffic noise level to be an increase of 15 dBA or more where the existing noise level is 50 dBA or less, or 10 dBA or more where the existing noise level is greater than 50 dBA.

The NAC are used by the NCDOT to establish noise impact thresholds for considering noise impact abatement measures. The NAC are not attenuation criteria or targets. The basic goals of the NAC are to help minimize the adverse noise impacts on the community during the operation of the project and, where necessary and appropriate, to provide feasible and reasonable noise abatement.

4.5.2 Traffic Noise Model

Existing and future traffic noise levels were predicted using FHWA's Traffic Noise Model (TNM) version 1.1 highway noise prediction model. The FHWA's TNM is used for predicting noise levels on all NCDOT projects. Input parameters necessary to run TNM include average daily and peak hour traffic volumes and speeds, vehicle types, receiver locations and elevations, roadway geometry, variations in terrain between the noise source and receiver, and the presence of any building rows, barriers and/or buffers.

4.5.3 Predicted Noise Levels

A total of 201 noise sensitive receivers, representing the 285 noise sensitive sites described in Section 3.6.4 of Chapter 3, were modeled in TNM for 2025 for the No-Build Alternative and the five Build Alternatives. The results are presented in the following tables, Table 4-14 through Table 4-19. Each table identifies the difference in noise levels between the existing condition and 2025 noise levels. The results are organized by the noise sensitive areas presented in Figure 3-5 in Chapter 3.

No-Build Alternative

Table 4-14 presents the predicted existing and 2025 design hour noise levels for the No-Build Alternative by receiver within the 15 noise sensitive areas along US 321. A total of 182 noise sensitive sites were evaluated for this alternative.

As shown in Table 4-14, the predicted noise levels at all of the noise sensitive areas for the No-Build Alternative are expected to exceed the existing condition noise levels by less than 3 dBA. However, under the No-Build Alternative, 19 noise sensitive sites (residences) would have noise levels that approach or exceed the NAC level. It is widely accepted that the average human ear can barely perceive noise level changes of 3 dBA or less. Therefore, the changes in noise levels from the existing condition to the 2025 No-Build Alternative would be negligible. The increases in future noise levels under the No-Build Alternative are related to an increase in projected traffic volumes.

Preferred Alternative

Table 4-15 presents the predicted existing and future noise levels for the Preferred Alternative by receiver within the 15 noise sensitive areas along US 321. A total of 182 noise sensitive sites were evaluated for this alternative.

As shown in Table 4-15, the predicted noise levels for the Preferred Alternative are expected to exceed the NAC at 28 of the 182 modeled sites (Receivers 2, 23, 39, 44, 57, 70, 97, and 113). These sites are adjacent to US 321 in areas where the widening would move the roadway, and therefore, vehicle traffic, closer to the residences. A less than 1 dBA reduction in future noise levels is also expected to occur at the 27 residences represented by Receivers 74 and 120. In these noise sensitive areas, the widening of US 321 would move vehicle traffic farther away from the residences. In no case would the Preferred Alternative cause a substantial increase in noise levels; the highest predicted increase is 7.3 dBA.

Bypass Alternative 1A

Table 4-16 presents the predicted existing and 2025 noise levels for Bypass Alternative 1A at receivers within the alternative's corridor, noise sensitive areas 1 through 6 and 14 through 21. A total of 136 noise sensitive sites were evaluated for this alternative.

Table 4-14. Predicted Existing and Future Noise Levels for the No-Build Alternative at Receivers Adjacent to US-321

Noise Sensitive Area	Representative Receiver Number	Number of Sensitive Receptors	NAC (dBA)	L _{eq} (h) (dBA)		Difference
				Existing Condition	2025 No-Build Alternative	
1	2	4	66	65.7	68.5	2.8
2	3	3	66	58.6	61.3	2.7
3	6	2	66	54.7	57.4	2.7
	11	5	66	47.4	50.2	2.8
4	12	4	66	54.0	56.7	2.7
	16	5	66	42.0	44.7	2.7
5	18	2	66	56.2	59.0	2.8
	19	2	66	54.2	56.9	2.7
6	23	2	66	63.8	66.4	2.6
	25	16	66	54.2	56.8	2.6
7	32	7	66	51.4	54.1	2.7
	38	14	66	61.4	63.9	2.5
	39	2	66	67.6	70.1	2.5
8	44	5	66	68.0	70.4	2.4
	50	9	66	60.5	63.0	2.5
9	56	17	66	61.4	63.9	2.5
	57	1	66	63.9	66.3	2.4
10	70	5	66	63.8	66.2	2.4
	74	23	66	60.9	63.4	2.5
11	89	14	66	60.9	63.4	2.5
12	93	3	66	60.9	63.4	2.5
13	97	9	66	61.7	64.1	2.4
	99	11	66	59.5	62.0	2.5
	108	4	66	63.5	65.9	2.4
14	113	1	66	62.5	65.1	2.6
	114	5	66	54.9	57.5	2.6
15	117	2	66	52.1	54.7	2.6
	120	5	66	51.5	54.0	2.5
Total Number of Noise Sensitive Sites		182				

Table 4-15. Predicted Existing and Future Noise Levels for the Preferred Alternative at Receivers Adjacent to US-321

Noise Sensitive Area	Representative Receiver Number	Number of Sensitive Receptors	NAC (dBA)	L _{eq} (h) (dBA)		Difference
				Existing Condition	2025 Preferred Alternative	
1	2	4	66	65.7	69.3	3.6
2	3	3	66	58.6	62.3	3.7
3	6	2	66	54.7	58.7	4.0
	11	5	66	47.4	49.7	2.3
4	12	4	66	54.0	57.3	3.3
	16	5	66	42.0	45.0	3.0
5	18	2	66	56.2	60.0	3.8
	19	2	66	54.2	59.0	4.8
6	23	2	66	63.8	67.1	3.3
	25	16	66	54.2	58.4	4.2
7	32	7	66	51.4	53.8	2.4
	38	13	66	61.4	61.4	0.0
	39	3	66	67.6	74.9	7.3
8	44	5	66	68.0	70.3	2.3
	50	9	66	60.5	60.9	0.4
9	56	16	66	61.4	61.8	0.4
	57	2	66	63.9	71.2	7.3
10	70	6	66	63.8	68.9	5.1
	74	22	66	60.9	60.1	-0.8
11	89	14	66	60.9	65.8	4.9
12	93	3	66	60.9	65.8	4.9
13	97	5	66	61.7	68.5	6.8
	99	13	66	59.5	65.8	6.3
	108	6	66	63.5	65.6	2.1
14	113	1	66	62.5	66.2	3.7
	114	5	66	54.9	57.9	3.0
15	117	2	66	52.1	57.2	5.1
	120	5	66	51.5	51.3	-0.2
Total Number of Noise Sensitive Sites		182				

Table 4-16. Predicted Existing and Future Noise Levels for Bypass Alternative 1A

Noise Sensitive Area	Representative Receiver Number	Number of Sensitive Receptors	NAC (dBA)	L _{eq} (h) (dBA)		Difference
				Existing Condition	2025 Bypass Alternative 1A	
1	2	4	66	65.7	73.7	8.0
2	3	3	66	58.6	64.8	6.2
3	6	2	66	54.7	61.8	7.1
	11	5	66	47.4	51.2	3.8
4	12	4	66	54.0	58.5	4.5
	16	5	66	42.0	46.8	4.8
5	18	2	66	56.2	62.7	6.5
	19	2	66	54.2	62.7	8.5
6	23	2	66	63.8	69.0	5.2
	25	16	66	54.2	58.4	4.2
14	113	1	66	62.5	64.9	2.4
	114	5	66	54.9	60.9	6.0
15	117	2	66	52.1	65.4	13.3
	120	5	66	51.5	57.8	5.8
16	129	6	66	47.6	55.3	7.7
	130	6	66	47.3	67.0	19.7
	134	1	66	45.7	73.6	27.9
17	136	2	66	46.1	63.5	17.4
	139	4	66	44.7	74.1	29.4
18	141	2	66	44.7	72.7	28.0
	143	1	66	43.2	57.9	14.7
	145	10	66	42.5	62.7	20.2
19	155	9	66	43.3	66.2	22.9
	159	3	66	39.9	74.0	34.1
	192	1	66	37.1	60.6	23.5
20	163	10	66	37.1	74.6	37.5
	164	1	66	36.2	53.5	17.3
	167	4	66	35.2	48.2	13.0
21	177	5	66	40.8	56.4	15.6
	179	2	66	39.8	70.1	30.3
	185	5	66	41.5	66.5	25.0
	188	6	66	45.8	59.0	13.2
Total Number of Noise Sensitive Sites		136				

As shown in Table 4-16, the future noise levels for the proposed Bypass Alternative 1A would exceed the NAC at six of the modeled residences (Receivers 2 and 23). An additional 21 residences (Receivers 117, 136, 145, 164, 177, and 192) would experience a substantial increase in future noise levels. Also, the prediction results indicate that 42 residences (Receivers 130, 134, 139, 141, 155, 159, 163, 179, and 185) would be exposed to both an exceedance of the NAC and a substantial increase above existing noise levels. All but six of the 80 affected residences would be along the new right-of-way after it leaves existing US 321. Predicted increases would be as high as 37.5 dBA.

Bypass Alternative 1B

Table 4-17 presents the predicted existing and 2025 noise levels for Bypass Alternative 1B at receivers within its corridor, the same corridor as Bypass Alternative 1A. A total of 136 noise sensitive sites were evaluated for this alternative.

Table 4-17. Predicted Existing and Future Noise Levels for Bypass Alternative 1B

Noise Sensitive Area	Representative Receiver Number	Number of Sensitive Receptors	NAC (dBA)	L _{eq} (h) (dBA)		Difference
				Existing Condition	2025 Bypass Alternative 1B	
1	2	4	66	65.7	73.6	7.9
2	3	3	66	58.6	64.8	6.2
3	6	2	66	54.7	61.7	7.0
	11	5	66	47.4	51.3	3.9
4	12	4	66	54.0	56.9	2.9
	16	5	66	42.0	46.0	4.0
5	18	2	66	56.2	59.5	3.3
	19	2	66	54.2	63.1	8.9
6	23	2	66	63.8	65.2	1.4
	25	16	66	54.2	57.8	3.6
14	113	1	66	62.5	64.7	2.2
	114	5	66	54.9	61.3	6.4
15	117	2	66	52.1	61.8	9.7
	120	5	66	51.5	57.0	5.5
16	129	6	66	47.6	55.7	8.1
	130	7	66	47.3	66.2	18.9
17	136	5	66	46.1	60.9	14.8
	139	1	66	44.7	74.1	29.4
18	141	2	66	44.7	68.9	24.2
	143	1	66	43.2	57.7	14.5
	145	10	66	42.5	62.6	20.1
19	155	2	66	43.3	66.8	23.5
	159	1	66	39.9	73.9	34.0
	192	10	66	37.1	62.0	24.9
20	163	8	66	37.1	74.5	37.4
	167	7	66	35.2	47.7	12.5
21	177	12	66	40.8	56.0	15.2
	179	2	66	39.8	69.5	29.7
	185	2	66	41.5	66.7	25.2
	188	2	66	45.8	58.8	13.0
Total Number of Noise Sensitive Sites		136				

As shown in Table 4-17, above, the predicted noise levels for the proposed Bypass Alternative 1B would exceed the NAC at four of the 136 modeled residences (Receiver 2). An additional 32 residences (Receivers 145, 177, and 192) would experience a substantial increase in future noise levels. Also, the prediction results indicate that 25 residences (Receivers 130, 139, 141, 155, 159, 163, 179, and 185) would be exposed to both an exceedance of the NAC and a substantial increase above existing noise levels. All but four of the 76 affected residences would be along the new right-of-way after it leaves existing US 321. Predicted increases would be as high as 37.4 dBA.

Bypass Alternative 4A

Table 4-18 presents the predicted existing and 2025 noise levels for Bypass Alternative 4A at receivers within the corridor’s noise sensitive areas (1 through 6, 15 through 20, 22 and 23). A total of 137 noise sensitive sites were evaluated for this alternative.

Table 4-18. Predicted Existing and Future Noise Levels for Bypass Alternative 4A

Noise Sensitive Area	Representative Receiver Number	Number of Sensitive Receptors	NAC (dBA)	L _{eq} (h) (dBA)		Difference
				Existing Condition	Bypass Alternative 4A	
1	2	4	66	65.7	73.8	8.1
2	3	3	66	58.6	65.1	6.5
3	6	2	66	54.7	53.9	-0.8
	11	5	66	47.4	53.4	6.0
4	12	4	66	54.0	53.2	-0.8
	15	1	66	44.3	67.3	23.0
	16	4	66	42.0	58.0	16.0
5	18	2	66	56.2	56.4	0.2
	19	2	66	54.2	57.8	3.6
6	23	2	66	63.8	62.0	-1.8
	25	16	66	54.2	52.2	-2.0
15	118	2	66	52.7	51.6	-1.1
	122	5	66	47.7	53.5	5.8
16	129	6	66	47.6	50.2	2.6
	130	7	66	47.3	57.4	10.1
17	139	6	66	44.7	53.1	8.4
18	143	2	66	43.2	58.9	15.7
	145	9	66	42.5	54.3	11.8
	151	2	66	40.2	60.0	19.8
19	155	9	66	43.3	45.4	2.1
	159	3	66	39.9	45.7	5.8
	192	1	66	37.1	45.7	8.6
20	163	6	66	37.1	43.1	6.0
	167	9	66	35.2	54.5	19.3
22	195	3	66	27.0	58.2	31.2
23	197	22	66	60.2	61.7	1.5
Total Number of Noise Sensitive Sites		137				

As shown in Table 4-18, the predicted noise levels for the proposed Bypass Alternative 4A would exceed the NAC at four of the 155 modeled residences (Receiver 2). An additional 20 residences (Receivers 16, 130, 143, 151, 167, and 195) would experience a substantial increase in future noise levels. In addition, the prediction results indicate that one residence (Receiver 15) would be exposed to both an exceedance of the NAC and a substantial increase above existing conditions. These increases would occur in areas east of Blowing Rock and north of the Blue Ridge Parkway where the proposed bypass would be constructed on new location. Predicted increases would be as high as 31.2 dBA.

Bypass Alternative 4B

Table 4-19 presents the predicted existing and 2025 noise levels for the Bypass Alternative 4B by receivers within its corridor, the same corridor as Bypass Alternative 4A. A total of 137 noise sensitive sites were evaluated for this alternative.

Table 4-19. Predicted Existing and Future Noise Levels for Bypass Alternative 4B

Noise Sensitive Area	Representative Receiver Number	Number of Sensitive Receptors	NAC (dBA)	L _{eq} (h) (dBA)		Difference
				Existing Condition	Bypass Alternative 4B	
1	2	4	66	65.7	73.8	8.1
2	3	3	66	58.6	65.3	6.7
3	6	2	66	54.7	53.7	-1.0
	11	5	66	47.4	56.3	8.9
4	12	4	66	54.0	52.6	-1.4
	16	5	66	42.0	62.4	20.4
5	18	2	66	56.2	56.2	0.0
	19	2	66	54.2	58.0	3.8
6	23	2	66	63.8	62.1	-1.7
	25	16	66	54.2	52.1	-2.1
15	118	2	66	52.7	51.9	-0.8
	122	5	66	47.7	54.5	6.8
16	129	6	66	47.6	50.2	2.6
	130	7	66	47.3	58.1	10.8
17	139	6	66	44.7	52.6	7.9
18	143	2	66	43.2	56.7	13.5
	145	9	66	42.5	53.4	10.9
	151	2	66	40.2	58.7	18.5
19	155	9	66	43.3	44.3	1.0
	159	3	66	39.9	46.0	6.1
	192	1	66	37.1	59.8	22.7
20	163	6	66	37.1	44.6	7.5
	167	9	66	35.2	55.5	20.3
22	193	2	66	28.2	60.0	31.8
	195	1	66	27.0	66.0	39.0
23	197	22	66	60.2	60.3	0.1
Total Number of Noise Sensitive Sites		137				

As shown in Table 4-19, the predicted noise levels for the proposed Bypass Alternative 4B would exceed the NAC at four of the 137 modeled residences (Receiver 2). An additional 19 residences (Receivers 16, 151, 167, 192, and 193) would experience a substantial increase in future noise levels. In addition, the prediction results indicate that one residence (Receiver 195) would be exposed to both an exceedance of the NAC and a substantial increase above existing conditions. Like Bypass Alternative 4A, these increases would occur in areas east of Blowing Rock and north of the Blue Ridge Parkway where the proposed bypass would be constructed on new location. Predicted increases would be as high as 39 dBA.

4.5.4 Analysis

The relation of the predicted noise levels to the NAC and existing levels is summarized in Table 4-20. The Preferred Alternative would raise noise levels to a point approaching or exceeding the NAC at 28 sensitive receptors, an increase of nine over the No-Build Alternative, which follows the same corridor. Bypass Alternatives 1A and 1B, which would pass through residential neighborhoods would have a substantially greater noise impact than the other alternatives, with 61 to 69 noise sensitive receptors. Bypass Alternative 4A and 4B also would have a substantial impact on 24 to 25 noise sensitive receptors.

Table 4-20. Number of Noise Sensitive Receptors Affected by Alternative

Type of Noise Impact	No-Build	Preferred Alternative	Bypass Alternatives			
			1A	1B	4A	4B
Exceeds NAC	19	28	6	4	4	4
Substantial Increase	0	0	21	32	20	19
Both	0	0	42	25	1	1
Total	19	28	69	61	25	24

With the Bypass Alternatives, a small reduction in traffic noise levels would occur for receivers adjacent to US 321 in Blowing Rock because of the diversion of traffic to the proposed bypass. The diversion of vehicle traffic to Bypass Alternatives 1A and 1B would result in an average noise reduction of 3.4 dBA. The average noise reduction associated with Bypass Alternatives 4A and 4B would be less than 1 dBA. The small benefit would be greater with Bypass Alternatives 1A and 1B because they would divert more traffic to the bypass than would Bypass Alternatives 4A and 4B.

4.5.5 Project Noise Abatement

Since noise levels at certain receivers along each of the Build Alternatives were determined to exceed the NAC of 66 dBA, present a substantial increase over existing conditions, or both, the feasibility and reasonableness of noise abatement measures were evaluated for all of the affected sensitive sites. Feasibility of an abatement measure deals primarily with design and engineering considerations. Reasonableness is a more subjective measure and demonstrates that good judgment and common sense were used in making a decision with respect to the abatement measure.

As outlined in 23 CFR 772, abatement may include the following mitigation measures: noise barriers, traffic system management, alignment modifications, and land use control. When noise

abatement measures are being considered, every effort should be made to obtain substantial noise reduction at the affected receivers. The design goal of an abatement measure is a reduction of 8 dBA or more. If a minimum reduction of 5 dBA cannot be achieved, an abatement measure is not considered feasible.

The following sections discuss the noise abatement measures that were investigated for this project.

Noise Barriers

Noise barriers reduce noise levels by blocking the sound path between the roadway and noise sensitive sites. To be effective in reducing traffic noise impacts, a noise barrier must have certain characteristics. The barrier must be long (the barrier should extend four times as far in each direction as the distance from the receiver to the barrier), must be continuous (with no gaps or discontinuities in the design whether they be for pedestrian access, cross-street penetration, or access to the roadway for maintenance purposes), and must be sufficiently high to provide the necessary reduction in noise levels at an affected site.

In order for a barrier to be considered feasible and reasonable, it must meet the following minimum criteria:

- Provide a minimum insertion loss (noise reduction) of 5 dBA to all of the affected sites, with a design goal of 8 dBA for the receivers immediately behind the barrier.
- The cost to construct the barrier should not exceed \$35,000 per benefited receptor plus an incremental increase of \$500 per dBA average increase in the predicted exterior noise levels of the impacted receptors of the area. For purposes of this determination, benefited receptors are those that would experience a reduction of 5 dBA or more in the level of traffic noise as a result of the noise barrier.

Barrier analyses were conducted at receptors where predicted noise levels for the Build Alternatives would exceed the NAC and/or show a substantial increase above predicted existing noise levels. The TNM computer program was utilized to evaluate the cost-effectiveness and acoustic-effectiveness of noise barriers. Noise barriers of varying heights and lengths were modeled at each location considered. The results of the noise barrier analyses were compared to the minimum criteria.

After review of the noise level results and geometry of the project, it is not considered reasonable or feasible to construct noise barriers at affected sensitive receptors, except for one area along Bypass Alternatives A1 and A2, for the following reasons:

- The noise sensitive sites along the project corridors are often scattered and low-density residences. Noise barriers are not cost-effective in such settings.
- For the noise sensitive areas along US 321, acoustically effective noise barriers would block or limit the access of residents to US 321 by blocking driveways and side streets.
- At noise sensitive areas 16 and 17 along the Blue Ridge escarpment, the residences are elevated as much as 80 to 90 feet above the proposed bypass alternatives. A barrier placed along the proposed right-of-way would not be effective since the maximum barrier height allowed by NCDOT standards is 25 feet. The most acoustically effective barrier location would be at the highest point relative to the roadway. One option might be to construct the

barriers near the homes and outside of the NCDOT right-of-way. This option would require the homeowners to grant a dedicated easement for the maintenance of the barrier. Also, the barrier would obstruct the panoramic views from these homes of Blackberry Valley.

In noise sensitive area 19 (see Figure 3-5 in Chapter 3), a noise reduction of 5 to 12 dBA could be achieved at four receptors. (Four other receptors would receive smaller reductions from the same barrier.) The average cost for protecting the four receptors with a greater than 5 dBA reduction would be \$41,940 per receptor. The increase in noise levels with Bypass Alternatives 1A and 1B at the four receptors would be 15.5-29.9 dBA from 41.5-43.3 dBA (existing) to 59.0-71.4 dBA (with Bypass Alternatives 1A or 1B). The large amount of increase adds \$14,950 (\$500 times 29.9 dBA) to the base \$35,000 cost effectiveness measure for a total of \$49,950, making this barrier cost-effective.

Traffic System Management Measures

Traffic system management measures that limit motor vehicle speeds and reduce traffic volumes can be effective noise mitigation measures. However, these measures also negate a project's ability to accommodate forecast traffic volumes.

Alignment Modifications

Alignment modifications generally involve orientating and/or siting the roadway at sufficient distances from noise sensitive areas to minimize noise impacts. As discussed in Section 2.2 of Chapter 2, the study team evaluated numerous locations for the Build Alternatives. The locations of the alternatives under consideration offer the best set of alternatives that balance engineering criteria, limitations imposed by terrain and the various community, cultural resource, and natural resource impacts.

Land Use Controls

Another noise abatement measure is the use of land use controls to minimize impacts to future development. Local government and planning agencies with land use control authority could consider anticipated noise level changes along the Preferred Alternative so new homes and other sensitive uses are set back from the road sufficiently to avoid noise impact. A setback distance of 200 feet from the center of the nearest travel lane of the Build Alternatives to the 66 dBA noise level was calculated. Traffic noise levels should not exceed 66 dBA at new homes set back at least 200 feet from the road.

4.6 Historic and Archaeological Resources

This section describes the effect of the alternatives on historic and archaeological resources. The material follows guidance associated with Section 106 of the National Historic Preservation Act of 1966 (36 CFR Part 800). Section 106 requires federal agencies to take into account the effects of their undertakings (federally-funded, licensed, or permitted) on properties included in or eligible for inclusion in the National Register of Historic Places and to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings. The Preferred Alternative is subject to Section 106 because a Section 404 Clean Water Act permit is required from the USACE for dredge and fill impacts to waters of the United States within the boundary of the Green Park Historic District. The other alternatives may not be subject to Section 106, since no federal permit or license applies to the portion of the alternatives that effect eligible properties, and since no federal funds are being used. Nonetheless, Section 106 consultation occurred for all detailed study alternatives and is reported here. Compliance with Section 106 meets and exceeds compliance with G.S. 121-12(a), the state statute that requires

review of state undertakings that affect historic properties listed on the National Register. None of the alternatives would affect archaeological resources. The Preferred Alternative would have an Adverse Effect on the Green Park Historic District and on the Green Park Inn. Bypass Alternatives 4A and 4B would have an Adverse Effect on Blue Ridge Parkway. [The other alternatives would have no Adverse Effect on historic resources.]

4.6.1 Historic Resources

As described in Chapter 3, in Section 3.7.1 and for the Blue Ridge Parkway in Section 3.8.3 three historic resources listed on the National Register of Historic Places (NRHP) are present in the project's area of potential effects (APE): the Green Park Historic District, the Green Park Inn, and the Bollinger-Hartley House. The Blue Ridge Parkway is eligible for inclusion in the National Register. All of the Build Alternatives would affect historic resources listed on or eligible for inclusion in the National Register of Historic Places. Only three alternatives would have an Adverse Effect on such resources: the Preferred Alternative would have an Adverse Effect on Green Park Historic District and the Green Park Inn. Bypass Alternative 4A and 4B would have an Adverse Effect on the Blue Ridge Parkway. The No-Build Alternative would not have an effect on any historic properties.

An Adverse Effect is defined in the regulations of the Advisory Council on Historic Preservation that implement Section 106 of the National Historic Preservation Act of 1966 (36 CFR Part 800.5(a)(1)) as:

An Adverse Effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

The regulations also present the following examples of adverse effects:

- (i) Physical destruction of or damage to all or part of the property;
- (ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's standards for the treatment of historic properties (36 CFR part 68) and applicable guidelines;
- (iii) Removal of the property from its historic location;
- (iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
- (v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;

(vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and

(vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

The determinations of effect by resource and alternative are shown in Table 4-21. These determinations were affirmed during the DEIS review by the study's historic resource consulting parties, including the USACE, State Historic Preservation Officer, for resources affected by the Preferred Alternative. The State Historic Preservation Office/NCDOT concurrence form for the assessment of effects is presented in Appendix A as a part of "Other Correspondence" with the "NC Department of Cultural Resources."

Table 4-21. Determination of Effect for Project Area Historic Resources

	Preferred Alternative	Bypass Alternative			
		1A	1B	4A	4B
Bollinger-Hartley House	No Adverse Effect	Not in APE ¹	Not in APE	Not in APE	Not in APE
Green Park Historic District	Adverse Effect	No Adverse Effect	No Adverse Effect	Not in APE	Not in APE
Green Park Inn	Adverse Effect	Not in APE	Not in APE	Not in APE	Not in APE
Blue Ridge Parkway	No Effect	No Adverse Effect	No Adverse Effect	Adverse Effect	Adverse Effect

¹ APE =area of potential effects

The Preferred Alternative was determined to have an Adverse Effect on two historic resources, the Green Park Historic District and the Green Park Inn. Section 7.11 of Chapter 7 describes the continued consultation with consulting parties to develop means for minimizing and mitigating the Adverse Effects and the resulting MOA (Appendix G) between the NCDOT, the USACE, and the State Historic Preservation Office.

The following paragraphs describe the potential impacts to the four historic resources and the basis for the determinations of effect in Table 4-21.

Bollinger-Hartley House

The Bollinger-Hartley House is west of US 321 north of Sunset Drive. It is below the elevation of existing road and cannot be seen from the road. The house is important in the architectural history of Blowing Rock and Watauga County. The Preferred Alternative would remain within the existing right-of-way adjacent to the Bollinger-Hartley House and would not encroach on the National Register boundaries of the property. The house, however, would be affected by the Preferred Alternative.

Behind the house, a steep vegetated slope rises from the home to the existing road. Here, a portion of the Preferred Alternative would occur adjacent to the home. A retaining wall would be built to hold the widened road and to replace a portion of the slope. The wall would parallel the east property boundary for approximately 230 feet. At the southern boundary of the property, the wall would be 12 feet high. The wall's height would diminish to zero as it continues north. Adjacent to the house the wall would be about 4 feet high and set on the hillside at a higher elevation than the home. The wall would be within the existing right-of-way approximately 40 feet from the back of the home. A portion of the vegetated slope would remain between the home and the wall.

Peak hour noise levels in 2025 at the house (65.6 dBA) would not exceed the FHWA's Noise Abatement Criteria. Noise levels would increase by less than 3 dBA over existing levels (63.5 dBA). A nearly identical increase would occur with the No-Build Alternative (to 65.9 dBA).

The retaining wall would not substantially change the character of physical features within the property's setting that contribute to its historic architectural significance. The visual and auditory elements of the Preferred Alternative would not rise to the level that they would diminish the integrity of the resource's significant historic architectural features. Therefore, the Preferred Alternative would have No Adverse Effect on the Bollinger-Hartley House.

Green Park Historic District – Effect of the Preferred Alternative

In the Green Park Historic District, the Preferred Alternative would be a four-lane road with curbs and gutters and no median. Left turn lanes would be provided for those turning from US 321 to Green Hill Road or Rock Road. The Preferred Alternative would adversely affect the District by converting approximately 3.7 acres of District land to highway right-of-way. It would displace one contributing structure and its associated stone walls. It would take a portion of the property from two additional contributing structures. In addition to requiring some property within the District, the Preferred Alternative would have visual and construction related impacts.

The potential impacts to the Green Park Historic District and its contributing properties, including the Green Park Inn, are discussed below under the following subheadings: displacement and area affected, potential for incompatible development, visual change, traffic operations, drainage, air quality, noise, Blowing Rock Country Club hole #4, and construction. Figure 3-8 in Chapter 3 shows the relation of the historic district to the Preferred Alternative.

Displacement and Land Area Affected. Table 4-22 indicates the effects of the Preferred Alternative on contributing properties. A total of approximately 3.0 acres of new property from the District would be acquired as highway right-of-way. This area would be reduced slightly by the use of 11-foot lanes within the District. The thin solid line that parallels the proposed pavement shown in Figure 3-8 in Chapter 3 and Figure D-1c to Figure D-1e (in Appendix D) is the proposed right-of-way line. One contributing structure, the Cottage (#21 in Table 4-22), would be displaced. Two other contributing structures would lose a portion of their associated grounds through the acquisition of additional right-of-way. Approximately 280 square feet from of the rear portion of the Shuford Family Cottage (#10) property and 0.17 acre of the front yard of the A.G. Jonas Cottage (#23) property would be purchased for new right-of-way. Included in the loss of land would be the removal of the associated landscaping elements that are characteristic of the District (see the discussion of "Visual Change" below).

The Preferred Alternative would also result in the temporary displacement during construction of the business sign for the Green Park Inn on the west side of US 321, stone walls along the west side of US 321, and a sidewalk on the east side of US 321 in front of the Green Park Inn. These

Table 4-22. District and Contributing Properties Affected¹

Number	Property Name	Structure Displaced	Other Features
	Green Park Historic District	Cottage (#21 in Table 3-15)	Informal and densely wooded landscaping and stone walls along west side of US 321 removed and replaced.
District Contributing Properties:			
10	Shuford Family Cottage and garage	No	None
20	Green Park Inn (individually National Register listed)	No	Sidewalk removed and rebuilt during construction; sign on west side of US 321 is within the new right-of-way. It would be replaced. The parking lot on the west side would not be replaced because it is no longer owned by the Green Park Inn.
21	Cottage	Yes	Home, driveway, and associated stone wall removed.
23	A.G. Jonas Cottage	No	40 feet of densely wooded landscaping between house and road removed, leaving 25 feet
39	Blowing Rock Golf Course	No	An approximately 6-foot-high retaining wall replaces a slope at the edge of the fairway of hole #4

¹ No property is affected by the Preferred Alternative from the contributing structures that are not included in this table.

features would be reconstructed or relocated during construction. The Green Park Inn sign is on property not owned by the Inn and would likely need to be replaced on the east side of US 321 on property owned by the Inn. An approximately 6-foot-high retaining wall would be constructed along the edge of the golf course, adjacent to hole #4. The retaining wall would replace an existing embankment that lies between the existing US 321 pavement and the golf course. Use of a retaining wall here would permit the creation of an 8-foot-wide flat berm between the curb of the Preferred Alternative and the golf course, in keeping with standard NCDOT highway design practice. A railing would be placed on top of the retaining wall for pedestrian safety.

Potential for Incompatible Development. Since the purpose of the Preferred Alternative is to improve safety and serve traffic associated with already anticipated growth, there is no reason to believe that the Preferred Alternative would influence existing development trends one way or another in the District. In addition, the Preferred Alternative would not increase the accessibility of vacant properties. These findings apply both to vacant District lands along US 321 and other parts of the District where vacant land exists.

The overall direction of the Blowing Rock Comprehensive Plan (1993) is the preservation of the resort village character of Blowing Rock, a character that was developed in large measure because of the contributing structures and landscaping of the District. Thus, given these policies, the design of any new development in the District would likely complement the surrounding historic structures. New structures, however, would be contemporary and non-contributing. Full development of the vacant lands along US 321 in the District would create a line of contemporary structures that would separate the part of the District east of US 321 from the part west of US 321.

Visual Change. Visual impacts of the Preferred Alternative and the other alternatives being evaluated are described in Section 4.3. Table 4-23 describes changes the Preferred Alternative is expected to cause to the visibility of US 321 within the district and from its contributing structures. Visual changes would result from the increase in the number of lanes from two to four

Table 4-23. Visual Change in District and at Contributing Properties

Number ¹	Property Name	Distance in Feet from Structure to Widened ROW/ Change from Existing Condition	Distance in Feet from Structure to Widened Pavement/ Change from Existing Condition	Width in Feet of Vegetative Cover Between Widened Road and Structure/ Change from Existing Condition	New Pavement Width/Change from Existing Road in Feet	Change in Visibility of US 321 from Resource Without Proposed Landscape Plan
	Green Park Historic District	US 321 passes through district	US 321 passes through district	Varies (see contributing structures)	48-60/22-34	Remains visible; a few once obscured properties would have clear or partial views; pavement width increased in front of resources.
	District Contributing Properties:					
1	<i>The Blowing Rock</i> and Reception Center/Gift Shop	600/0	615/5	550/0	50/26	No change in profile of road in long distance views to the north but new rock cut is visible from <i>The Blowing Rock</i> and parking lot.
2	Charles H. Turner Cottage and associated servants cottage	410/-35 [N]	430/-30 [N]	0/-20[N]	50/26	Becomes clearly visible to the north; views southeast unchanged.
3	Jack Dunavant Cottage	415/-40 [N]	430/-35 [N]	0/-20 [N]	50/26 [N]	Becomes clearly visible to the north; views southeast unchanged.
5	Much More Cottage	410/-35 [N]	445/-25 [N]	110/0 [N]	55/31 [N]	Remains mostly obscured to the north; views southeast unchanged.
6	Little More Cottage	400/-35 [N]	420/-30 [N]	90/0 [N]	58 /34 [N]	Remains mostly obscured to the north; views southeast unchanged.
7	McDonald Family Cottage and garage	400/-25 [N]	420/-20[N]	90/0 [N]	50/26	Remains mostly obscured to the north; views southeast unchanged.
8	Harper-Shuford-Wise Cottage	380/-10	390/-5 [N]	190/0 [N]	50/26	Remains mostly obscured.
9	Gideon's Ridge Inn	190/0	230/0	180/0	50/26	Remains mostly obscured.
10	Shuford Family Cottage and garage	100/-10	120/0	80/0	50/26	Remains partially obscured.
11	Clement-Slane Cottage and garage/servant's room	285/-40	307/-33	50/-50	54/30	Remains mostly obscured.
12	Faraway and garage and other contributing structures	580/-50	610/-35	150/-60	60/36	Remains totally obscured.
13	Knox Family Cottage and shed	390/-60	325/-30	25/-25	60/36	Remains partially obscured

Table 4-23. Visual Change in District and at Contributing Properties

Number ¹	Property Name	Distance in Feet from Structure to Widened ROW/ Change from Existing Condition	Distance in Feet from Structure to Widened Pavement/ Change from Existing Condition	Width in Feet of Vegetative Cover Between Widened Road and Structure/ Change from Existing Condition	New Pavement Width/Change from Existing Road in Feet	Change in Visibility of US 321 from Resource Without Proposed Landscape Plan
14	Cannon Family Cottage	265/-55	290/-40	20/-30	48-60/24-36	Becomes partially obscured
15	Henkel Family Cottage	270/-75	310/-40	0/0	48-60/24-36	Remains clearly visible.
17	McDowell Cottage	320/-60	355/-30	210/0	48-60/24-36	Remains mostly obscured.
18	Robert A. Dunn Cottage	495/-55	535/-20	360/-40	48/24	Remains totally obscured.
20	Green Park Inn (National Register listed)	55/0	65/0	0	48-60/24-36	Remains clearly visible; pavement width increased in front of resource, but near edge would be no closer than existing (see Figure 3-8 in Chapter 3).
21	Cottage	NA	NA	NA	NA	Structure is displaced
23	A.G. Jonas Cottage	33/-42	54/-26	25/-40	48/24	To be blocked by a fence added along the property line.
24	Cottage and garage	65/-25	100/0	50/0	60/36	Remains mostly obscured. Near lane would be no closer, but road would be 38 feet wider.
26	Craig Family Cottage and garage/servant's room	290/0	300/0	100/0	64/40	Remains mostly obscured.
9	Green Family Cottage	335/0	350/0	190/0	64/40	Remains totally obscured
33	Charles Calvert Smoot, III Cottage and garage	510/-90	570/-50	460/-70	50/26	Remains totally obscured.
34	Helen Potts Armstrong Cottage	630/-140	770/-40	580/-20	52/28	Remains totally obscured
35	James Ross Cannon Cottage	795/0	810/0	370/0	64/40	Remains totally obscured.
39	Blowing Rock Golf Course	35/0 (to green north of US 321)	50/0 (to green north of US 321)	0	48/24	Remains clearly visible.
43 ²	Young-Shaw-Steele House	NA	NA	NA	NA	US 321 is not visible from this structure.

¹ Numbers used in the Green Park Historic District Nomination. Missing numbers correspond to non-contributing structures.

² Property part of proposed Green Park Historic District expansion, see "Phase II Intensive Architectural Survey and Evaluations," Mattson, Alexander and Associates, Inc., May 24, 1997.

and accompanying topographic changes and vegetation losses. Views from the properties within the district and views of the district from the road would both change. Change would be associated with the roadway, the view of the road, and the view from the road would be as follows:

- Roadway Changes
 - Roadway Width. The Preferred Alternative would increase the existing 24-foot pavement width to 48 feet, except in the Green Hill Road/Rock Road Intersection area where it would increase to 60 feet because of the installation of left turn lanes.
 - Topographic Changes. Excavation to accommodate the widened roadway surface would alter the existing topography within the planned right-of-way. The proposed area of excavation is the dashed line adjacent to the proposed pavement shown in Figure D-1c to Figure D-1e (in Appendix D). The relationship of the Green Park Inn and the A.G. Jones Cottage to proposed excavation of the existing ground is illustrated in Figure 4-11 and Figure 4-12. These are the two contributing structures closest to the Preferred Alternative.
 - Vegetation and Other Landscape Features Lost or Changed. The widening of existing US 321 through the District would result in some loss of upper and lower story vegetation that currently contributes to the turn-of-the-century resort village character and blocks views of US 321 for many of the structures in the district. The loss of vegetation would be confined to the portion of the district through which existing US 321 passes in Blowing Rock. Low decorative stone walls would be removed from in front of the contributing structure that would be displaced. A landscape plan would be designed and implemented to replace vegetation. Stone walls displaced would be replaced.

- View of the Road

As shown in Table 4-23, the Preferred Alternative would result in changes in the view of the road from several of the properties contributing to the Green Park Historic District.

- Green Park Inn. The existing roadway is clearly visible from the front of the Inn (including the front porch), and the Preferred Alternative would remain clearly visible. The view from the Inn would be of a wider roadway surface with the Preferred Alternative. There would be no change in the distance of the near lane to the Inn. The new pavement would be added to the west side of the road, away from the Inn (see Figure 3-8 in Chapter 3). The surface of the new road would be lower than the existing road by about 6 inches to accommodate the installation of curbs without acquiring any Inn property. The sidewalk along the front of the Inn would be removed during the construction of the project, but it would be replaced. The removal of upper and lower story vegetation along the west side of the road would also open up views from the Green Park Inn of contributing and compatible structures in the District. Views of features outside the district would not be opened.

Blowing Rock Country Club Golf Course. The golf course users now have a clear view of approximately 400 feet of US 321 beginning at Goforth Road and continuing north until tree cover and structures begin to obstruct the view from the course. The Widening

Figure 4-11. Preferred Alternative at Green Park Inn

Figure 4-12. Preferred Alternative at the A.C. Jonas Cottage

Alternative would remove two structures currently blocking the view of US 321 from the course; beyond that point, the existing structures and vegetation would continue to block the view. For approximately 500 feet beginning at Goforth Road, the near lane would be no closer to the golf course than the existing road; beyond that point the new pavement would begin to shift to the golf course's side of the road but would not acquire any property from the golf course. (See Figure D-1g and Figure D-1h in Appendix D.) The road generally would be 48 feet wide in front of the golf course, an increase of 24 feet. The road surface would remain above the level of the golf course and would not be seen. A retaining wall approximately 6 feet high would be introduced between US 321 and the Blowing Rock Country Club property line to accommodate an 8-foot wide flat berm between the curb and the wall. Currently, the terrain slopes downward from the edge of the existing pavement to the golf course. Changes in the topography and vegetation lost to the widened right-of-way on the west side of US 321 would be seen from the golf course. These change would be adjacent to hole #4, the course's signature hole.

- Other Contributing Properties. For five of the contributing properties, the views of the roadway would be altered by a decrease in the depth of vegetation between the property and the widened roadway or by the introduction of the widened roadway into already clear views of existing US 321 (see Table 4-23). Changes would be as follows:

The Blowing Rock and Reception Center/Gift Shop. Views from *The Blowing Rock* and Reception Center/Gift Shop are of portions of US 321 outside the historic district. From *The Blowing Rock* and the parking lot of the gift shop, the view to the north across the gorge for approximately 2,600 feet would include a new rock cut on the Preferred Alternative west of Norwood Circle. A portion of the cut would be landscaped with new trees. To the southeast, US 321 would remain mostly obscured.

Charles. H. Turner Cottage. The existing 20 feet of vegetation between this structure and US 321 would be removed by the right-of-way. Although now obscured from structure views, approximately 600 feet of US 321 and its widened pavement would become clearly visible to the north of this structure. The near lane, however, would be 430 feet away. In addition, re-vegetation in the right-of-way would replace some of the trees lost. US 321 at its location southeast of the structure would remain obscured.

Jack Dunavant Cottage. The 20 feet of existing vegetation between this structure and US 321 would be removed by the right-of-way. Although now partially obscured, an 800-foot length of US 321 and its widened pavement would become clearly visible to the north of this structure. The near lane, however, would be 430 feet away. In addition, re-vegetation in the right-of-way would replace some of the trees lost. A potential view of US 321 to the southeast would remain obscured.

Henkel Family Cottage. The wider pavement would be visible from this home. Landscaping would partially shield these views.

A.G. Jonas Cottage. Forty feet of vegetation between this structure and US 321 would be removed by the right-of-way; 25 feet of vegetation would remain. A fence approximately 12 feet high would be built along the property line blocking US 321 and its widened pavement from view. The near lane of US 321 would be 54 feet away from the nearest corner of the house rather than 80 feet. The right-of-way line would be 33 feet away from the structure. (See Figure 4-12.) The Preferred Alternative would require 0.17 acre

of land associated with this structure. The impact here reflects a reduction achieved since the DEIS preliminary designs by the addition of a retaining wall at this location.

- Other Properties in the District. Nineteen other properties would have little or no change in their existing views of US 321, as described in Table 4-23. The view of the road would remain partially to totally obscured by vegetation and/or intervening structures. All but two of these properties would be at least 200 feet away from the near edge of pavement. The two closer properties would be 100 and 120 feet away.

- **View from the Road**

With the Preferred Alternative, the loss of vegetation would open the fronts of some contributing structures on Gideon Ridge Road and Pinnacle Avenue to motorists' views. The reduction in the density of vegetated cover at the A.G. Jonas Cottage could open the now private space to partial view by US 321 users. However, that view would be blocked by the provision of a fence approximately 12 feet high just inside the property line. Views of incompatible features outside the boundaries of the district would not be opened.

Traffic Operations. The Green Park Inn and one contributing home are the only structures in the District with direct access to US 321. The contributing home would be displaced. The entrance to the Inn would be unchanged. An approximately 30-space parking lot for the Green Park Inn on the west side of US 321 and outside the Inn's National Register boundary (but within the District) would be displaced by the Preferred Alternative and not replaced since it is no longer owned by the Green Park Inn. The sign for the Green Park Inn would be displaced and replaced in some form, although it would need to be relocated to property owned by the Green Park Inn.

A concentration of pedestrians traveling across US 321 occurs at the Green Park Inn. Pedestrians cross the highway to reach the Inn from the parking lot just described. That movement would no longer occur with the removal of the parking lot.

Noise. With the No-Build Alternative, increased traffic volumes would raise peak hour noise levels less than 3 dBA at sensitive receptors. It is widely accepted that the average human ear can barely perceive noise level changes of 3 dBA or less. With the Preferred Alternative, most sensitive receptors in the District would experience either no change in noise levels or an increase that is less than 3 dBA over existing levels. At three homes, levels would rise 7.3 dBA from 67.6 dBA to 74.9 dBA and would exceed the Federal Highway Administration's (FHWA) noise abatement criteria (NAC). Noise barriers would not be cost-effective at these homes and would introduce an additional non-historic feature into the District. (See Section 4.5.)

The A.G. Jonas Cottage is one of the homes that would be affected by an increase in noise with the Preferred Alternative. As part of developing an impact mitigation plan for the Green Park Historic District, a detailed noise barrier analysis was conducted at the A.G. Jonas Cottage. It reaffirmed that a noise barrier at the Jonas Cottage would not be reasonable because first it would protect a single receptor. In addition, the barrier required would be 137 feet long and 12 feet high. It would need to be placed along the US 321 right-of-way line, extending both north and south of the Jonas property, creating a substantial additional change in the appearance of this part of the District.

Given that the Jonas Cottage is a contributing structure to the district, the barrier analysis was revisited from the perspective of whether a fence with sound mitigation properties could be built on the Jonas property and achieve the minimum insertion loss both in the yard next to the house

and at a second floor level balcony facing US 321. Unlike a noise barrier, which would be within the US 321 right-of-way and parallel the road, a fence would be on the Jonas property and enclose the yard adjacent to US 321. A noise barrier analysis determined that a 12-foot privacy fence enclosing the yard would provide a noticeable noise loss in the yard and on the balcony. Along US 321, the total height of the fence and the planned retaining wall would be 16 feet. With the fence, peak period noise levels for the Preferred Alternative would drop at the yard from 67.6-68.8 dBA to 60.9-59.1 dBA, a drop of 6.7-9.7 dBA. Noise levels at the balcony would drop from 70.0-70.7 dBA to 64.5-64.2 dBA, a drop of 5.5-6.5 dBA.

Drainage. Members of the Blowing Rock Country Club expressed the concern that runoff from the widened pavement would tax the capacity of a storm sewer under the golf course. US 321 roadway drainage in the Green Park Historic District would be channeled by curbs and gutters and conveyed via a closed storm drain system to a suitable new outfall.

The vertical alignment (profile) of the roadway directly controls the location and placement of drainage structures. Utilizing gravity flow, drainage systems usually begin several hundred feet downhill of crests (tops of hills or high points) and flow toward a sag (low points). Upon reaching a sag, the drainage system discharges to an available natural outfall that is of sufficient size to handle the expected peak flow. The Preferred Alternative would have sags at approximately 500 feet south of Green Hill Road, the intersection of Country Club Drive, and the intersection of US 321 Business. Crests would be at the intersection of US 321 with Goforth Road and at the intersection with Norwood Circle.

On-site (highway) and off-site (flowing onto the highway from the surrounding terrain) runoff would be handled by pipe drainage systems. The off-site runoff would be from a catchment area west of US 321 and bounded by Pinnacle Avenue. Rather than allowing this runoff to pass through the Blowing Rock Country Club on the east side of US 321, the new US 321 drainage system would catch the flow. The on-site and off-site flow would then exit the storm drain at one of the natural outfalls. The natural outfalls are at the swale at approximately 500 feet south of Green Hill Road, the swale opposite Country Club Road, and the swale along US 321 before US 321 Business.

Blowing Rock Country Club Hole #4. Two homes outside the District but adjacent to the Blowing Rock Country Club golf course hole #4 would be displaced. Country club officials have indicated that the displacement of the two homes adjacent to hole #4 would increase their liability risk because these homes help prevent errant drives from the tee from reaching US 321 and striking passing motor vehicles.

Construction. Chapter 2 in Section 2.4.1 describes a sequence of construction operations and discusses timing, traffic control, and maintenance of access for the Preferred Alternative. Section 4.16 addresses topics related to contractor control, excavation procedures, (including blasting), control of erosion, dust, and noise, and other construction issues.

In the Green Park Inn Historic District, construction of the Preferred Alternative would not be complex. First, the two new lanes would be constructed and then traffic would be switched to the new lanes during reconstruction of the existing lanes. In the road section to the north of the District where existing curves are being straightened, a pilot car operation would be needed for approximately 5 to 10 months (depending upon the time of year when the contractor commenced the operation) to allow for one lane of travel. Traffic waiting to go northbound on the single available lane could back-up into the District. The access points to the Green Park Inn would be

kept open. Dust and noise would affect the Inn's guests. The Inn is not air-conditioned, and the windows are open in the summer. Sitting on the front porch is a common activity of guests.

In developing and implementing its construction projects, the NCDOT endeavors to minimize inconveniences and disturbances and would do so with the Preferred Alternative, as discussed in Section 4.16. Construction operations would be conducted in a manner that minimizes noise and dust, protects landscaping outside the proposed right-of-way, maintains traffic flow and access, and protects historic structures from damage during blasting.

Mitigation Defined in Memorandum of Agreement. An MOA on mitigation of adverse effects of the Preferred Alternative on the Green Park Historic District between the USACE, the NCDOT, and the NC State Historic Preservation Officer was signed in September 2004. Several others also signed the MOA as concurring parties (Town of Blowing Rock, Caldwell County, the owner of the Green Park Inn, the owner of Cottage #21, and the Blowing Rock Country Club). The Concerned Citizens of Blowing Rock, Blowing Rock Historical Society, and the owners of the A.C. Jonas Cottage were given the opportunity to sign as concurring parties but chose not to sign. The MOA is presented in Appendix G. Its stipulations include:

- The documentation of existing conditions in the District prior to construction;
- The components of a construction vibration control program;
- A community communications program for the construction period;
- Requirements for design features and design review;
- Development implementation of a landscape plan, including replacing stone walls displaced by the Preferred Alternative;
- Strategies for reducing construction period impacts; and
- Provisions for consultation with the State Historic Preservation Officer (SHPO) and property owners on the specifics of impact mitigation at contributing structures and features.

It also includes provisions for dispute resolution.

Green Park Historic District --Effect of Bypass Alternatives 1A and 1B

Earthwork that would place Bypass Alternatives 1A and 1B on a cut below the existing terrain would be within 65 feet of the National Register-eligible extension of the District described in Chapter 3, Section 3.7.1 that includes the contributing Young-Shaw-Steele House. Trees planted as a part of the landscape plan would block views of the cut from the Young-Shaw-Steele House. This contributing structure is the only one that would be affected by Bypass Alternatives 1A and 1B. Goforth Road would be realigned slightly to be adjacent to one part of the boundary. Traffic noise would increase in the area, as discussed in Section 4.5.3. The changes in the setting and the increased traffic noise would not diminish the integrity of the District's or the contributing structure's significant historic features. Architecture is the structure's contributing feature. Thus, Bypass Alternatives 1A and 1B would not adversely affect the District.

Green Park Historic District --Effect of Bypass Alternatives 4A and 4B

Bypass Alternatives 4A and 4B would not have an effect on the Green Park Historic District.

Green Park Inn

The Green Park Historic District is within the APE of the Preferred Alternative. The Preferred Alternative would require rebuilding the sidewalk in front of the Inn. The Preferred Alternative would not affect the Inn itself, the stone walls in front of the Inn, or any other historic element within the Inn's property boundaries. The adverse impacts to the Green Park Inn would relate to changes in its setting and construction-related impacts (described above for the District). Impacts to the Green Park Inn are addressed in the MOA developed for the District (Appendix G).

None of the bypass alternatives (1A, 1B, 4A, or 4B) would have an effect on the Green Park Inn.

Blue Ridge Parkway

The Preferred Alternative would have No Affect on the Blue Ridge Parkway. Bypass Alternatives 1A and 1B would affect the Blue Ridge Parkway, but it would not be adverse. Bypass Alternatives 4A and 4B would have an Adverse Effect. The introduction of new visual elements into the viewshed of the Parkway is the only effect of the Build Alternatives on the Blue Ridge Parkway. Only in the case of Bypass Alternatives 4A and 4B would the introduction of these visual elements rise to the level that they would diminish the integrity of the Parkway's significant historic features. The visual impacts of Bypass Alternatives 4A and 4B would indirectly alter a portion of the characteristics of the Parkway that qualify the property for inclusion in the National Register. This change would occur in a manner that would diminish the integrity of the property's setting, feeling, and association. Alternative 4B would have a smaller impact than Alternative 4A because of the introduction of additional bridges. The additional bridges would reduce the amount of earthwork, changes in the shape of the landscape, and vegetation loss. The nature and extent of those visual impacts is described in Section 4.7.3, the parks and recreation impact discussion. They also are presented in Section 4.3, "Visual and Aesthetic Quality." Cumulative impacts of NCDOT projects affecting the Parkway are discussed in Section 4.15.5.

4.6.2 Archaeological Resources

Background research and field surveys revealed no known or potential archaeological resources in the project area. The SHPO confirmed in a letter dated June 13, 2001 that no further archaeological studies were needed (see Appendix A). Therefore, none of the alternatives would affect such resources. The MOA stipulates that the NCDOT will prepare a plan of action to be implemented should archaeological resources inadvertently accidentally be discovered during construction of the Preferred Alternative. It includes provisions for the assessment of the significance of discovered resources. (See Appendix G.)

4.7 Parks and Recreation Areas

The Build Alternatives would affect two recreation resources and one park. The Blowing Rock Assembly Grounds, a camp owned by the United Church of Christ, would be affected by Bypass Alternatives 1A and 1B. Two ancillary buildings would be displaced and its entrance would be changed. Noise levels would increase near the bypass. The Preferred Alternative would affect the Blowing Rock Country Club golf course. A retaining wall and other changes to the landscape on US 321 would be introduced to views from the fairway of the course's signature hole. Two adjoining homes that block errant tee shots would be displaced. All the Build Alternatives would affect the Blue Ridge Parkway, a national park. The introduction of new visual elements into the viewshed of the Parkway would be the only effect of the Build Alternatives on the Parkway.

4.7.1 Blowing Rock Assembly Grounds

The only alternatives that would affect the Blowing Rock Assembly Grounds would be Bypass Alternative 1A and 1B, both of which would have the same impact to the grounds. The bypass would pass through a corner of the southern portion of the Blowing Rock Assembly Grounds in a deep cut (as deep as 40 feet). It would displace two of its structures, a garage and a barn. The NCDOT would pay for both structures and the land. Adequate time would be provided for the Assembly Grounds to replace these structures prior to their demolition.

The entrance to the Blowing Rock Assembly Grounds from Goforth Road would be permanently relocated approximately 500 feet further north on Goforth Road. (See the drawings in Appendix D.) Access would be maintained to the Assembly Grounds during construction. During excavation in the Goforth Road area, maintenance of Goforth Road traffic could require the temporary detour of Goforth Road traffic onto Assembly Grounds property at its realigned intersection with Goforth Road.

The proposed deep cut would change the view of the landscape at the Assembly Grounds entrance. A bridge would be built to take Goforth Road across the bypass. Changes in views would be concentrated at the entrance to the Grounds. Plantings would be placed on the slopes adjacent to both sides of the proposed bypass where the existing landscape would be altered. The bypass would not affect hiking trails on the Grounds.

Traffic noise would be heard at Assembly Grounds cabins near the bypass.

4.7.2 The Blowing Rock Country Club

Only the Preferred Alternative would affect the privately owned Blowing Rock Country Club. Impacts would occur where existing US 321 parallels the fairway of the fourth hole. The pavement would be 48 feet wide at the golf course, an increase of 24 feet. The nearest lane of the Preferred Alternative would be no closer to the golf course than the existing pavement. The widened road would move back the slope on the side of US 321 opposite from the golf course and existing vegetation and a home would be lost. The road would remain above the level of the golf course. As it would continue north from the course, the Preferred Alternative would remove two structures currently blocking the view of US 321 from the course; beyond that point, the existing structures and vegetation would continue to block the view of US 321 from the course.

An approximately 6-foot-high retaining wall would be constructed along the edge of the golf course, adjacent to the fourth hole. The retaining wall would replace an existing embankment that lies between the existing US 321 pavement and the golf course. Use of a retaining wall here would permit the creation of an 8-foot-wide flat berm between the curb of the Preferred Alternative and the golf course, in keeping with standard NCDOT highway design practice. A sidewalk, five feet in width, would be constructed on this berm on the east side of US 321 from Green Hill road to US 321 Business. A railing would be placed on top of the retaining wall.

The changes in the topography, lost vegetation, and displacement described above would be seen by users of the golf course, particularly those at the fourth hole. The fourth hole is considered the club's signature hole, with its signature views of the Green Park Inn and Green Hill. Country club officials have indicated that the displacement of the two homes adjacent to the fourth hole would increase their liability risk because these homes help prevent errant drives from the tee from reaching US 321 and striking passing motor vehicles.

With the Preferred Alternative, the NCDOT would coordinate with the country club officials to mitigate visual impacts to the golf course related to the retaining wall and liability issues related to the displacement of the two homes. Retaining walls would be of formed concrete with a simulated masonry surface treatment designed to simulate the existing stone walls in the area. Additional plantings could be placed in front of the wall. Mitigation opportunities related to the loss of the homes could include: 1) use of a retaining wall and revised driveway to eliminate the need to displace the homes (planning such an idea would be discussed and would involve the homes' owner), or 2) trees and other vegetation to serve as an alternative means for blocking errant drives.

4.7.3 The Blue Ridge Parkway

None of Build Alternatives would require land from the Blue Ridge Parkway. Bypass Alternatives 4A and 4B would include a tunnel under the Parkway, but the portals would be outside the Parkway boundaries. As discussed in Section 4.6.1, the Blue Ridge Parkway is eligible for the National Register of Historic Places. It also is a national park.

The five Build Alternatives would all affect the Blue Ridge Parkway. The introduction of new visual elements into the viewshed of the Parkway is the only effect of the Build Alternatives on the Blue Ridge Parkway. Only in the case of Bypass Alternatives 4A and 4B would the introduction of these visual elements be a substantial impact. Alternative 4B would have a smaller impact than Alternative 4A because of the introduction of additional bridges. The additional bridges would reduce the amount of earthwork, changes in the shape of the landscape, and vegetation loss. The nature and extent of those visual impacts are described in this section. They also are presented in Section 4.3, "Visual and Aesthetic Quality." Cumulative impacts of NCDOT projects affecting the Parkway are discussed in Section 4.15.5.

As documented in Section 3.8.3 of Chapter 3, the Blue Ridge Parkway is an "elongated park featuring a road designed for pleasure travel and embracing scenic, recreational, or historic features of national significance." The purposes of the Blue Ridge Parkway include influencing the protection of the scenic, natural, and cultural resources within the corridor; i.e., those lands that are visible from the Parkway and/or situated adjacent to the boundary. Efforts by the National Park Service to ensure the conservation of key vistas have included the purchase of adjoining parcels and scenic easements. Concern for protecting the parkway and its vistas in the face of increasing mountain development have spurred a variety of conservation efforts in recent years. According to a National Historic Landmark Theme Study prepared by Blue Ridge Parkway officials, the parkway is identified as an unparalleled surviving example of parkway design of the 1930s and remains the most significant example of pre- and post-war automotive parkway design with the greatest degree of integrity in the United States (National Park Service, August 21, 2000).

The most notable feature of the Parkway in the project area is the southward panoramic view of Blackberry Valley in Caldwell County from Thunderhill overlook. It is the Parkway's highest rated view in Watauga County (of 55) and only one of seven panoramas overlooking forested ridges and valleys within an 80-mile region (National Park Service, August 21, 2000). Parkway officials describe the view to the north in the Thunderhill overlook area as a "panorama view into a broad rural valley with framing hills (mix of agriculture and forest land use)." The view to the north in the Thunderhill overlook area also is considered important. The characteristics of these views are described in detail in Section 3.4.2 in Chapter 3 under "Landscape Unit Six."

Preferred Alternative

Glimpses of the Preferred Alternative may be possible from the Blue Ridge Parkway, including Thunderhill overlook. Here the Parkway is, however, at least 1.5 miles away from the Preferred Alternative and the cuts and fills of the Preferred Alternative would not change the profile of the terrain as viewed from the Parkway. From the perspective of vehicles moving along the Parkway, the visual sensitivity of this area as defined by NC State's visual sensitivity mapping (described in Section 4.3.5) is low to moderate. Thus, the impacts of the Preferred Alternative on Parkway views would be minimal and the visual impacts of the Preferred Alternative would not rise to the level that they would diminish the integrity of the Parkway's significant historic features.

Bypass Alternative 1A

It would also be possible to see glimpses of Bypass Alternative 1A from the Blue Ridge Parkway, including Thunderhill overlook. As with the Preferred Alternative, the Parkway is at least 1.5 miles away from the visible portions of the bypass and the cuts and fills of the bypass would not change the profile of the terrain as viewed from the Parkway. From the perspective of vehicles moving along the Parkway, the visual sensitivity of this area is low to moderate. Thus, the impact of Bypass Alternative 1A on Parkway views would be minimal and would not rise to the level that they would diminish the integrity of the Parkway's significant historic features.

Bypass Alternative 1B

The location and appearance of Bypass Alternative 1B from the Blue Ridge Parkway would be similar to that of Bypass Alternative 1A. However, the cut into Gideon Ridge would change the profile of the terrain as viewed from the Parkway. The largest part of the cut (with a face as high as 440 feet vertically) would be exposed to parkway viewers. Thus, the impact of Bypass Alternative 1B on the Parkway would be greater than that of Bypass Alternative 1A. However, given that the Parkway is at least 1.5 miles away from the visible portions of the bypass and that Gideon Ridge is only a small, distant component of the overall view, the impact would not rise to such a level that it would diminish the integrity of the Parkway's significant historic features.

Bypass Alternative 4A

Four segments of Bypass Alternative 4A would be seen from the Blue Ridge Parkway from two viewer perspectives. Three segments would be seen from viewers looking south, including Thunderhill overlook. This is the same viewpoint from which the Preferred Alternative and Bypass Alternatives 1A and 1B would be seen. Ridge lines extending from the Blue Ridge escarpment would block views of Bypass Alternative 4A in two locations as it moves from Blackberry Road on existing US 321 to the tunnel under the Parkway. The view from Thunderhill overlook with and without Bypass Alternative 4A is presented in Figure 4-7. The second viewer perspective looks to the north.

Blackberry Road to Where the Alternative Leaves the Existing Road. For a distance of 1,900 feet from Blackberry Road to approximately Station 600 (see the drawings in Appendix D to identify the design station numbers), which is shortly after the alternative leaves the existing road, cuts and fills and the southern end of a bridge that make up the bypass would be in view from the Blue Ridge Parkway, including Thunderhill overlook. This is the same area that would contain the terrain changes associated with the Preferred Alternative and Bypass Alternatives 1A and 1B. Here, Bypass Alternative 4A would be over 2 miles away, the new roadway and the resultant changes in the landscape would be roughly perpendicular to the viewer's sight line, and the profile of the terrain as created by the peaks of ridgelines would not be altered. From the perspective of vehicles moving along the Parkway, the visual sensitivity of this area is low to

moderate. Given these factors, the visual impact on the Parkway of this part of the bypass would not be substantial. The terrain would then obscure views of the bypass from approximately Station 600 until approximately Station 620 near the Blackberry Condominiums.

Blackberry Condominium Area. In the area of the Blackberry Condominiums, the bypass would come back into view from the Parkway. It would be in view from Station 620 to approximately Station 655, a distance of approximately 3,500 feet. This portion of the bypass would include several large cuts and fills. The most prominent feature of this part of the bypass would be a fill that begins at Station 622 and continues to approximately Station 626, a distance of about 400 linear feet. At its longest point, the fill would show a face approximately 600 feet long vertically. The bypass would then enter an area where the road cuts into the terrain. Cut slopes would be on both sides of the road so only a portion of the cut would be exposed to views from the Parkway, but the exposed face would be as much as 240 feet long vertically. A retaining wall as high as 48 feet would be in view from Station 635 to 636+50, a distance of 150 feet. Two additional fills with exposed vertical faces as high as 320 feet would occur before the bypass would disappear again from view. The road alignment and the terrain changes generally would be perpendicular (90 degrees) to the viewer's sight line. From the perspective of vehicles moving along the Parkway, the visual sensitivity of the first fill is high. The other areas are low to moderate. This area is approximately 1.5 miles from Thunderhill overlook. Plantings would be placed on the slopes where the existing landscape would be altered. Both cut and fill slopes would be replanted. The most substantial changes to the landscape in this area would be on the fill slopes where re-vegetation can be more extensive. Although the impact to Parkway views is greater for this segment of the bypass than for the first segment in view, the visual impact of this part of the bypass on the parkway would not be substantial because of distance, the orientation to the Parkway of the terrain changes, and re-vegetation opportunities.

South of the Parkway, Bypass Alternative 4A and rural road intersections providing access points to adjoining properties would cause a portion of the area between the start of the bypass and the Blackberry Condominiums to be less isolated and potentially enhance the desirability for residential development. The land made more accessible would be at much lower elevations (3,200 feet) than the existing homes with valued views (3,500 to 3,900 feet) in elevation. Thus, Bypass Alternative 4A would not create the potential for additional lots with valued views and any development generated would tend to be below the elevation of the bypass. These factors combined with the distance to the Blue Ridge Parkway, do not create a substantial additional visual impact on the Parkway for induced development.

Along the Blue Ridge Escarpment. Terrain would again obscure views from the Parkway and Thunderhill overlook of the bypass from Station 655 to about Station 665, a distance of 1,000 feet. The bypass would then remain in view for a distance of about 2,400 feet as it follows the Blue Ridge escarpment until about Station 689, where vegetation would begin to obscure views. If vegetation were not present, the bypass, including one large fill, would remain in view until about Station 696. This segment of the bypass would contain substantial cuts and fills as it passes along the undulating terrain of the Blue Ridge escarpment. The change in the landscape as viewed from the Parkway and Thunderhill overlook would be extensive. The changes would be less than a mile from the Parkway and the cuts and fills would be seen at a 45-degree angle, which would make the alteration of the terrain more obvious than if they were viewed at a viewer's sight line. Today, when one looks at the Blue Ridge escarpment from the Parkway, one sees a steeply sloping terrain that undulates in and out as the ridges (high points) and swales (low points) that extend out at 90 degrees (perpendicular) from the escarpment rise and fall. Into that setting would be imposed new man-made shapes, including the flat, linear plane of the roadway and a two-sided cut into perpendicular ridges at two locations. These two-sided cuts would create

unnatural gouges in the terrain as deep at the center as 130 and 80 feet, respectively. The tallest side vertical surface of these two cuts, which would be exposed to view, would be 440 and 330 feet high, respectively. Three swales would be filled, creating a surface as long as 620, 420, and 360 feet vertically, respectively. From the perspective of vehicles moving along the Parkway (as defined by the Parkway's visual sensitivity mapping), the visual sensitivity of the first and deepest cut and the first fill is high. The other areas are of low to moderate sensitivity. Nighttime viewers would see the headlights and taillights of motor vehicles moving along the escarpment. The extensive changes in the terrain along the escarpment, the proximity to the Parkway and the high value placed on natural views from Thunderhill overlook would combine to create a substantial visual impact in this area. Trees would be planted on the slopes where the existing landscape would be altered. The plantings would soften the edges of the altered landforms and ultimately cover the large fills. However, because of the view angle and limits on planting in cuts, the road would remain an obvious imposition on the landscape, particularly in the two areas where deep cuts would be made into the ridgelines emanating from the escarpment.

As illustrated by Figure 4-7, the three segments described above do appear to merge into one as each winds along the terrain. Thus, with Bypass Alternative 4A, viewers on the Parkway at Thunderhill overlook would see a continuous series of cuts and fills from the start of the alternative at Blackberry Road to where it disappears from view near the Parkway.

If control of access were purchased along the bypass, there would be no change in the accessibility to properties along the Blue Ridge escarpment and no additional potential for development created along the escarpment. If control of access were purchased, properties below Green Hill would not have access to the bypass but would continue to use their existing access point along existing US 321 and rural roads.

North from the Blue Ridge Parkway. Viewers on the Parkway could view the portion of the bypass north of the Parkway in two ways. First, the bypass would be in view looking to the northwest for drivers on the Parkway. Second, persons stopped at Thunderhill overlook could cross the Parkway on foot and either climb a small ridge or walk several hundred feet east to view the bypass from the same vantage point as those driving on the Parkway. From the perspective of drivers, the visual sensitivity mapping for the Parkway generally classifies the area that would be occupied by the bypass as visible but of low sensitivity given the brief time that it would be viewed. Terrain would block views of the bypass from where it emerges from the north end of the tunnel to about Station 724, a distance of approximately 800 feet. The bypass would come into view about Station 724 and would remain in view until about Station 755. The bypass should for the most part disappear from Parkway views at Station 755. Thus, the bypass would be visible from the Parkway for about 3,100 feet. The tunnel administration building and emergency vehicle garage also would be seen. For the first 1,000 feet of this 3,100 feet, the bypass would be built on fill with a face 20 to 160 feet long vertically. The next 700 feet would involve a cut into the terrain with an exposed face being about 160 feet long vertically. For 500 feet the bypass would again be on fill as high as 60 feet above the existing terrain and with a vertical face as high as 170 feet. The final 900 feet would include a large cut in the hillside with a vertical face as high as 250 feet. Existing terrain would likely obscure the lower portion of this cut. These cuts and fills would be 2,000 to 3,800 feet away from the Parkway. The trees for the proposed re-vegetation plan would ultimately hide the fill areas from view. Both the cuts and fills of this section of the bypass are much lower than those cuts and fills along the Blue Ridge escarpment. Although considered a valuable view by Parkway officials, this view does not have the value or the opportunity for lingering stays by viewers offered by the view to the south. Thus, a portion of the bypass north of the Parkway would not have substantial visual impacts but they

would make a notable contribution to the overall visual impact when combined with the visual impacts south of the Parkway.

North of the Parkway, the bypass divides a single property. Either the NCDOT would replace access removed by the construction of the bypass or pay damages to the property owner for the removal of access. The introduction of the road into this area would reduce the quality of life in the area and adversely affect the rural values that caused the area's two families to make their homes in this setting. This loss of values could serve as an incentive for the owners to seek an alternative use for the land, such as residential or commercial development. The purchase of control of access would reduce or eliminate the potential for commercial development. However, even with control of access along the bypass, this area would still be accessible via Thunder Mountain Road. Consequently, development could still occur. However, the lack of access from the bypass might make this area less appealing for certain types of development (e.g., commercial). The presence of the bypass and the lack of infrastructure could initially be a limiting factor. The area is developable all the way to the Parkway boundaries and any secondary development would have a substantial impact on Parkway views to the north.

Conclusion. Bypass Alternative 4A would have an adverse impact on the Parkway. This conclusion is based on:

- The value of preserving the viewshed of the Blue Ridge Parkway as a whole;
- The presence of the Thunderhill overlook, which provides a place for Parkway users to stop and linger, enjoying the view from this part of the Parkway;
- The high value Parkway officials place on views from Thunderhill overlook and other views from the Thunderhill overlook area;
- The extent of the terrain changes on the Blue Ridge escarpment, including large fills and two deep cuts into ridge lines emanating from the escarpment;
- The fact that viewers looking from Thunderhill overlook would see a continuous series of cuts and fills from the start of the alternative at Blackberry Road to where it disappears from view near the Parkway; and
- The additional impacts to views north of the Parkway for drivers and for those stopped at Thunderhill overlook who may choose to walk across the Parkway.

If this bypass were the preferred alternative, Blue Ridge Parkway officials would be consulted and would be expected to provide important input into final design decisions. It is also recognized that final design work would seek opportunities to reduce the visual affect of this alternative on the Parkway, perhaps by including some of the components of Bypass Alternative 4B. The potential for new development north of the Parkway would need to be investigated further. If a strong likelihood exists that such development could occur, then measures would be considered to reduce that potential.

Bypass Alternative 4B

Similar to Bypass Alternative 4A, four segments of this alternative would be seen from the Blue Ridge Parkway from two viewer perspectives. Again, three segments would be seen from viewers looking south, including Thunderhill overlook. The views from Thunderhill overlook

with and without Bypass Alternative 4B is presented in Figure 4-9. Again, the forth segment would be seen by viewers looking to the north.

Blackberry Road to Where the Alternative Leaves the Existing Road. Like with Bypass Alternative 4A, cuts, fills, and part of a bridge would be in view of the Parkway for the southern 1,900 feet of this alternative. Similarly, the visual impact of this part of the bypass on the Parkway in this area would not be substantial. The terrain would then obscure views of the bypass until approximately Station 620 near the Blackberry Condominiums.

Blackberry Condominium Area. In the area of the Blackberry Condominiums, the bypass would then be in view of the Parkway from Station 620 to approximately Station 655, a distance of approximately 3,500 feet. Most of the large fills that would be a part of Bypass Alternative 4A would be replaced by four bridges. The bridges would be approximately 750, 800, 400 and 600 feet long, respectively. Only part of the last bridge would be seen from the Parkway. The bridges would be as high as approximately 150, 120, 75, and 100 feet, respectively. One large fill would occur in this area. It would begin at Station 632 and continue to approximately Station 635, a distance of about 300 feet. At its highest point, the fill would show a face approximately 390 feet long vertically. A cut, showing a face as long as 240 feet (73 meters) vertically, would be above the fill. The road alignment and the terrain changes generally would be perpendicular (90 degrees) to the viewer's sight line. From the perspective of vehicles moving along the Parkway, the visual sensitivity of the one large cut and fill is high. The visual sensitivity of other areas is low to moderate. This part of the bypass is approximately 1.5 miles from Thunderhill overlook. Plantings would be placed on the slopes where the existing landscape would be altered. Both cut and fill slopes would be replanted. The visual impact of this part of the bypass on the Parkway would not be substantial because of distance, the orientation to the Parkway, the use of bridges and re-vegetation opportunities. The impact that would occur would be less than that of Bypass Alternative 4A.

Since Bypass Alternative 4B, as designed for this assessment, would provide one point of access, the potential for induced development, while present, is less than what is would be for Bypass Alternative 4A.

Along the Blue Ridge Escarpment. Like with Bypass Alternative 4A, terrain would again obscure views from the Parkway of the bypass from Station 655 to about Station 665, a distance of 1,000 feet. The bypass would come into view about Station 665 and remain in view for a distance of about 2,400 feet as it follows the Blue Ridge escarpment until about Station 689, where vegetation would begin to obscure views. If vegetation were not present, views would remain until about Station 696.

This segment of Bypass Alternative 4B would contain one substantial cut and one large fill (although smaller than any of the fills in this area associated with Bypass Alternative 4A) as it passes along the undulating terrain of the Blue Ridge escarpment. Bridges would replace much of the cuts and fills associated with Bypass Alternative 4A. As with Bypass Alternative 4A, Bypass Alternative 4B would include several retaining walls in this section. The bypass would change the landscape as viewed from the Parkway and Thunderhill overlook, although the changes would be less extensive than with Bypass Alternative 4A. The changes, however, would be less than a mile from the Parkway and the cuts and fills would be seen at a 45-degree angle, which would make the alteration of the terrain more obvious than if they were viewed at a 90-

degree angle (perpendicular to the viewer's sight line). The vertical changes to the landscape in this area would include:

- A retaining wall approximately 670 feet long and as high as 50 feet, for approximately 250 feet below the road would be a fill showing a face as long as 80 feet vertically.
- A bridge approximately 1,100 feet long and as high as 170 feet long.
- A fill for approximately 450 feet showing a face as long as 600 feet vertically.
- A two-sided cut into a perpendicular ridge, which would create an unnatural gouge in the terrain as deep at the center as 90 feet. In the cut is a retaining wall of 60 feet, and above the wall, a cut showing a face as long as 290 feet vertically. Two homes at the top of the escarpment would be displaced. It is at this point that the view of the bypass from the Parkway would begin to be obscured by trees.
- The flat, linear plane of the roadway also would be introduced to views.

From the perspective of vehicles moving along the Parkway, the visual sensitivity of the location of the first fill is high. The other areas are of low to moderate sensitivity. Nighttime viewers would see the headlights and taillights of motor vehicles moving along the escarpment.

The combination of the changes in the terrain along the escarpment, the proximity to the Parkway, and the high value placed on natural views from Thunderhill overlook would combine to create a visual impact in this area. The impact, however, would be less than the impact associated with Bypass Alternative 4A. The fills would be fewer and shallower, and only one deep cut into the ridges instead of two, would emanate from the escarpment. Thus, much of the existing slope emanating from the escarpment would be unchanged. Trees would be planted on the slopes where the existing landscape would be altered. The plantings would soften the edges of the altered landforms and ultimately cover fills. Trees lost during the construction would be replanted and equipment haul roads regraded to the lines of the original terrain. The bypass, however, would create an obvious change to the landscape, particularly in one location where a deep cut would be made into a ridgeline emanating from the escarpment.

As with Bypass Alternative 4A, the three segments described above, from the perspective of the Parkway viewer, appear to merge into one as each winds along the terrain. With Bypass Alternative 4B, viewers would see three substantial areas of earthwork, two in the background more than a mile away and one near the tunnel just before the bypass disappears from view. From the two background areas of earthwork (near the Blackberry Condominiums) to the foreground cut and fill near where the bypass would again disappear, the bypass would be seen as an almost continuous bridge, with few evident changes in the existing terrain in evidence. (See Figure 4-9.)

Like Bypass Alternative 4A, if control of access were purchased along the bypass, there would be no change in the accessibility to properties along the Blue Ridge escarpment and no additional potential for development created along the escarpment. If control of access were purchased, properties below Green Hill would not have access to the bypass and would continue to use their existing access points along US 321 and rural roads.

North from the Blue Ridge Parkway. Like Bypass Alternative 4A, viewers at the Parkway could view the portion of the bypass north of the Parkway by driving by or walking from Thunderhill

overlook. From the perspective of drivers, the 3-mile visual sensitivity mapping for the Parkway generally classifies the area that would be occupied by the bypass as visible but of low sensitivity given the brief time that it would be viewed. Terrain would block views of the bypass from where it emerges from the north end of the tunnel to about Station 727, a distance of about 800 feet. The bypass would come into view about Station 727 and would remain in view until about Station 758. The bypass should for the most part disappear from Parkway views at Station 758. Thus, like Bypass Alternative 4A, this bypass would be visible from the Parkway for about 3,100 feet. The tunnel administration building and emergency vehicle garage also would be seen. For the first 500 feet of this 3,100 feet, the bypass would be built on fill with a face 30 to 160 feet long vertically. Unlike Bypass Alternative 4A, which would continue on fill, the next 500 feet of this bypass would be on a bridge as high as 70 feet. The next approximately 600 feet would involve a cut into the terrain with the longest part of the exposed vertical face being about 160 feet, similar to Bypass Alternative 4A. For 500 feet the bypass would again be on fill as high as 85 feet above the existing terrain and with a face as long as 180 feet vertically. The final 1,000 feet would be on a bridge as high as 65 feet. Existing terrain would likely obscure the final segment of this bridge. The views of these cuts, fills and bridges would be 2,000 to 3,800 feet away from the Parkway. The trees for the proposed re-vegetation plan would ultimately hide the fill areas from view. The length of cut in view of the Parkway would be less with this alternative than with Bypass Alternative 4A (approximately 600 feet versus 1,600 feet). Although considered a valuable view by Parkway officials, this view does not have the value nor the opportunity for lingering stays by viewers offered by the view to the south. Thus, alone the visual impacts to the Parkway of the portion of the bypass north of the Parkway would not be substantial, but they would contribute to the overall visual impact when combined with the visual impacts south of the Parkway. Overall, however, the impact to Parkway views would be less with Bypass Alternative 4B compared with Bypass Alternative 4A.

The nature of Bypass Alternative 4B's impacts to the rural community north of the Parkway would be similar to that of Bypass Alternative 4A. Thus, the factors that create a potential for encouraged development in the area are the same as with Bypass Alternative 4A. Again, the presence of the bypass and the lack of infrastructure could initially be a limiting factor. The area is developable all the way to the Parkway boundaries and any secondary development would have a substantial impact on Parkway views to the north.

Conclusion. Like Bypass Alternative 4A, Bypass Alternative 4B would affect the viewshed of the Parkway. As noted for 4A, Parkway officials place a high value on preserving the viewshed of the Blue Ridge Parkway as a whole. In addition, the Thunderhill overlook provides a place for Parkway users to stop and linger at the view from this part of the Parkway, and Parkway officials place a high value on views from Thunderhill overlook and other views from the Thunderhill overlook area. The portion of the viewshed affected by Bypass Alternative 4B is the same as Bypass Alternative 4A, but throughout the viewshed both north and south of the Parkway, the visual impact of 4B would be less than 4A. This difference can be best illustrated by comparing Figure 4-7, which shows 4A as seen from Thunderhill overlook, and Figure 4-9, which shows 4B as seen from Thunderhill overlook. As described above, three segments of these bypass alternatives appear to merge into one as each Alternative winds along the terrain. With Bypass Alternative 4A, one would see a continuous series of cuts and fills from the start of the alternative at Blackberry Road to where it disappears from view near the Parkway. With Bypass Alternative 4B, viewers would see three substantial areas of earthwork. From the distant cut and fill at the Blackberry Condominiums to the cut and fill near where the bypass would again disappear, the bypass would be seen as an almost continuous bridge, with only minimal changes in the existing terrain in evidence. Additional bridges would be in views to the north, as well. A potential exists for induced development that would affect the viewshed of the parkway.

Although a different type of visual feature than exists today, views of the bridges associated with this alternative could be seen by some viewers as an intriguing man-made structure.

Although the visual impact would be less, it is concluded that Bypass Alternative 4B would have an adverse impact on the Blue Ridge Parkway, once again based on:

- The value of preserving the viewshed;
- The presence of the Thunderhill overlook and its visitors;
- The value of the views from the Thunderhill overlook area; and
- The remaining changes to the Blue Ridge escarpment made by the alternative.

As with Bypass Alternative 4A, if this bypass were the preferred alternative, Blue Ridge Parkway officials would be consulted and would be expected to provide important input into final design decisions. It is also recognized that final design work should seek opportunities to reduce further the visual affect of this alternative on the Parkway. As with Bypass Alternative 4A, the potential for new development north of the Parkway would need to be investigated further and measures identified to reduce the potential for such development.

4.8 Fog

As discussed in Section 3.9 of Chapter 3, localized features that affect fog occurrence or duration are not substantially different among the Build Alternatives. Therefore, based on available data, it can be concluded that there is no difference in the potential for fog between the five Build Alternatives.

Techniques for mitigating the effects of regional-scale fog are to provide either advance notification to the motoring public or to increase visibility using special roadway lighting. These techniques include one or more of the following: variable-message or general warning signs, flashing warning lights, rumble strips, special in-pavement lights or markers, and overhead lighting. Lighted warning devices are triggered automatically by local fog detection devices. Automated, low-power localized radio bulletins or broadcasts (highway advisory radios) also can be remotely or automatically activated or deactivated as weather conditions change. These techniques would be effective with any of the Build Alternatives and the No-Build Alternative.

More data could be useful to understanding the severity, frequency, and duration of local fog occurrences. Such data gathering could involve a monitoring program implemented over two years. The monitoring network would have at least four monitoring stations. Each monitoring station would consist of a 30-foot-high meteorological tower, sensors, a fog detector, a data acquisition system and a data telemetry system. Where electrical line power is unavailable, solar panels and batteries would be employed. If such monitoring program were conducted, the fog monitoring network could be made permanent. It could be used to detect, on a real-time basis, low visibility weather conditions, and in turn, to alert targeted regional agencies to take action and to activate automatic warning equipment. Any decision on the characteristics and extent of a fog data gathering program would have to be made in consideration of the fact that there is not enough regional data available to know whether the fog in Blowing Rock is any worse than anywhere else in the region and whether it warrants more attention than anywhere else in the region.

As described in the MOU with the Town of Blowing Rock (Appendix G), the NCDOT will evaluate during final design flashing warning lights, pavement markers, rumble strips and/or

stripes, delineation, warning signs, and/or lighting that would be appropriate to increase safety and improve driver behavior during fog occurrences. The plans would be submitted by the NCDOT to SHPO and the Town for review, including the results of the evaluation that led to the selection of particular warning devices.

4.9 Ecological Resources

Bypass Alternative 4A would have the greatest effect on ecological resources in the project area, crossing 20 streams (six would be bridged), using 93 acres of natural plant communities, and involving the greatest fragmentation of habitat. The introduction of bridges to create Bypass Alternative 4B would reduce that impact to 20 streams crossed (14 would be bridged) and the use of 38 acres of natural plant communities. Habitat fragmentation also would be reduced. Bypass Alternatives 1A and 1B would each cross five streams and use 39 to 40 acres of natural plant communities. Bypass Alternative 4B would have additional temporary habitat disturbance for haul roads associated with bridge construction. The Preferred Alternative would cross six streams and would use 27 acres of natural plant communities. It would involve the least habitat fragmentation. It would involve the greatest amount of parallel fills in streams (1,070 linear feet). All alternatives would affect less than an acre of wetlands. Impacts to stream and wetland areas would require a permit from the USACE. A review of potential stream restoration sites surrounding the project area indicates that adequate options exist to offset stream impacts associated with any of the five Build Alternatives. The project area contains appropriate habitat for only one Federally listed Endangered or Threatened species, Heller's blazing star. A survey for Heller's blazing star was conducted in August 2003 to determine potential impacts of the project after the selection of the preferred alternative. No examples of the Heller's Blazing Star were found. The No-Build Alternative would not affect ecological resources.

The following paragraphs describe in detail the impacts related to physical resources, particularly impacts on water quality, terrestrial resource impacts, jurisdictional area (stream and wetland) impacts, and the potential for impacts to threatened and endangered species.

4.9.1 Physical Resource Impacts

Project impacts on topography and soils would be restricted to the cut-and-fill limits of the selected alternative. The use of existing urban land, widening of the existing road, bridging of major river and stream crossings, and the location of the alignments through areas of low to moderate relief would minimize impacts to soils and topography. Erosion is a severe hazard on the steep side slopes and ridges along the Blue Ridge escarpment, particularly in areas where the surface is bare or has been disturbed.

The Preferred Alternative would include crossings of six streams, and all crossings would utilize culverts. The Preferred Alternative would follow primarily along the existing US 321 alignment, where impacts would be minimized because of the presence of existing development. A portion of the Preferred Alternative would cross the steep drainage above Bailey Camp Creek and an unnamed tributary of the Yadkin River (jurisdictional crossing numbers 1, 2A, and 2B in Figure 3-9 in Chapter 3). Most of this alternative, however, is in the watershed of the Middle Fork New River, where US 321 crosses and parallels the Middle Fork for approximately 0.8 mile, crossing two of its tributaries (jurisdictional crossings 3 and 5) and the Middle Fork itself (jurisdictional crossing 4). Elevation gradients along the Preferred Alternative would be minor in comparison to the steeper gradients that characterize the other alternatives, and would, therefore, minimize the potential for erosion and sedimentation in receiving waters. Generally, streams within this

alternative have low-moderate gradient, meandering riffle-pool channels (see Section 3.10.2 in Chapter 3).

Bypass Alternatives 1A and 1B, with five crossings each, would affect the fewest streams. This route would cross the headwaters of the Middle Fork (jurisdictional crossing 6), and parallel an unnamed tributary of Middle Fork at its northern terminus (jurisdictional crossing 7). A large section of Bypass Alternative 1A would be within the headwaters of the Middle Fork. The terrain varies significantly but is substantially less severe than the gradients of Bypass Alternatives 4A and 4B. Streams within this alternative vary according to local topography, but are riffle-pool channels or high gradient, low sinuous, step-pool channels.

Bypass Alternative 4A would cross 20 streams (jurisdictional crossings 1, 8A to 12, 14 to 24), of which six would be bridged. Beginning at the southern terminus, Bypass Alternative 4A would cross numerous step-pool streams on the steep, undulating ridge and cove topography of the Blue Ridge escarpment. North of the Blue Ridge Parkway, Bypass Alternative 4A would negotiate less severe topography. Streams within this watershed are predominantly moderate gradient, riffle-pool streams.

Bypass Alternative 4B would follow a similar path along the escarpment as Bypass Alternative 4A. Again, 20 streams (jurisdictional crossings 1, 8A to 14, 16 to 24) would be crossed. However, this alternative would include 14 bridges, which would reduce impacts to soils and streams.

None of the alternatives would directly affect streams designated as Water Supply I (**WS-I**), Water Supply II (**WS-II**), High Quality Waters (**HQW**), or Outstanding Resource Waters (**ORW**). Middle Fork (crossed by the Preferred Alternative and Bypass Alternative 1A), however, is under special management to protect downstream waters designated as **ORW**, and Left Fork Mulberry Creek is designated a **HQW**.

Temporary construction impacts caused by erosion and sedimentation would be minimized through implementation of a stringent erosion control schedule and the use of NCDOT's Best Management Practices (BMPs). The contractor would follow contract specifications pertaining to erosion control measures as outlined in 23 CFR 650, Subpart B and Article 107-13 entitled "Control of Erosion, Siltation, and Pollution" (NCDOT, July 1995). These measures include the use of dikes, berms, silt basins, and other containment measures to control runoff; elimination of construction staging areas in floodplains and adjacent to waterways; re-seeding of herbaceous cover on disturbed sites; management of chemicals (herbicides, pesticides, de-icing compounds) with potential negative impacts on water quality; and avoidance of direct discharges into streams by catch basins and roadside vegetation.

The North Carolina Water Supply Watershed Protection Act of 1989 (House Bill 156) requires all local governments that have land-use jurisdiction within water supply watersheds, or a portion thereof, to be responsible for implementation and enforcement of nonpoint source management. In accordance with this act, Caldwell and Watauga Counties and the Town of Blowing Rock have adopted watershed protection ordinances requiring 30-foot stream buffers, density limits, and BMPs. However, while road crossings are exempt from locally-designated buffer area impacts, road-building activities should attempt to minimize the project footprint in buffer areas, direct runoff away from surface waters, and maximize the utilization of storm-water BMPs.

Short- and long-term impacts to stream geomorphology would be limited to stream reaches within the road footprint. Short-term impacts to stream reaches adjacent to the road footprint would be temporary and localized during construction and could include sediment deposition and

erosion. Long-term impacts to adjacent reaches, resulting from construction, could include altered surface flows resulting from increases in impervious surfaces, increased nutrient inputs, and various pollutants (e.g., volatile organic compounds [VOC]). Temporary and permanent containment and diversionary measures would be installed to control and filter roadside runoff. Impacts by stream realignment would be minimized through proper channel construction sequencing and adequate stabilization of the new stream bank through a combination of hardened structures and vegetation plantings.

4.9.2 Terrestrial Resource Impacts

The alternatives' construction footprint would range from a low of 58 acres for Bypass Alternative 4B to a high of 108 acres for Bypass Alternative 4A. The Preferred Alternative would result in adverse effects to the least amount of natural communities (27 acres). Implementation of Bypass Alternative 4A would result in the greatest habitat loss of the alternatives, because 93 acres of the 108 acres of affected plant communities is currently generally undisturbed, closed canopy forest. Potential plant community impacts within Bypass Alternatives 1A, 1B and 4B would include similar amounts of natural communities (39 to 47 acres). The Preferred Alternative would result in the least adverse impacts to wildlife because of the existing urbanized nature of its corridor (49 acres of the 76 acres of plant communities affected are classified as urban/disturbed). Long-term displacement would be expected for forest-interior species with Bypass Alternative 4A and to a lesser extent with Bypass Alternative 4B. There are no designated rare or unique natural areas within the project area.

Plant Community Impacts

Potential impacts to plant communities that would result from the five Build Alternatives reflect the relative abundance of communities within the project area. Table 4-24 lists the approximate coverage of plant communities within each alternative. Data presented in the table are based on the construction footprint contained in the preliminary designs for these alternatives (see Appendix D), aerial photography, and field reconnaissance.

Table 4-24. Areas of Each Plant Community by Alternative

Plant Community	Preferred Alternative	Bypass Alternative 1A	Bypass Alternative 1B	Bypass Alternative 4A	Bypass Alternative 4B
Chestnut Oak Forest	18 / 24% ¹	24 / 26%	28 / 33%	33 / 31%	17 / 29%
Cove Forest	9 / 12%	15 / 17%	12 / 14%	60 / 55%	30 / 52%
NATURAL PLANT COMMUNITY SUBTOTAL	27 / 36%	39 / 43%	40 / 47%	93 / 86%	47 / 81%
Pastoral	–	–	–	11 / 10%	8 / 14%
Urban/Disturbed	49 / 64%	55 / 57%	45 / 53%	4 / 4%	3 / 5%
TOTAL	76 / 100%	94 / 100%	85 / 100%	108 / 100%	58 / 100%

¹ Impact areas are given in acres / percent of total impact for each alternative

The construction footprints of the alternatives would range from a low of 58 acres for Bypass Alternative 4B to a high of 108 acres for Bypass Alternative 4A. Much of the Preferred Alternative would be within residentially and commercially developed areas of Blowing Rock

and existing road rights-of-way, where urban/disturbed land, characterized by a high degree of impervious surface, is the dominant mapped community (64 percent). The Preferred Alternative would result in adverse affects to the least amount of natural communities (chestnut oak forest and cove forest).

Potential plant community impacts within Bypass Alternatives 1A, 1B and 4B would include similar amounts of natural communities (39 to 47 acres). The areas of disturbed land within Bypass Alternatives 1A and 1B would include more residential land and less commercial land as compared to the Preferred Alternative. Land disturbed and maintained for residential use is typically characterized by a greater coverage of vegetation and more diverse vegetation and smaller impervious surfaces than areas maintained for commercial use.

Bypass Alternative 4A would include both the greatest amount of land and the greatest coverage of natural communities (93 acres). Natural communities within Bypass Alternatives 4A and 4B are more remote and less disturbed regions than those of the other alternatives.

Wildlife Impacts

Forest fragmentation and loss of wildlife habitat are unavoidable consequences of highway development. However, depending upon the alternative, a varying degree of wildlife impacts would be expected. In addition, the adaptability of wildlife species would determine their reaction to highway construction. Species habituated to human disturbance (raccoon, opossum, white-tailed deer, American crow, northern mockingbird, rat snake) would respond to construction with only short-term displacement. At the other end of the spectrum, species that avoid habitat edges (including new edges created by a road project's fragmentation of habitat), known as forest-interior species (e.g., some neotropical migrant birds such as wood thrush and ovenbird), as well as species with a low tolerance for environmental pollutants (many fish, most frogs and salamanders), and species with a general tendency to avoid human disturbance (e.g., black bear) would likely be eliminated from the vicinity of the constructed alternative.

Impacts to aquatic species would result from habitat loss or degradation of water quality. Minor to moderate stream modifications would be expected in connection with culvert extensions, culvert installation and stream channel modifications. These modifications could lead to various short-term and long-term impacts to aquatic wildlife. Short-term impacts would include loss of existing riparian vegetation and increased turbidity and sedimentation associated with construction. Long-term impacts would include loss of streambed habitat, increase in stream velocities and migration barriers if culverts were installed improperly. Impacts to aquatic life would be minimized with the implementation of an erosion control plan (see Section 4.16.6) during the construction phase and with proper design and installation of culverts and relocated channels.

The Preferred Alternative would result in the least adverse impacts to wildlife because of the existing urbanized nature of its corridor (only 27 of the affected 76 acres of plant communities are relatively undisturbed at present). No additional fragmentation would result from this alternative because it would follow the existing road. Short-term displacement of local wildlife populations would occur during and immediately following construction. Most local species are habituated to man-made disturbances and would be expected to move back into the vicinity of the construction area. Movement through the area would become more dangerous for many transient species because of the increase in width of the new roadway. The Preferred Alternative would be unlikely to affect economically important game species because of the alternative's urban and suburban setting. Culvert extensions at the six stream crossings would have minimal impact to aquatic species.

Implementation of Bypass Alternatives 1A or 1B would have intermediate impacts in comparison to the other alternatives. Implementation of one of these alternatives would result in the loss of 85 to 94 acres of plant communities, although 45 to 55 acres for each alternative is currently subject to some kind of maintained or disturbed state. Approximately 0.5 mile of both alternatives would result in fragmentation of natural forests on the Blue Ridge escarpment; however, this new fragmentation is in close proximity to areas that are currently disturbed. Disturbed areas along these alternatives are primarily residential development and are characterized by substantial canopy cover and habitat for species habituated to anthropogenic activities. The effect of Bypass Alternatives 1A and 1B on economically important game species would be slight, as little of these alternatives would occur in undisturbed areas outside of Blowing Rock town limits. Stream culverts would continue to allow limited movement of terrestrial and aquatic species across the highway corridor. Potential short and long term impacts of culverts to aquatic species would include those listed above.

Implementation of Bypass Alternative 4A would result in the greatest habitat loss of the alternatives, because 93 acres of the 108 acres of affected plant communities are generally undisturbed, closed canopy forest. Additionally, some of the affected areas, found both on the escarpment and north of the Blue Ridge Parkway on the Blue Ridge plateau, are remote. Removal of these communities would generate over 2.0 miles of cleared highway corridor through previously undisturbed areas. The primary impacts to animal life would occur from direct removal of the large and the structurally complex forest habitat by cutting, filling, clearing, grading and paving. This change would result in the reduction in wildlife diversity and a population composition change that would include more species adapted to anthropogenic disturbance near the alternative's corridor and between the alternative's corridor and Blowing Rock. Since immediately adjacent habitat of similar type would be undisturbed, animals such as small mammals, many passerine birds and reptiles would be able to reestablish themselves in adjacent undisturbed areas. Songbirds and small mammal populations in the area enjoy sufficient mobility to find suitable habitats in proximity to the disturbed area. Bridged sections of this alignment would allow for migration of terrestrial animals along riparian and valley slopes. Stream culverts would continue to allow terrestrial and aquatic species limited movement across the highway corridor. Potential short and long-term impacts of culverts to aquatic species would include those listed above.

Long-term displacement would be expected for forest-interior species. Movement through the area would become more dangerous and restrictive for many transient species because of the presence of new barriers and traffic. The effect on economically important game species would be mixed. Habitat fragmentation would improve habitat for some species (i.e., white-tailed deer, eastern cottontail, groundhog and raccoon) and degrade habitat for other species (i.e., black bear, wild turkey and wild boar).

While following a similar path as Bypass Alternative 4A, Bypass Alternative 4B would result in substantially less plant community impact and fragmentation. Extensive use of bridging by Bypass Alternative 4B would result in the smallest amount of plant community impacts (58 acres) of the five Build Alternatives and would ameliorate remaining impacts by spanning valleys and associated riparian corridors. Implementation of this alternative would require construction of haul roads to reach the isolated cut and fill areas and bridgework. Approximately 2.0 miles of haul roads would be cleared through previously undisturbed areas. As with Bypass Alternative 4A, much of the affected areas are relatively remote and include primarily undisturbed, closed canopy forest (47 out of 58 acres is undisturbed). In portions of the alignment that would not be bridged, potential impacts to habitat would be similar to those expected for Bypass Alternative

4A. The extensive bridging proposed for Bypass Alternative 4B would allow terrestrial species passage across the highway corridor and minimize impacts to stream habitat.

Rare and Unique Natural Areas

There are no designated rare or unique natural areas identified within the project area according to Natural Heritage Program (NHP) records. Thus, no impacts would occur with any of the alternatives.

4.9.3 Jurisdictional Area Impacts

Jurisdictional areas are streams and wetlands regulated by the USACE, as described in Section 3.10.2 in Chapter 3. Bypass Alternatives 1A and 1B would have the least amount of jurisdictional stream impacts (580 to 730 feet). Jurisdictional streams would be affected the most by Bypass Alternative 4A (5,935 feet). Bypass Alternative 4B, which shares a similar route as Bypass Alternative 4A, would reduce jurisdictional impacts in this corridor substantially (to 1,120 feet) by incorporating additional bridges. The Preferred Alternative would have similar stream impacts to Bypass Alternative 4B (1,440 feet). All alternatives would affect less than an acre of wetlands. Impacts to jurisdictional areas would require a permit from the USACE. A review of potential stream restoration sites surrounding the project area indicates that adequate options exist to offset stream impacts associated with any of the five Build Alternatives.

Impacts

The five Build Alternatives would infringe upon existing jurisdictional areas (open waters and vegetated wetlands). Total jurisdictional areas within each of the five alternative corridors are tabulated in Table 4-25 to Table 4-29 and summarized in Table 4-30. These areas are based on the construction limits presented in the preliminary designs found in Appendix D. Bypass Alternatives 1A and 1B would have the least amount of jurisdictional impacts, including no wetland impacts and 580 linear feet and 730 linear feet of stream impacts, respectively. Jurisdictional areas would be affected the most by Bypass Alternative 4A with approximately 5,935 linear feet of stream impacts and 0.09 acre of wetlands. Bypass Alternative 4B, which shares a similar route as Bypass Alternative 4A, would minimize jurisdictional impacts with additional bridges, reducing the impacts to 1,120 linear feet of stream and 0.01 acre of wetland. The Preferred Alternative would have approximately 1,440 linear feet of stream impacts and 0.07 acre of wetland impacts.

In most cases, affected streams would be crossed perpendicularly with the use of a culvert. In some cases, the impact would involve a parallel fill (see Table 4-31). Parallel fills refer to streams that run parallel to the new alignment and must be filled and moved in order to accommodate the new roadway. Three of the alternatives, the Preferred Alternative, Bypass Alternative 1B, and Bypass Alternative 4B, would contain parallel fills.

Bypass Alternative 1B would contain 590 linear feet of parallel fill in streams. This would account for over 80 percent of the 730 linear feet of streams affected by Bypass Alternative 1B. Bypass Alternative 4B would contain 125 linear feet of parallel fill in streams. This would account for less than 15 percent of the nearly 1,120 linear feet of streams affected by Bypass Alternative 4B. The Preferred Alternative would contain 1,070 feet of parallel fill in streams. This would account for 74 percent of the 1,440 linear feet of streams affected by the Preferred Alternative and be the greatest parallel stream impact of all the Build Alternatives.

Table 4-25. Jurisdictional areas that Occur Within the Construction Limits of the Preferred Alternative

Crossing Number	Streams ¹			Wetland Impacts
	Total Impacts	Culverted Length	Parallel Fill	
1	200 / 0.04	200 / 0.04	–	–
2	1,045 / 0.24	50 / 0.01	995 / 0.23	0.07
3	75 / 0.01	–	75 / 0.01	–
4	100 / 0.01	100 / 0.01	–	–
5	20 / 0.00	20 / 0.00	–	–
TOTAL	1,440 / 0.30	370 / 0.06	1,070 / 0.24	0.07

¹ Stream impacts include both culverted streams, filled streams and streams adjacent to the proposed alignment to be moved (i.e., parallel fill). Stream impacts are given in linear feet / acres. Wetland impacts are measured in acres. Crossing numbers are depicted in Figure 3-9 in Chapter 3. Impacts shown in bold are impacts identified as wholly or partially avoidable as discussed below under “Mitigation.”

Table 4-26. Jurisdictional Areas that Occur Within the Construction Limits of Bypass Alternative 1A

Crossing Number	Streams ¹			Wetland Impacts
	Total Impacts	Culverted Length	Parallel Fill	
1	250 / 0.06	250 / 0.06	–	–
7	330 / 0.06	140 / 0.01	190 / 0.05	–
TOTAL	580 / 0.12	390 / 0.07	190 / 0.05	–

¹ Stream impacts include both culverted streams, filled streams and streams adjacent to the proposed alignment to be moved (i.e., parallel fill). Stream impacts are given in linear feet / acres. Wetland impacts are measured in acres. Crossing numbers are depicted in Figure 3-9 in Chapter 3. Impacts shown in bold are impacts identified as wholly or partially avoidable as discussed below under “Mitigation.”

Table 4-27. Jurisdictional Areas that Occur Within the Construction Limits of Bypass Alternative 1B

Crossing Number	Streams ¹			Wetland Impacts
	Total Impacts	Culverted Length	Parallel Fill	
2	400 / 0.09	–	400 / 0.09	–
7	330 / 0.06	140 / 0.01	190 / 0.05	–
TOTAL	730 / 0.15	140 / 0.01	590 / 0.14	–

¹ Stream impacts include both culverted streams, filled streams and streams adjacent to the proposed alignment to be moved (i.e., parallel fill). Stream impacts are given in linear feet / acres. Wetland impacts are measured in acres. Crossing numbers are depicted in Figure 3-9 in Chapter 3. Impacts shown in bold are impacts identified as wholly or partially avoidable as discussed below under “Mitigation.”

Table 4-28. Jurisdictional Areas that Occur Within the Construction Limits of Bypass Alternative 4A.

Crossing Number	Streams ¹			Wetland Impacts
	Total Impacts	Culverted Length	Parallel Fill	
1	475 / 0.09	475 / 0.09	–	–
9	725 / 0.20	725 / 0.20	–	–
10	675 / 0.21	675 / 0.21	–	–
11	150 / 0.03	150 / 0.03	–	–
14	625 / 0.14	625 / 0.14	–	–
15	225 / 0.05	225 / 0.05	–	–
16	400 / 0.11	400 / 0.11	–	–
17	1,350 / 0.31	1,350 / 0.31	–	–
18	200 / 0.06	200 / 0.06	–	–
19	20 / 0.00	20 / 0.00	–	–
20	390 / 0.17	390 / 0.17	–	–
21	325 / 0.06	325 / 0.06	–	–
22	375 / 0.11	375 / 0.11	–	–
23	–	–	–	0.09
TOTAL	5,935 / 1.53	5,935 / 1.53	–	0.09

¹ Stream impacts include both culverted streams, filled streams and streams adjacent to the proposed alignment to be moved (i.e., parallel fill). Stream impacts are given in linear feet / acres. Wetland impacts are measured in acres. Crossing numbers are depicted in Figure 3-9 in Chapter 3. Impacts shown in bold are impacts identified as wholly or partially avoidable as discussed below under “Mitigation.”

Table 4-29. Jurisdictional Areas that Occur Within the Construction Limits of Bypass Alternative 4B

Crossing Number	Streams ¹			Wetland Impacts
	Total Impacts	Culverted Length	Parallel Fill	
1	75 / 0.01	–	75 / 0.01	–
12	350 / 0.08	350 / 0.08	–	–
13	10 / 0.00	10 / 0.00	–	–
16	325 / 0.07	325 / 0.07	–	–
18	160 / 0.04	160 / 0.04	–	–
19	150 / 0.03	150 / 0.03	–	–
20	50 / 0.02	–	50 / 0.02	–
23	–	–	–	0.01
TOTAL	1,120 / 0.27	995 / 0.24	125 / 0.04	0.01

¹ Stream impacts include both culverted streams, filled streams and streams adjacent to the proposed alignment to be moved (i.e., parallel fill). Stream impacts are given in linear feet / acres. Wetland impacts are measured in acres (hectares). Crossing numbers are depicted in Figure 3-9 in Chapter 3. Impacts shown in bold are impacts identified as wholly or partially avoidable as discussed below under “Mitigation.”

Table 4-30. Jurisdictional Streams and Wetlands Within Each Alternative

Alternatives	Stream Crossing Total	Streams Impacted ¹	Total Stream Impacts ²	Total Wetland Impacts ³
Preferred Alternative	5	5	1,440 / 0.30	0.07
Bypass Alternative 1A	4	2	580 / 0.12	–
Bypass Alternative 1B	5	2	730 / 0.15	–
Bypass Alternative 4A	19	13	5,935 / 1.53	0.09
Bypass Alternative 4B	21	7	1,120 / 0.27	0.01

¹ A jurisdictional crossing may contain multiple streams and associated wetlands

² Stream impacts are measured in linear feet / acres.

³ Wetland impacts are measured in acres.

Table 4-31. Alternatives that Contain Streams Affected by Parallel Fill

Alternatives	Crossing Number ¹	Parallel Fill Impacts ²
Preferred Alternative	2	995 / 0.23
	3	75 / 0.01
Bypass Alternative 1A	7	190 / 0.05
Bypass Alternative 1B	2	400 / 0.09
	7	190 / 0.05
Bypass Alternative 4B	1	75 / 0.01
	20	50 / 0.02

¹ Refers to crossing numbers in Figure 3-9 in Chapter 3.

² Parallel fill impacts are given in feet / acres.

Permitting

Impacts to jurisdictional areas would require a permit from the USACE. Permits would be required for encroachment into jurisdictional wetlands/surface waters regardless of the chosen alternative and final alignment. The USACE in their comments on the DEIS indicated that an individual permit would be required rather than a nationwide or general permit.

Section 401 of the Clean Water Act requires each state to certify that state water quality standards would not be violated for activities that: 1) involve issuance of a federal permit or license; or 2) require discharges to “waters of the United States.” The USACE cannot issue a Section 404 permit until Section 401 certification is issued. Therefore, the NCDOT would need to apply to North Carolina Department of Water Quality (NCDWQ) for Section 401 certification as part of the USACE permit process.

Caldwell and Watauga counties are among the 25 mountain counties designated as having trout waters. Projects in trout waters require review by the NC Wildlife Resources Commission (NCWRC). Several streams in the project area, including the Middle Fork, Bailey Camp Creek, an unnamed tributary to the Yadkin River, Martin Branch, Aho Branch, and an unnamed tributary to Aho Branch are designated by the NCWRC as Public Mountain Trout Waters and are managed under Hatchery Supported Regulations.

Mitigation

Mitigation policy is recommended in accordance with Section 404(b)(1) Guidelines of the Clean Water Act (40 CFR 230), mitigation policy mandates articulated in a USACE/US Environmental Protection Agency (USEPA) MOA; Page and Wilcher (1990), Executive Order 11990 (42 FR 26961 [1977]), and US Fish and Wildlife Service (USFWS) mitigation policy directives (46 FR 7644-7663 [1981]).

Mitigation is defined as efforts that a) avoid, b) minimize, c) rectify, d) reduce or eliminate, or e) compensate for adverse impacts to the environment. Section 404(b)(1) Guidelines, the USACE/USEPA MOA, and Executive Order 11990 stress avoidance and minimization as primary considerations. Avoidance and minimization must be fully evaluated before compensatory mitigation can be discussed.

The USFWS policy also emphasizes avoidance and minimization. However, for unavoidable losses, mitigation efforts should be based on the value and scarcity of the habitat at risk. Methods used to achieve this goal include the physical modification of replacement habitat for conversion to the type that is lost; restoration of previously altered habitat; increased management of similar replacement habitat so that in-kind value of the lost habitat is replaced; or a method combining any or all parts of these measures.

Existing policy guidelines on mitigation sequencing would be employed for this project. Measures to avoid, minimize, and compensate for wetland impacts would be employed in descending order of priority where feasible.

Decisions on whether the Preferred Alternative avoided or minimized jurisdictional area impacts to the extent practicable were made at the NEPA/404 Merger Team's Concurrence Point 4A/2A meeting on April 20, 2004. (See Section 7.10.2 of Chapter 7 for a description of that meeting.) Additional information presented at the meeting on the characteristics of jurisdictional areas affected and the impacts of the Preferred Alternative are shown in Table 4-32 and Table 4-33.

Avoidance. All alternatives would contain jurisdictional areas, so complete avoidance is not possible by selection of one alternative over another. Bridging jurisdictional systems is proposed in the preliminary designs for the larger stream systems. Additional avoidance could be achieved through use of bottomless culverts, replacement of fill slopes and additional bridging at locations noted in Table 4-25 to Table 4-29. Identified avoidance areas include most of the wetlands impacts within the project area (jurisdictional crossings 2 and 23), as well as stream segments identified as parallel fill in Bypass Alternatives 1B and 4B.

The practicability of avoiding the impacts was addressed during the Merger Team's Concurrence Point 4A/2A meeting for the Preferred Alternative. Jurisdictional crossing 4 represents the only major stream crossing affected by the Preferred Alternative. Avoiding this impact and impacts to jurisdictional system 5 are not practicable because the existing road crosses these streams. Avoidance of jurisdictional systems 1, 2, 3, which parallel US 321, were not considered practicable because of added community impacts and cost associated with the design changes needed to avoid the impact. The Merger Team's concurrence on these avoidance efforts is documented on concurrence forms found in Appendix F.

Not placing staging areas in lowland sites, careful containment of toxic or hazardous materials near creeks and tributaries, and employment of strict erosion and sediment control procedures are practices that would be employed to avoid impacts to wetlands adjacent to the project during construction.

Table 4-32. Preferred Alternative Stream Characteristics and Impact

Stream Number	Streams Characteristics						Stream Impacts			
	Stream Name	Width (feet)	Depth (feet)	Best Usage Classification	Perennial or Intermittent	DWQ Stream Classification Rating	Total Impacts		Lateral-Culvert (feet/acres)	Longitudinal-Parallel Fill (feet/acres)
							Feet	Acres		
1	UT ¹ to Yadkin River	8	1.0	CTr ²	Perennial	22.5	200	0.04	200/.04	--
2	UT to Yadkin River	10	1.0	CTr	Perennial	23.5	1,645	0.24	50/.01	995/.23
2A	UT to Yadkin River	8	0.5	CTr	Perennial	15.5	--	--	--	--
3	UT to Middle Fork	3	0.5	WS-IV+ ³	Perennial	13.5	75	0.01	--	75/.07
4	Middle Fork	15	2.0	WS-IV+	Perennial	31.5	100	0.01	100/0.01	--
5	UT to Middle Fork	8	0.5	WS-IV+	Perennial	19.0	20	0.00	20/0.00	--
Totals							1,440	0.30	370/0.06	1,070/30

¹ Upper Tributary

² "C" denotes Aquatic life propagation and survival, fishing, wildlife, secondary recreation, and Agriculture. "Tr" denotes a stream as suitable for natural trout propagation and maintenance of stocked trout.

³ "WS-IV" denotes waters which are protected as water supplies and generally located in moderately to highly developed watersheds. "+" designation indicates that these waters are subject to a special management strategy concerning storm water controls and water quality standards in order to protect downstream waters designated as Outstanding Resource Waters.

Table 4-33. Preferred Alternative Wetland Characteristics and Impact

System Number	Wetland Type (Cowardin Classification)	DWQ Rating	Riverine or Non-Riverine	Isolated or Contiguous	Parallel Impacts (acres)
2	PSS6/7	55	Riverine	Contiguous	0.07

Minimization. Because many of the jurisdictional areas are bank-to-bank systems, with little if any adjacent wetlands, construction of culverts with cross-sectional areas at least equal to the original stream channel would minimize impacts upon such areas. Reductions of fill slopes, canopy removal in or near floodplain systems, and reductions of median widths at stream/wetland crossings could reduce jurisdictional stream and wetland losses.

The minimization of impacts was addressed during the Merger Team’s Concurrence Point 4A/2A meeting for the Preferred Alternative. It was agreed that at jurisdictional crossing 4, a replacement of the existing culvert would be the appropriate structure for the Preferred Alternative at this location. Table 4-34 lists the design characteristics of this structure. One component of the decision on whether to include a culvert was whether species that potential trigger a high quality resource designation were at the stream location under consideration. Such species in the project area are shown in Table 4-35. The team agreed that these species are not present at jurisdictional crossing 4.

Table 4-34. Major Stream Crossing

System Number	Name	Existing Structure		Required Structure		Estimated Construction Cost
		Design Characteristics	Length	Design Characteristics	Length	
4	Middle Fork of the New River	2 @ 8’ X 6’ Reinforced Concrete Box Culvert	44 feet	Extend existing structure.	94 feet	\$96,000.00

Table 4-35. Species Potentially Triggering High Quality Resource Designation.¹

Common Name	Scientific Name	County	State Ranking ²
Bog Turtle	<i>Clemmys muhlenbergii</i>	Watauga	S2G3
Kanawha minnow	<i>Phenacobius teretulus</i>	Watauga	S2G3G4
Green floater	<i>Lasmigona subviridis</i>	Watauga	S1G3
Brook floater	<i>Alasmidonta varicosa</i>	Caldwell and Watauga	S1G3
Bent avens	<i>Geum geniculatum</i>	Caldwell and Watauga	S2G2

¹ Species have not been surveyed in the project area. They may or may not exist.

² <http://ils.unc.edu/parkproject/nhp/inven.htm>

It was agreed that a retaining wall would be used to reduce the 0.07-acre impact on wetlands associated with jurisdictional crossing 2. The retaining wall would be included in the final design of the Preferred Alternative in the area of design stations 679+00 to 681+00. At the other locations where jurisdictional areas would be affected by the Preferred Alternative, it was agreed that the design depicted in the DEIS and FEIS minimized impacts. The Merger Team's concurrence on these minimization efforts is documented on concurrence forms found in the Appendix F.

Compensation. Since avoidance and minimization would be emphasized, only minor jurisdictional wetland area loss would occur. However, impacts to streams, depending on the alternative, would be great enough to require compensatory mitigation. The on-site relocation of streams affected by parallel fills could provide the mitigation needed at these sites. Compensatory mitigation is recommended for all additional unavoidable stream and wetland losses. A few on-site restoration opportunities are available in or near the project area and would be investigated further during mitigation planning for the preferred alternative. A review of potential mitigation sites was conducted. Refer to Figure 4-13 for the location of these sites. Brief descriptions of these sites are as follows:

- Stream restoration is available for approximately 500 linear feet of the unnamed tributary to Middle Fork that parallels Possum Hollow Road (Site 1 on Figure 4-13). The lower reach segment of stream was channelized and is devoid of riparian vegetation. Remnants of the old channel remain on the adjacent, abandoned floodplain. Restoration efforts would attempt to target natural channel conditions of the stream prior to disturbance. Stream restoration could include channel reconfiguration/construction, bank stabilization and buffer reforestation.
- Stream restoration is available for several degraded streams because of livestock activity (Sites 2, 3, 4). The lack of fencing adjacent to these tributaries has allowed livestock access to the channel, causing bank erosion and channel entrenchment. Restoration efforts could include channel reconfiguration/construction, bank stabilization, buffer reforestation and exclusion of livestock from the channel. Based on the review of potential sites, Sites 2, 3 and 4 combined contain approximately 2,500 linear feet of stream that are potentially available for stream mitigation activities. Site 3 also contains recent fill material over a wet meadow plant community, which could afford approximately 0.5 acre of wetland restoration.
- Stream restoration could be available for portions of the trout-supporting waters of Aho Branch and its unnamed tributary as result of areas exposed by a breached impoundment and agricultural practices (Site 5). The channels are experiencing severe degradation, including entrenchment, erosion sedimentation and bank collapse. Wetland restoration/enhancement also could be available in the adjacent floodplain. Disturbances from land clearing and flooding have decreased wetland functions. Stream restoration activities and reforestation should enhance or restore wetland functions. Stream restoration activities could include channel reconfiguration/construction, bank stabilization and buffer reforestation. Based on preliminary analysis approximately 3,300 linear feet of stream could be available for restoration activities
- Additional mitigation opportunities could include removal of old fill material from the vicinity of jurisdictional areas, enhancement of stream corridors within and downstream of developed areas and preservation of riparian fringe forests through conservation easements.

Figure 4-13. Potential Stream Mitigation Sites

This review of potential stream restoration sites surrounding the project area indicates the potential for adequate options to offset stream impacts associated with any of the five Build Alternatives. A specific mitigation program for the Preferred Alternative would be developed during final design and the permit application process.

If the above opportunities do not provide needed compensatory mitigation, off-site mitigation options would be investigated. In accordance with the “Memorandum of Agreement Among the North Carolina Department of Environment and Natural Resources [NCDENR], the NCDOT, and the USACE, Wilmington District,” July 22, 2003, the NCDENR’s Ecosystem Enhancement Program (EEP), would be requested to provide off-site mitigation to satisfy the federal Clean Water Act compensatory mitigation requirements for the preferred alternative.

Wetlands Finding

Based on the above considerations, it is determined that there is no practicable alternative to the proposed construction in wetlands, and that the proposed action includes all practicable measures to minimize harm to these resources.

4.9.4 Threatened or Endangered Species

The project area contains appropriate habitat for only one Federally listed Endangered or Threatened species, Heller’s blazing star. Based on systematic searches conducted within areas of suitable habitat along the Preferred Alternative during the flowering period, it was concluded that the Preferred Alternative may affect, but is not likely to adversely affect, Heller's blazing star. No impacts are expected by the Build Alternatives to the other Federally-listed species in the counties containing the proposed project (see Table 3-21 in Chapter 3).

Bog turtle is a small turtle reaching an adult size of approximately 3 to 4 inches. This otherwise darkly-colored species is readily identifiable by the presence of a bright orange or yellow blotch on the sides of the head and neck (Martof *et. al.* 1980). The bog turtle population has declined drastically within the northern portion of its range because of over-collection and habitat alteration. As a result, the bog turtle is listed as Threatened within the northern portion of its range, and as Threatened because of Similarity of Appearance (T[S/A]) to the northern population within the southern portion of its range, which includes North Carolina. The listing bans the collection and interstate and international commercial trade of bog turtles from the southern population. The listing allows incidental take of bog turtles in the southern population resulting from otherwise lawful activity.

The bog turtle is typically found in bogs, marshes and wet pastures, usually in association with aquatic or semi-aquatic vegetation and small, shallow streams over soft bottoms (Palmer and Braswell 1995). In North Carolina, bog turtles have a discontinuous distribution in the mountains and western Piedmont. The NC Natural Heritage Program (NCNHP) records indicate no documented occurrences of bog turtle within 2.0 miles of the project area.

Landscape and drainage alteration by humans and continual disturbance in commercial and residential areas make it is highly unlikely that bog turtles occur in the project area wetlands. However, the emergent wetlands found near the northern terminus of Alternatives 4A and 4B (jurisdictional crossing 23 shown on Figure 3-9 in Chapter 3) could contain habitat suitable for the bog turtle. No detailed field surveys of the bog turtle were conducted.

T(S/A) species are not subject to Section 7 (of the Endangered Species Act) consultation with the USFWS and a biological conclusion is not required.

Northern flying squirrel is a nocturnal denizen of mixed and coniferous forests in the northern United States and Canada. Adults range in size from 10.5 to 12.5 inches long. This squirrel has a loose, furred fold of skin on each side of the body between the wrists and the ankles, which can be spread to form wings for gliding. The northern flying squirrel is known from high-elevation, isolated pockets in the mountains of North Carolina, including Roan Mountain, Mt. Mitchell, and The Great Smokey Mountains (Weigl, 1987).

BIOLOGICAL CONCLUSION: NCNHP records indicate no documented occurrences of the northern flying squirrel within 2.0 miles of the project area, and no flying squirrels were observed during field surveys. No project alternatives would adversely affect the northern flying squirrel because of an absence of appropriate habitat (high-elevation spruce-fir forests) within the project area. **NO EFFECT**

Spreading Avens is an erect, densely hairy, perennial herb ranging to 20 inches tall. A basal rosette of odd-pinnately compound leaves is produced from a horizontal rhizome. These leaves are long stalked and terminated by a large kidney-shaped lobe; tiny leaflets are usually present below the terminal lobe (Kral, 1983). Small, sessile, serrated leaves are found on the flowering stem. Lanceolate sepals and relatively long petal lengths of 0.5 to 0.8 inches help differentiate spreading avens from related species (Massey et al., 1983). Bright yellow, five-petaled flowers approximately 2.4 to 3.1 inches across are produced from June to August; these are followed between July and October by hairy achenes with a persistent, straight style approximately 0.2 inches long (Massey et al., 1983). Vegetative parts emerge in May and persist through October.

Spreading avens usually occurs at elevations greater than 5,000 feet in mountain grass balds, grassy clearings in heath balds, as well as in crevices of granitic rock. Spreading avens cannot tolerate shading or crowding (Kral, 1983). Spreading avens is found in a few northwestern counties of North Carolina, and in nearby counties of Tennessee.

BIOLOGICAL CONCLUSION: NCNHP records indicate that spreading avens has not been documented within 2.0 miles of the project area, and spreading avens was not observed during the field visit. No project alternative would adversely affect spreading avens because of a lack of potential habitat (elevations greater than 5,000 feet and mountain balds) within the project area. **NO EFFECT**

Roan Mountain bluet, formerly treated as a variety of the summer bluet (*Houstonia* [= *Hedyotis*] *purpurea*), is a low, erect to spreading perennial herb with a squarish stem, typically growing to 6 inches high. The leaves are opposite, sessile, rounded basally but taper to a pointed tip and have smooth, toothless margins. Small, deep purple, tubular flowers are produced on small terminal clusters in June and July with fruiting occurring in July and August. It differs from the more common *H. purpurea* by having larger, smooth-edged leaves, and by larger flowers, capsules and seeds (Weakley, unpublished).

Roan Mountain bluet is endemic to the high Blue Ridge Mountains of North Carolina and Tennessee, mostly from 4,200 to 6,300 feet in elevation. It grows in crevices of rock outcrops as well as in thin, gravelly soils of grassy balds near summit outcrops (Weakley, 1993).

BIOLOGICAL CONCLUSION: NCNHP records indicate no documented occurrences of the Roan Mountain bluet within 2.0 miles of the project area, and none were observed during field surveys. No project alternative would adversely affect Roan Mountain bluet because of an absence of appropriate habitat (rock outcrops and grassy balds) within the project area. **NO EFFECT**

Heller's blazing star is an erect herbaceous perennial with glabrous stems that reaches heights of 4 to 20 inches. The leaves are simple, linear to lanceolate, alternate and arranged spirally along the stem. Leaf size is variable, with a gradual decrease in size up the stem. The inflorescence consists of compact heads arranged in a raceme-like fashion along the stem. The heads typically contain seven to ten tubular florets, which may be purple to lavender in color. Heller's blazing star is distinguished from related species by shorter height and relatively short pappus (modified calyx lobes), half or less of the length of the corolla tube. Flowers are produced from July to September, with fruiting occurring from August to October (Massey et al., 1983).

Heller's blazing star has been found on rocky summits at high elevations in the mountains of western North Carolina. This species typically is found in full sun growing in shallow, acidic soils on or around granitic outcrops, ledges and cliff faces (Kral, 1983; Massey et al., 1983).

An August 2003 protected species survey during the flowering period determined that there are rock outcroppings, ledges, and cliffs presenting suitable habitat for Heller's blazing star at five sites along US 321. None of these five sites, however, are natural rock outcroppings. They are bedrock exposed from the existing road cut. The sites range from approximately 15 to 100 feet in height above the road surface and receive full to partial sun exposure with southeast, east, or northeast facing slopes. All the sites exhibit scattered, small ledges and crevices along the rock face with shallow soil supporting herbaceous and woody vegetation. During the survey of these five sites, neither Heller's blazing star, nor any other *Liatris* species, was found. Incidental plants observed on vegetated areas of rock faces and ledges were blue curls (*Trichostema dichotomum*), hawkweed (*Heiracium* sp.), evening primrose (*Oenothera biennis*), common mullein (*Verbascum thapsus*), spotted knapweed (*Centaurea biebersteinii*), saxifrage (*Saxifraga* sp.), goldenrod (*Solidago* sp.), sunflower (*Helianthus* sp.), greater coreopsis (*Coreopsis major*), aster (*Aster* sp.), narrow-leaved vetch (*Vicia angustifolia*), Deptford pink (*Dianthus armeria*), staghorn sumac (*Rhus hirta*), winged sumac (*Rhus copallinum*), blackberry (*Rubus* sp.), Virginia pine (*Pinus virginiana*), mountain laurel (*Kalmia latifolia*), blueberry (*Vaccinium* sp.) and bracken fern (*Pteridium aquilinum*).

BIOLOGICAL CONCLUSION: Heller's blazing star was documented approximately 0.2 mile west of the project area near *The Blowing Rock* (NCNHP records), but not within the project area. Suitable habitat for this species (granitic outcrops) occurs in the project area; however, a field survey along the Preferred Alternative during the flowering period found no examples of this species. **MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT**

Spruce-fir moss spider inhabits moss mats that grow on rocks and boulders under high-altitude spruce-fir forests in the southern Appalachian Mountains. Adults are 0.1 to 0.2 inches in length. This species is extremely vulnerable to desiccation, and is adapted to the high rainfall of these mountains and the moist environment provided by the mosses (Harp, 1992).

BIOLOGICAL CONCLUSION: NCNHP records indicate no documented occurrences of the spruce-fir moss spider within 2.0 miles of the project area. No project alternative would adversely affect northern spruce-fir moss spider because of an absence of appropriate habitat (high-elevation spruce-fir forests) within the project area. **NO EFFECT**

Dwarf-flowered heartleaf is a small, spicy-smelling, rhizomatous perennial herb with long-stalked leaves and flowers. Leaves are heart-shaped, evergreen, leathery, and dark green above and paler below; the upper leaf surface is often patterned with pale green reticulate mottles. The leaves grow to about 2.4 inches in length and form a dense, spreading rosette. The flowers, which appear in April and May, are solitary, flask-shaped, fleshy and firm, and have three triangular

lobes. This species differs from related species by having smaller flowers with calyx tubes that narrow distally rather than broaden (Kral 1983).

Dwarf-flowering heartleaf is found in acidic sandy loam on north-facing wooded slopes of ravines in the Piedmont of North and South Carolina. This species typically occurs in oak-hickory-pine forest where hydrologic conditions range from moist to relatively dry, but also may be present in adjacent pastured woodland. This species typically is found in or under moist duff at the bases of trees or mountain laurel (*Kalmia latifolia*) (Kral 1983). In North Carolina, dwarf-flowered heartleaf is known from a few southwestern Piedmont counties (Amoroso and Finnegan 2004).

A thorough search of suitable habitat for dwarf-flowered heartleaf along an approximately 1.9-mile section of the Preferred Alternative in Caldwell County, on the headwaters of an unnamed tributary to the Yadkin River south of the Green Park Inn, failed to disclose any individuals of the genus *Hexastylis*. It was expected that any occurrences of this evergreen genus would be readily observed, since very few understory plants were green and actively growing during the field surveys (one exception was an unknown plant in the family Asteraceae). In addition, leaf litter from the previous autumn was partially decomposed and did not obscure ground-level plants to a substantial degree.

BIOLOGICAL CONCLUSION: The NCNHP does not record any occurrences of dwarf-flowered heartleaf within 2 miles of the Preferred Alternative. Although suitable habitat for the plant is present along an approximately 1.9-mile section of the Preferred Alternative, a thorough search in March 2006 failed to disclose any individuals in its genus. Based on NCNHP data, systematic searches, and professional judgment, the Biological Conclusion is NO EFFECT.

The Virginia big-eared bat (*Corynorhinus townsendii virginianus*) is a subspecies of Townsend's big-eared bat. It is listed as federally endangered by the US Fish and Wildlife Service. It is listed by the State of North Carolina as a rare and endangered species. It is a medium-sized bat with forearms measuring 1.5 to 1.9 inches long and weighing 0.25 to 0.42 ounces. Total body length is 3.9 inches, the tail is 1.8 inches, and the hind foot is 0.4 inches. This bat's long ears (1 inch) and facial glands on either side of the snout are distinctive. Fur is light to dark brown. This bat utilizes caves year-round as roost sites. Grandfather Mountain (Avery County) has the only known population of these rare mammals in North Carolina, although members of the colony are known to travel as far as Wilson Creek to the east and the Cranberry Iron Mines to the west.

BIOLOGICAL CONCLUSION: Although the Virginia big-eared bat is not listed for Watauga or Caldwell Counties, the US 321 project is approximately 8 miles away from Grandfather Mountain. On March 24, 2005, biologists assessed the project area for habitat suitable for the Virginia big-eared bat. The assessment was done at the request of the US Fish and Wildlife Service. Rock overhangs and hollows within approximately 165 feet of US 321 were visually inspected for bats and bat guano. Only a few small overhangs were found in close vicinity to the road and none appeared to be suitable for bats. No suitable roosting habitat for the Virginia big-eared bat exists in the project impact area. Effects from this project are expected to be small and confined to existing disturbed areas. NO EFFECT

4.10 Floodplains and Regulatory Floodways

The Preferred Alternative would affect 100-year floodplains in two areas. Where Middle Fork crosses US 321, the existing culvert would be extended and the widened pavement would

encroach on the floodplain at the crossing for approximately 40 feet (12.2 meters). The floodplain encompasses the existing intersection of US 221 and US 321 at the northern end of US 321 in Blowing Rock. The widened pavement of the Preferred Alternative would be in the floodplain for approximately 800 feet. The US 321/US 221 intersection would be moved out of the floodplain. In neither location would the floodway be affected.

Bypass Alternatives 1A and 1B would not affect a 100-year floodplain or a floodway.

Bypass Alternatives 4A and 4B would cross a 100-year floodplain on its northern end via on bridges at two points. The Aho Branch of the Middle Fork and a tributary would be crossed. The floodplain and floodway would be unaffected by these crossings. North of the second crossing, where the Aho Branch of the Middle Fork runs parallel to Aho Road, less than 0.1 acre (0.04 hectare) of fill would be placed in the floodplain.

The No-Build alternative would have no floodplain impacts.

Flooding impacts by the Build Alternatives would be minimal for the following reasons:

1. The placement of fill material for roadway embankments in the 100-year floodway would not be of sufficient quantity to affect floodway flows.
2. Existing waterway openings would be maintained.
3. Where fill in the floodplain would be required, modeling would be done during detailed design to ensure that any increases in backwater levels would be less than that permitted by federal law and local ordinances. If the increases exceed what is permitted, the design would be revised to correct the problem.
4. Where culverts penetrate the existing embankment, they would be lengthened so that the existing drainage function would be preserved. Existing culverts would be used at stream crossings with the Preferred Alternative, except where US 321 crosses a tributary of Middle Fork in Blowing Rock. At that location, the culvert would be replaced by another of the same size. Additional culvert improvements would be made during final design, if necessary, based on a hydraulic capacity analysis.
5. No substantial constraints to flow would be placed in floodways and the flood stage elevation upstream of the project would not be affected with any of the Build Alternatives.

4.11 Hazardous Material Sites and Underground Storage Tanks

Based on coordination with the Environmental Protection Agency (EPA) and the North Carolina Department of Environment and Natural Resources, it was determined that no hazardous materials sites exist in the corridors of the five Build Alternatives, but five underground storage tank sites were identified. The Preferred Alternative would affect three gas stations and one furniture business; Bypass Alternative 1A and 1B would affect one gas station; and Bypass Alternative 4A and 4B would affect one private residence with underground storage tanks.

If the Preferred Alternative cannot be designed to avoid any of the properties with underground tanks, a full site investigation would be conducted during right-of-way acquisition to determine whether the storage tanks have leaked into surrounding soils. If contaminated soils are present,

they would be removed and disposed as per state and federal requirements for transportation, treatment, storage, and disposal of such soils. Extra costs associated with handling contaminated soils would be taken into account when negotiating the purchase price or proposed right-of-way containing such soils. The storage tanks would be removed.

No contaminated soils would be disturbed with the No-Build Alternative.

4.12 Energy

The amount of energy required to construct a highway project of this type is substantial but temporary in nature and generally leads to reduced operating costs and energy use once the project is completed. A reduction in costs would come from improved access, travel time, and safety. The Build Alternatives would reduce congestion in Blowing Rock and increase operational safety. These factors generally make the operational cost and energy use of the Build Alternatives less than those for the No-Build Alternative. In the long run, the operational savings of Build Alternatives would tend to offset the construction energy requirements and result in future net savings.

Energy use during construction is directly related to construction cost. Therefore, the lowest cost alternative that would achieve the project's traffic movement objectives would use the least energy overall, and any net savings would be achieved at an earlier date. The estimated construction costs of the five Build Alternatives (in constant 2001 dollars), in order of increasing cost, and therefore, increasing energy use, are:

- Preferred Alternative: \$22.7 million;
- Bypass Alternative 1A: \$50.6 million;
- Bypass Alternative 1B: \$67.0 million;
- Bypass Alternative 4A: \$161.2 million; and
- Bypass Alternative 4B: \$241.4 million.

As such, the Preferred Alternative would be more efficient than the Bypass Alternatives in terms of the energy use, with the Bypass Alternatives using progressively more energy.

4.13 Mineral Resources

There are no known mineral resources of an economic value within the project corridor.

4.14 Utilities

All of the Build Alternatives would relocate utilities. The extent of utility relocations would vary by alternative. All relocations would be coordinated with utility companies.

4.14.1 Water and Sewer Impacts

For the Preferred Alternative, water and sewer lines would be relocated from the Country Club Drive area through to the north end of the project. The private line near the Blackberry Condominiums would be relocated with the Preferred Alternative as it would with Bypass Alternatives 1A and 1B. Also with Bypass Alternatives 1A and 1B, water and sewer lines would be relocated to accommodate the cut in the terrain at Green Hill Road, construction on Possum

Hollow Road at Forest Lane, the relocation of the US 221 intersection, and the intersection with US 321 at the north end of the project. Bypass Alternatives 4A and 4B would affect no water and sewer lines.

4.14.2 Telephone Line Impacts

Toll and distribution lines cross US 321 at various points. A distribution line runs along US 321. These would be relocated. Lines within Blowing Rock in the Preferred Alternative corridor would be placed underground. Underground cables would be relocated at the Possum Hollow Road intersection.

Where the Bypass Alternatives would follow the existing road, toll and distribution lines would be relocated. With Bypass Alternatives 1A and 1B, aerial lines would be relocated in the Green Hill Road area, the Wonderland Drive area, the Goforth Road area and the Possum Hollow Road area. An underground cable would be relocated at Bypass Alternatives 4A and 4B's intersection with US 321 at Aho Road. A remote terminal also would be relocated at Aho Road.

4.14.3 Electric and Cable Line Impacts

The Preferred Alternative would require the relocation of a main electric line for most of the Alternative's length from the Blackberry Condominiums northward, and feeder lines would have to be retapped into the mainline. The same lines would be affected by Bypass Alternatives 1A and 1B until they diverge from existing US 321. In Blowing Rock, the electrical lines within the US 321 corridor would be placed underground. Blue Ridge Electric owns power substations on Possum Hollow Road and Aho Road near US 321. The substation on Possum Hollow Road would not be affected by any alternative. Bypass Alternatives 4A and 4B would relocate the Aho Road station. With Bypass Alternatives 1A and 1B, aerial lines would be relocated in the Green Hill Road area, the Wonderland Drive area, the Goforth Road area and the Possum Hollow Road area.

4.14.4 Relocation Procedures

Utility relocation work for the Preferred Alternative likely would be its most challenging construction element. The challenge stems from the decision to bury utilities within Blowing Rock as a part of mitigating visual impacts in the community. Existing aerial utilities would need to be buried in rock, and existing underground utilities would be upgraded concurrently with road construction. In locations where the terrain is relatively flat, it would be possible to move utilities underground in advance of road construction. With the widely varying topography of Blowing Rock, however, the depth of soil and rock in areas where the road would be cut into the terrain is too great to trench in advance of road construction. In addition, fills to build the existing terrain up to the elevation of the widened road must be in place before utility relocations commence. The affected utilities must be relocated underground without conflicting with roadway storm sewer, power and signal service. Potential strategies for managing this situation that would include:

- The NCDOT's close and continual coordination with the Town of Blowing Rock and utility company representatives;

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- An integrated utility relocation plan that includes:
 - Designated berths for underground relocations,
 - Stacked utilities in common trenches,
 - Phasing of relocations to accommodate roadway construction activities,
 - Temporary aerial relocations,
 - A blasting program that includes utility trench blasting with roadway cuts,
 - Provisions for coordinating temporary (24 hours or less) outages with affected customers, and
 - Contingency plans for temporary or alternate utility service connections to customers;
 - A dedicated, full time utility coordinator to represent the NCDOT;
 - Conduits and sleeves for planned utilities that are part of the project design (usually steel pipes installed under a roadway to accommodate later installation of water or sewer line; once installed, sleeves eliminate the need to excavate the roadway for the utilities that pass through the sleeves);
 - Installed but unused (spare) conduits for future potential underground utility road crossings at each leg of an intersection and at selected intermittent locations along the main line; and
 - Spare conduits parallel to US 321 for future potential services.

A contractor's quality bonus program might be suitable for the Preferred Alternative. Such a program could measure the contractor's bonus eligibility by such criteria as effective management of utility relocations to minimize disruption of service.

Steps that could be used to avoid damaging existing buried pipes and utilities during required blasting could include stringent pre-qualification requirements, blasting controls, blast plan submittals and reviews, careful inspection of work, blast effects monitoring, and blasting effect evaluation studies.

Utility relocation work on both Bypass Alternatives 1A and 1B would be less complex and involved than on the Preferred Alternative. The contractor would sequence utility relocations to accommodate earthwork. It could be advantageous to relocate utilities temporarily from their location in the terrain to be excavated.

The relocation of utilities would be the least complicated with Bypass Alternatives 4A and 4B. No underground utilities exist in their corridor, and generally only limited aerial electric and telephone connections to rural dwellings are present. The contractor would sequence utility relocations to accommodate earthwork. This is a much simpler process than the complex phasing required for the Preferred Alternative and its proposed underground utilities.

4.15 Secondary and Cumulative Impacts

This section describes the secondary (indirect) and cumulative impacts that would occur with the Preferred Alternative and the four Bypass Alternatives and how they relate to development and resource use trends associated with the No-Build Alternative. These conclusions are based on the information presented in Chapter 3, including past trends, planned actions, and goals for the future.

The President's Council on Environmental Quality (CEQ) defines secondary (indirect) effects as those that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (*Code of Federal Regulations*, Title 40, Section 1508(I)). Such effects may include the effects of induced growth and induced changes in the pattern of land use, population density or growth rate, including effects on air and water and other natural systems, including ecosystems. The CEQ defines a cumulative impact as an impact on the environment which results from the incremental impact of a proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Secondary and cumulative impacts associated with the proposed US 321 Improvements Project would arise from reasonably foreseeable development, changes in the location of development because of the presence of a Build Alternative, and from the improvements project itself. None of the alternatives is expected to induce growth. The improvement to US 321 would serve already expected growth. The impacts of foreseeable development that would occur with the No-Build Alternative provide the starting point for the assessment.

This section first focuses its attention on community and natural resource secondary and cumulative impacts of each alternative. The area of concern or study area for this analysis reflects the expected area of influence of the Build Alternatives, which is the area of direct impact, the area surrounding each Build Alternative where impacts such as noise, visual change, and changes in accessibility could affect local development patterns, and water resources that could be affected by construction and development runoff.

The next subsection addresses cumulative visual impacts to the Blue Ridge Parkway by the Build Alternatives and other highway improvement projects in North Carolina that have or will impact the Parkway. The final subsection addresses cumulative impacts that could be associated with improving US 321 from NC 268 in Caldwell County to Blowing Rock, the project defined in a 1993 Environmental Assessment for US 321 improvements.

Except for the assessment of the cumulative impacts associated with improving US 321 from NC 268 in Caldwell County to Blowing Rock, the other TIP projects in the region (see Figure 1-1 in Chapter 1) are not assessed for cumulative impacts because the other TIP projects are not in proximity to the US 321 improvements project. As such, they would affect different communities and natural systems and thus together would not contribute multiple impacts to a single community or natural system.

Cumulative community impacts vary primarily by the location of the alternative as follows:

- All of the Build Alternatives would improve traffic flow on US 321 to an acceptable LOS through the design year. The No-Build Alternative would not provide an adequate LOS and congestion would make it difficult for local traffic that depends on US 321 to move around the community.
- The Preferred Alternative would not support Blowing Rock's goals for maintaining the village character of the community and its historic resources.
- Bypass Alternatives 1A and 1B would bisect existing and developing neighborhoods. Bypass Alternatives 1A and 1B would make an existing developing area less desirable for residential development.

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- Community impacts with Bypass Alternatives 4A and 4B would be focused on the disruption of small rural communities at the southern and northern ends of the bypass. Bypass Alternatives 4A and 4B would provide incentives for development at their southern and northern ends.

Impacts to water quality and hydrological integrity of area waterways are foreseeable for each Build Alternative. Included in these impacts are:

- Continued increased erosion of watershed soils;
- Sedimentation of stream, pond and lake waters;
- Scour and erosion of streambeds and banks; and
- Increased turbidity of waters.

Runoff from an increase in impervious surfaces associated with development would result in more sudden and intense pulses of flow after precipitation events, altering the amounts, velocities, and patterns of stream currents and contributing to the degradation of streambed structure. Pollutant loads carried in such runoff could include gasoline and oil, road salt, atmospheric depositions of toxic substances, pesticides, fertilizers, and bacterial contaminants. Degradation of habitat for aquatic organisms is an inevitable result of these impacts.

Road construction and other development would predictably result in eradication and fragmentation of plant communities, including generally undisturbed forests. These natural habitats also would be affected by changes in light, temperature, and humidity, and by the invasion of weedy and exotic species. Terrestrial animal habitats would incur predictable loss and degradation from changes in plant communities.

4.15.1 No-Build Alternative

The No-Build Alternative would include no improvements to existing US 321. Currently, Blowing Rock and its surrounding areas are undergoing an expansion of residential development. The Town's infrastructure and jurisdiction are expanding. Traffic studies (see Section 1.5.6 in Chapter 1) indicate that US 321 will exceed its capacity during high-use periods. These reasonably foreseeable activities are the causes of cumulative impacts for the No-Build Alternative and are discussed in this section. Increasing congestion would affect the quality of life in Blowing Rock, primarily for those in existing neighborhoods who depend on US 321 to reach homes, shopping and other activities. Development, particularly in undisturbed areas, would increase sedimentation in streams, increase the generation of wastewater and cause the loss and fragmentation of natural areas.

Development Trends

Blowing Rock is currently nearing its limits of residential and commercial build-out. The natural beauty of the Blowing Rock area and a demand for recreational housing have driven continued residential development and growth, even in areas with steep terrain. New development in Blowing Rock is focused mainly in the eastern section of the Town and on the outer margins of the Town limits, where undeveloped property still exists. The Wonderland Drive and Green Hill Road areas are among those in which available land is quickly being utilized for residential development. Development is proceeding outside of the Town also, primarily to the northwest. The Town of Blowing Rock has applied to Watauga County for a 1-mile extraterritorial jurisdiction to ensure that new development nearby meets the Town's standards and expectations.

This development is expected to continue, even if US 321 remains unimproved in the Blowing Rock area.

Increased congestion on US 321 is not expected to induce changes in development trends because the regular use of US 321 is not essential to persons living in developing areas and as a result, it would not generate associated secondary impacts such as additional or changed natural resource loss. New development in the Blowing Rock area is occurring in areas away from US 321. These areas already have access to current four-lane highways north via Possum Hollow Road, access on local roads to Downtown via the signalized intersection of US 321 at Sunset Drive (although the intersection would be congested during peak periods), and access to the northeast via the Blue Ridge Parkway. In addition, a project is programmed that will to widen US 321 to four lanes from Patterson to Blackberry Road and within 2 miles of Green Hill Road. Thus, for the most part, residents in the developing areas of Blowing Rock do not need to use US 321 except to visit the businesses along it. From a day-to-day perspective, the most important is the Food Lion grocery, approximately 1,500 feet north of the intersection of US 321 and Sunset Drive. Residents could choose to travel to the Food Lion and other businesses along US 321 during off-peak periods. Finally, the peak traffic periods along this section of US 321 are currently associated with tourism on weekends, with the highest peak in October (during the height of the fall foliage) and the next highest in the summer months. Thus, in the near future, daily local travel on US 321 would remain uncongested. As traffic continues to grow, however, weekday commuting peak periods also would begin to see congestion.

In addition, in terms of local travel, the comprehensive plans for the Town of Blowing Rock (2004) and Caldwell County (June 1995) call for a sidewalk system and a summer transit system. The *Alternative Transportation Plan* for Boone and Blowing Rock (Boone Town Council and Blowing Rock Town Commission, 1994) includes a system of sidewalks and bicycle and pedestrian paths. Implementation of these plans also would provide an alternative circulation system for residents of developing areas in the eastern part of Blowing Rock.

Community Impacts

The cumulative community impacts of the No-Build Alternative are associated with anticipated new development and growing traffic. As described above, the No-Build Alternative is not expected to affect current residential development trends and generate associated secondary impacts. The Town of Blowing Rock's Comprehensive Plan states that "preserving the village character should be of paramount concern in considering appropriateness." The plan also seeks to promote and encourage orderly development of the Town. It seeks improve its downtown; preserve historic features; establish parks, bicycle and pedestrian ways; and the provision of mass transit during the summer. The No-Build Alternative would not preclude these efforts.

The primary impact of the No-Build Alternative would be associated with congestion on US 321. Congestion would adversely affect the quality of life in Blowing Rock for those who depend on US 321 to reach homes, shopping and other activities. Residents in neighborhoods on Gideon Ridge and along Pinnacle Avenue, Country Club Drive, Norwood Circle, Skyland Drive, New River Lake Drive and Westview Drive must use US 321 to reach shopping and other activities. The only way to reach the Blowing Rock Country Club is via US 321. Guests of the Green Park Inn, the Days Inn, the Brookside Inn, and the Cliff Dwellers Inn all must go to and from their accommodations via US 321.

During the peak hour, all two-lane sections of US 321 would be highly congested in 2025 (LOS F). By 2025, even the typical weekday peak hour would be congested (at least LOS E). The Sunset Drive signalized intersection would be highly congested during the design hour. Wait

times for persons trying to exit driveways and unsignalized side streets would be long during the design hour (LOS F). Thus, congestion would make it difficult for local traffic that depends heavily on US 321 to move from one part of the community to another.

Natural Resources

Water Resources. Impacts from sedimentation are expected to continue during construction of new development. Construction in Blowing Rock, including the Wonderland Drive and Green Hill Road areas, would affect the water quality of Middle Fork South Fork of the New River. New development in areas north of the town limits would also affect Middle Fork. Increased sediment loads in these Blue Ridge plateau streams would degrade their riffle and pool channel structures and destabilize the streambed and banks. Structural degradation of these streams would be accompanied by altered water chemistry and compromised biological integrity. Loss of aquatic diversity and invasion of opportunistic, exotic species become likely in such compromised systems.

Increased sedimentation within headwaters of the Middle Fork would have repercussions for the functioning of Blowing Rock's Chetola Lake water supply. Headwater streams near potential residential construction areas, such as in the Wonderland Drive area, eventually transport sediment into Chetola Lake. Sediment buildup in the lake must be periodically removed to maintain the water retention capacity of the lake and relieve pressure on the dam structure. Increased water turbidity induced by sediment also raises the cost of drinking water treatment.

On the top of the Blue Ridge escarpment, residential construction activities would cause sedimentation in Bailey Camp Creek, Martin Branch and the headwaters of the Yadkin River. After construction is completed, all of these stream systems would be left with altered hydrology because of a new component of impervious surface in their respective watersheds. The degree of alteration would depend on the amount of impervious surface introduced. More extreme pulses in floodwater and runoff during rain events and subsequent streambank erosion and streambed scouring would be expected. In addition, removal of vegetative groundcover in developed areas would subject soils to continuing erosion and possible slipping and rockslides.

In developing areas where sewer systems have not been established and are not planned, septic systems would be installed. Septic systems are sometimes problematic, especially in the steep and sometimes shallow and rocky soils of the Blue Ridge escarpment. Effluent from these systems might easily reach streams because of steep slopes or shallow soils and would adversely affect water quality by bacterial contamination. Improperly draining systems could threaten the stability of soil on steep slopes.

Plant Communities. The impacts of development to area plant communities would include development projects currently under way and planned for the area. Plant communities within developed areas of Blowing Rock are primarily second growth forests, residential yards supporting a combination of native and exotic species and maintained areas supporting lawns and early-successional grasses, herbs and shrubs. Thus, loss of vegetation in these areas would not be a substantial concern.

Both oak-hickory forests on ridge tops and cove forests in hollows would be adversely impacted by development that is occurring in eastern Blowing Rock and along its outskirts. Ridge top locations are highly valued for residences because of the superior views they afford of mountainous terrain. Protected cove locations lower on slopes also would be developed. Impacts from lot clearing and home construction would include erosion and sediment being carried to lower elevations, increases in water temperatures as a result of loss of shading vegetation over

streams, loss of steady-state plant composition and structure, and a decrease in plant species diversity. Loss of topsoil decreases the productivity and richness of forest ecosystems. Sedimentation of streams and wetlands has adverse effects on aquatic life forms and water quality. Forest fragmentation and the likely introduction of exotic and invasive species would also result from lot clearing. Mature, stable plant communities would be modified into transient associations of early successional herbs, vines, shrubs and young trees. Sunlight penetrating moist cove forests would change the ambient temperatures and humidities of the microclimates in coves, and some species adapted to the cool and moist cove forests would be eliminated.

Wetlands and Open Waters. Impacts to area wetlands and waters could result from development projects currently under way and planned for the area, primarily in eastern Blowing Rock and along the Blue Ridge escarpment east of the town.

Because of steep and rocky landscape features, the project region contains only a small amount of vegetated wetlands. These areas of shallow or intermittent hydrology support hydric vegetation and sustain saturated soils. Vegetated wetlands absorb and store water, and often provide important habitat and nursery areas for diverse terrestrial and semi-aquatic fauna. A continuation of ongoing development in eastern Blowing Rock and along the escarpment is expected to result in minimal impacts to wetlands. Impacts to wetlands would primarily consist of increased sediment inputs from adjacent and upstream development and scour resulting from increased volumes and velocities of runoff following precipitation events.

Impacts to open waters (ponds and streams) were discussed above under “Water Resources.” Ongoing and planned development near Blowing Rock would have the potential to result in impacts to three major river basins, but primarily the New River and Yadkin River Basins. Likely impacts would include increased runoff volumes because of expanding impervious surfaces, water temperature fluctuations caused by a loss of shade vegetation, increases of chemical pollutant (fertilizers, fossil fuels, road salt) inputs resulting from direct runoff from developed areas into regional streams and ponds and a decrease in storage capacity in ponds due to increased sedimentation.

Fish and Wildlife Populations. Loss of forest cover, fragmentation of plant communities, a decrease of plant species diversity and degradation of water quality are reasonably foreseeable effects of development in this region. These impacts would result in a change in the type and amount of food and cover available to regional wildlife. The No-Build Alternative would support current development trends and not open new areas for development and degradation of wildlife habitat.

The greatest threat to aquatic habitats, including trout habitat, arising from current development trends is sedimentation from soil excavation during construction, which could overburden stream capacities, burying streambeds and destroying characteristic riffle and pool structures. Habitat niches for trout and their prey species thus could be lost. Any crossing of streambeds with culverts would modify the natural channel profile of the stream. This channel modification often results in avoidance of the stream reach by trout and other species, effectively eliminating habitat.

4.15.2 Preferred Alternative

The Preferred Alternative would involve improvements to existing US 321. With the Preferred Alternative, new development in Blowing Rock would be expected to continue as currently anticipated since most new residential development is remote from the Preferred Alternative. Induced changes in future development trends and associated secondary impacts, such as additional or changed natural resource loss, are not expected since traffic would remain in the

existing corridor and traffic growth would not change. New development plus the Preferred Alternative would be the causes of cumulative impacts, and these impacts are discussed in this section. A reduction in congestion associated with the widened roadway's ability to serve the forecast traffic growth on US 321 would benefit the quality of life in the area. In the area immediately surrounding the project, however, the Preferred Alternative would not support the community's goals to maintain the village character of the community and its historic resources. Development, particularly in undisturbed areas, would increase sedimentation in streams, increase the generation of wastewater, and cause the loss and fragmentation of natural areas. The Preferred Alternative would add to development-related impacts, particularly water quality impacts. The alternative would follow an already developed corridor and as such would add less impact to the natural environment than the other Build Alternatives being considered.

Development Trends and Change

Among the major considerations in secondary impact assessments of new or improved roadways are the effects of the activity on the pace and location of local and regional development. Often a functional relationship can be shown to exist between these events. Although improved roadways often result in accelerated or new development, this impact is neither consistent nor predictable (NCHRP, 1998).

The Preferred Alternative would have little effect on development projects that are now being undertaken in Blowing Rock, or on future development trends that could generate associated secondary impacts. Widening an existing road improves capacity and traffic flow, but unlike a new road, it does not change the accessibility of area vacant land. In addition, the FHWA states in their "Induced Travel: Frequently Asked Questions" (<http://www.fhwa.dot.gov/planning/itfaq.htm#qsup1>, 2006) based in part on the research in North Carolina by David T. Hartgen, (Hartgen, 2003): "The relationship between transportation improvements and land development is extremely complex, and even less well understood than its impacts on travel behavior. While improved transportation accessibility in a particular corridor may indeed make land more attractive for development, other factors such as water and sewer lines, quality of schools and other public services, undevelopable land (e.g., slope, floodplains, etc.), land acquisition and development costs, impact fees, and zoning ordinances also play major roles in shaping where development will take place, its nature, and its intensity." Finally, with the exception of development on New River Lake Drive, most new residential development is remote from the Preferred Alternative and is occurring despite growing traffic. For the most part, residents in the developing areas of Blowing Rock do not need to use US 321. The Preferred Alternative would make it easier for people in developing areas to move around the community, but this does not appear to be an effect that could influence development trends, as discussed above for the No-Build Alternative. New development of these areas is expected to proceed to the maximum density allowed by zoning.

Community Impacts

The cumulative community impacts of the Preferred Alternative would be primarily associated with the project's direct community impacts. New development associated with current development trends is controlled by area development regulations.

Blowing Rock's Comprehensive Plan considers preserving the Town's village character and its historic resources to be important. The Preferred Alternative would not be compatible with these objectives within the immediate project area. The Preferred Alternative would not be consistent with these goals given its adverse impact on the Green Park Historic District, which includes a wider pavement through the district, displacement of one contributing structure, and loss of stone

walls and vegetation. The appearance of the District would be altered at two of its most notable features, the Green Park Inn and the Blowing Rock Country Club's golf course. The Preferred Alternative would straighten curves on US 321 in the Country Club Drive and Norwood Circle area, changing its character. The part of US 321 near this area and the historic district are the only places on US 321 where the traditional village character of Blowing Rock can be viewed by the general traveler. Citizen representatives have expressed the opinion that a four-lane road anywhere in Blowing Rock is inconsistent with the community's village character. Because the Green Park Historic District is considered a central component of what makes Blowing Rock unique, there is concern that introducing a four-lane road into the district would lead to the long-term decline of Blowing Rock as a "special place" and preferred destination. Outside the area directly affected by the project, the Preferred Alternative would not preclude efforts to maintain a village character and associated development goals.

The MOU and MOA proposed as a part of the Preferred Alternative would help mitigate these long-term community impacts, including narrowing the roadway width to 11 feet, planting new vegetation, and replacing stone walls in the historic district. The MOU and MOA also would have a great benefit north of US 321 Business where decorative landscaping is limited to individual developments and does not consistently occur. Sidewalks shown in the *Alternative Transportation Plan for Boone and Blowing Rock* are included in the Preferred Alternative. These sidewalks also would be consistent with Blowing Rock's Comprehensive Plan, which encourages connecting the businesses along US 321, Shoppes on the Parkway, and the central business district with a series of sidewalks. The landscape plan included in this FEIS was prepared as an example of what could be done. The MOU and MOA agreements commit the NCDOT to working with the Town of Blowing Rock to finalize the plan and define its key components.

The Preferred Alternative would provide for more efficient traffic operations in Blowing Rock. US 321 would not be congested during peak periods, including the peak hour on an October weekend. Traffic signals and other intersection improvements would make it easier to enter US 321 from side streets and driveways than it would be with the No-Build Alternative. At driveways and unsignalized side streets, drivers would be able to take advantage of gaps in the traffic created as traffic signals at other intersections platoon or group traffic on US 321. It would be easier for local traffic that depends on US 321 to move from one part of the community to another than with the No-Build Alternative.

Natural Resources

Water Resources. Blowing Rock is situated at the headwaters of three major river systems. Construction activities in the area could potentially have far-reaching effects on the state's aquatic resources, both during construction and afterward. Included in those resources are High Quality Waters, Trout Waters, and Water Supply Waters.

Cumulative impacts to the headwaters of the New River and Yadkin River systems associated with construction of the Preferred Alternative and new area development would be similar to those for the No-Build Alternative. These impacts would include increases in sedimentation and intensity of runoff rates into headwater tributaries of the Yadkin River. An increase of sediment loads (primarily eroded sands and clays) in these escarpment streams could be expected to destabilize the stream beds and degrade both the chemical and biological integrity of these systems.

In addition to direct impacts described in Section 4.9.1, the Preferred Alternative would be the most likely alternative to contribute along with new development to affects on waters in the Upper Catawba River Basin, primarily during project construction. At the intersection of existing US 321

and US 321 Business, this alternative would cross the divide between the New and the Catawba watersheds. Although jurisdictional wetlands and open waters of the Catawba watershed are outside of the project footprint, runoff from construction activities at this point, whether the Preferred Alternative or new development, would affect headwaters of Johns River in the Catawba Basin. In addition, most of the southern portion of the US 321 corridor approaches the edges of the Catawba watershed, and potential exists for impacts to both Johns River and Mulberry Creek in this basin. Both of these watersheds are currently designated as Fully Supporting their designated uses, and Mulberry Creek is designated as High Quality Waters. Construction impacts within this portion of the alternative corridor would be contained with best management practices and would be far enough away from open waters in the affected watersheds to minimize the potential for erosion and sedimentation.

From the southern Blowing Rock town limits northward, this alternative would extend through the New River Basin and would affect headwaters of Middle Fork South Fork. Increased impervious surfaces would be created from the newly expanded roadway and cut-and-fill areas carved from rock. The impacts to these surfaces, however, would be similar to those described for the No-Build Alternative in connection with new development alone. Erosion and sedimentation could be expected to continue after construction activities associated with the road improvement and new development are complete and exposed soil and rock surfaces are stabilized. Environmental quality issues associated with this development also include impacts to the sylvan and pastoral character of the viewshed along the Blue Ridge Parkway, erosion and loss of soil, destabilized hillside slopes, degradation of stream water clarity and quality, changes in stream hydrology, migration of streambeds, and loss and fragmentation of wildlife habitat.

Landscaping associated with the Preferred Alternative and new development would require maintenance that could involve fertilizers, pesticides, and herbicides that would add to the component of pollutants washing into streams.

Plant Communities. As discussed in Section 4.9.2, the Preferred Alternative would cause little direct impact to plant communities. Impacts to plant communities in new residential areas also would be minimal, as described above for the No-Build Alternative.

Wetlands and Open Waters. The cumulative impact of the Preferred Alternative and ongoing development was discussed above for the No-Build Alternative. The combined impact to wetlands is expected to be minimal. Impacts to wetlands would primarily consist of increased sediment inputs from adjacent and upstream development and scour resulting from increased volumes and velocities of runoff following precipitation events.

Impacts to open waters (ponds and streams) were discussed above under “Water Resources.” The Preferred Alternative would add to impacts expected from development to stream hydrology and headwater drainage of the Yadkin River. Increased overland runoff from hard surfaces can add to long-term sediment and pollutant loads in stream waters. Increased flood pulses could be generated in the altered headwater streams and transferred to the main stem of the Yadkin River. Impacts to the headwaters of the Catawba River Basin, including Johns River and Mulberry Creek, could result from increased runoff, sedimentation, and pollution from larger impervious surfaces along the divide between the Yadkin, New, and Catawba River basins.

The Upper Yadkin River Basin and the Blue Ridge escarpment immediately east of Blowing Rock would be subject to the greatest of these impacts.

Fish and Wildlife Populations. Loss of forest cover, fragmentation of plant communities, a decrease of plant species diversity, and degradation of water quality are reasonably foreseeable effects of development in this region. Impacts of development combined with the Preferred Alternative to aquatic habitats would be similar to those for the No-Build Alternative. They would be associated with increased runoff into streams, increased sedimentation, pollutants, streambank erosion, flood pulses, and scouring of streambeds.

4.15.3 Bypass Alternatives 1A and 1B

The southern portion of Bypass Alternatives 1A and 1B would follow the existing US 321 route for approximately 1.4 to 1.6 miles, with minor alignment improvements. Bypass Alternative 1B would include a deep cut into Gideon Ridge just south of Blowing Rock to eliminate less than desirable curves in the existing road. The remainder of the alternative (approximately 2.2 to 2.4 miles) would be on new location, primarily through existing and developing residential areas in northeast Blowing Rock. With the Bypass Alternatives 1A and 1B, new development and associated traffic growth in Blowing Rock and its surrounding areas are expected to continue. The introduction of the bypass would make portions of the eastern part of Blowing Rock less desirable for residential development and some new development could shift other developable areas in Blowing Rock and the surrounding area, generating secondary impacts. These alternatives would bisect existing and developing neighborhoods.

Development Trends and Change

The Bypass Alternatives 1A and 1B corridor would be primarily in areas currently developed or being developed for residential use. They would introduce a through roadway into an area of single-family subdivisions and local streets. The construction of either Bypass Alternative 1A or 1B would require the purchase of subdivided lots as right-of-way. The desirability of remaining lots near the project corridor would likely decrease because of visual change and traffic noise. The loss of subdivided lots and the reduced desirability of remaining nearby lots could induce a shift in anticipated growth to other parts of Blowing Rock and the region. Pressure to subdivide and sell more undeveloped land at the Town's edges could increase, generating secondary impacts to the features of the subdivided land. Most nearby land available for future development is outside of the town limits of Blowing Rock, although inside the proposed Extraterritorial Jurisdiction (1 mile beyond the present Town boundary). The shift in potential development, however, would not be incompatible with comprehensive plans, but rather would shift the focus of permitted development.

Construction of Bypass Alternative 1A or 1B would be expected to result in limited opportunities for changes in commercial development patterns. At the southern juncture of the proposed bypass and existing US 321, the terrain is steep and unsuitable for commercial development. No access points are provided between Green Hill and Possum Hollow Road; thus, there would be no new incentives for commercial development in these residential areas. The common northern end of these corridors would be at the intersection of US 321 and Possum Hollow Road. This juncture is adjacent to the Town's US 321 commercial corridor and could be desirable for commercial development. The only new opportunity provided by the bypass is the area between the bypass' intersection with Possum Hollow Road and its intersection with existing US 321. Development opportunities would be limited, however, by the narrowness of this corridor and the presence of a stream.

Community Impacts

The cumulative community impacts of Bypass Alternatives 1A and 1B would be primarily associated with the project's direct community impacts. New development associated with current development trends and changes in those trends induced by the bypass would be controlled by area development regulations.

The Blowing Rock Comprehensive Plan seeks to uphold current land use controls designed to enhance and protect the existing unique character of the Town. Bypass Alternatives 1A and 1B would bisect existing and developing subdivisions in the Green Hill Road and Wonderland Drive areas. The introduction of a thoroughfare to this area would result in substantial negative noise, community cohesion, and visual impacts. Bypass Alternative 1B also would include a large cut into Gideon Ridge. Bypass Alternatives 1A and 1B would not affect the community's historic resources or affect the character of the area along existing US 321.

Bypass Alternatives 1A and 1B would provide for more efficient traffic operations in Blowing Rock. By 2025, however, a less than desirable LOS D would begin to appear on the existing two-lane US 321. Turn lane improvements to US 321 as a part of a future minor improvement project would be needed at Sunset Drive with these alternatives. Traffic volumes on US 321 that would be lower than they are today would make it easier to enter US 321 from side streets and driveways than with the No-Build Alternative. It would be easier for local traffic that depends on US 321 to move from one part of the community to another than with the No-Build Alternative. The characteristics of existing US 321 that contribute to high crash rates would remain.

Natural Resources

Water Resources. Construction of the southern portion of Bypass Alternatives 1A and 1B would involve widening of the existing US 321 from the southern project terminus to the curves on US 321 at the southern limits of Town. The cumulative effects of constructing this part of the alternative corridor in combination with new development to the Catawba River Basin, Bailey Camp Creek, and unnamed headwater tributaries in the Yadkin River Basin would be similar to those for this portion of the Preferred Alternative.

Impacts to Upper Yadkin waters would be similar to those for the No-Build Alternative, but road construction could increase some adverse impacts that are also associated with development. Larger areas of impervious surface would exist in the road and cut-and-fill areas. Tree canopy gaps would be much more extensive, larger areas of open waters would be exposed to full sun, and water temperature and floristic composition would change accordingly. Long-term erosion and runoff could be expected from construction on the escarpment.

Impacts to Middle Fork waters also would be similar to those associated with ongoing residential development discussed for the No-Build Alternative with some effects increased by bypass construction.

The unnamed tributary of Middle Fork that currently parallels Possum Hollow Road would be closely approached by Bypass Alternatives 1A and 1B. Impacts to this stream would rise if additional commercial development were induced by the bypass in this area. Degradation of these stream waters would subsequently influence the water quality of Middle Fork South Fork downstream. This portion of Middle Fork is currently designated as Hatchery Supported Trout Waters.

Additional impacts to water resources are possible from changes in the location of ongoing development. New development displaced from the project corridor could be relocated to more

remote areas that are generally less disturbed, and impacts to their more pristine waters would be greater.

Plant Communities. Bypass Alternatives 1A and 1B would cause limited impacts to plant communities within developed areas of Blowing Rock, including the vicinity of the northern terminus of this alternative. The additional impacts in eastern Blowing Rock from development would be similar to those for the No-Build Alternative. Development redirected by the presence of the bypass to other more remote areas also would cause impacts to plant communities. Construction in more pristine plant communities would result in more severe plant community disruption and changes in species composition.

The construction of Bypass Alternative 1A or 1B would add a large, continuous canopy gap into plant communities in the project area. An increase in invasive and weedy species in plant communities adjacent to the road footprint would result.

Wetlands and Open Waters. Combined impact of new development and Bypass Alternative 1A or 1B would affect waters in both the Yadkin and New River Basins. Headwater streams and ponds would be primarily affected. These alternatives would not include fill into wetlands. Impacts would be similar in nature to those already described under the No-Build Alternative for ongoing development in these areas. Some effects, such as those associated with larger impervious surfaces, would be greater following road construction because the addition of the bypass to the area would introduce a much larger, continuous hard surface than new residential development.

Bypass Alternative 1A or 1B could induce a change in the location of new development, and therefore, indirectly influence the characteristics of wetlands and open waters where such development occurs. Sediment and pollutant loads, alterations in hydrology, fluctuating water temperatures, and unstable stream channels are some attributes of wetlands and waters that would be affected by collective construction and development in the Blowing Rock area.

Fish and Wildlife Populations. Improvements and widening in the southern portion of the bypass corridor would have effects on wildlife populations similar to those of the Preferred Alternative. After construction is complete, traffic noise and the incursion of open areas would cause forest species to withdraw farther into more pristine areas. Impacts to wildlife habitat would, therefore, extend well beyond the edges of the roadway. Marginal wildlife habitat exists in the portion of eastern Blowing Rock that would contain the bypass. These disturbed sections are frequented by edge-adapted species that generally adjust easily to disturbance. A shift of development to more pristine areas induced by the bypass would fragment and degrade additional habitat.

Impacts to aquatic organisms associated with Bypass Alternatives 1A and 1B would arise from continuing sediment and pollutant runoff from new and expanded highway sections together with impervious surfaces that already exist or that are anticipated with new development. These surfaces would increase the amount of flow in nearby streams following precipitation events and snowmelt. Such changes in stream flow would disrupt aquatic habitats and possibly cause the elimination of some species. Like the No-Build and Preferred Alternatives, new development and the bypass would both increase sedimentation, pollutants, streambank erosion, flood pulses, and scouring of streambeds.

4.15.4 Bypass Alternatives 4A and 4B

The southern portion of Bypass Alternatives 4A and 4B would follow existing US 321 for approximately 0.2 mile, with minor alignment improvements. The remainder of the alternative (approximately 3.8 miles) would be on new location along the Blue Ridge escarpment, through a tunnel under the Blue Ridge Parkway, and through generally undeveloped forest and pasture land north of the Parkway.

Community impacts would be focused on the disruption of small rural communities at the southern and northern ends of the bypass. A potential for development pattern changes induced by Bypass Alternatives 4A and 4B also exists in these areas. Little new development is currently expected in these areas. These alternatives would provide for more efficient traffic operations in Blowing Rock. Bypass Alternative 4A would have the greatest impacts to natural resources, with most coming from the bypass itself and to a much lesser extent from development that might be induced at the bypass's southern and northern ends. Bypass Alternative 4B would reduce those impacts by the addition of bridges that would reduce impacts to streams, including chances of adverse effects to downstream stability and quality, and to the quality of wildlife habitat.

Development Trends and Change

The corridors of Bypass Alternatives 4A and 4B would be either in areas that are currently undeveloped and support forest or in areas that contain scattered residences and pastures. South of the Blue Ridge Parkway, both alternatives would traverse the steep slopes of the Blue Ridge escarpment. Although the terrain is steep in this area, it offers good long-distance views of the surrounding terrain, and many homes in the area have been built on steep terrain to take advantage of such views.

The accessibility of some properties adjoining the bypass would increase. An alternative access point would exist to most properties along the bypass so, in general, the NCDOT could readily purchase the right of access from the adjoining property owners. Uneconomical or small remnants that also have no access other than from the bypass also could be purchased by the NCDOT. In a few cases, large parcels would be divided and cut off from alternative access points. Here purchasing complete access rights also would involve purchasing large parcels of land. It is expected that at these locations some direct access to the bypass would be provided. With Bypass Alternative 4A, these locations include the three intersections (Figure D-4b, Stations 612+5 and 621; Figure D-4c, Station 635) of rural roads and the bypass and the large parcel split north of the Blue Ridge Parkway. For Bypass Alternative 4B, the additional bridges reduce the need for direct access to the bypass and in Appendix D a single rural road is shown intersecting the bypass.

South of the Parkway, Bypass Alternatives 4A and 4B and access points to adjoining properties would cause a portion of this area to be less isolated and would potentially enhance the desirability for residential development and induce a shift in area development patterns. The opportunities for better access would be between where the bypass would leave the existing road and the Blackberry Condominium area. The land made more accessible would be at much lower elevations than homes that today have the substantial view lots (3,200 feet in elevation rather than 3,500 to 3,900 feet). If NCDOT purchased right-of-access along the bypass, properties below Green Hill would continue to use their existing access points along US 321 and rural roads, and there would be no change in the accessibility to properties along the Blue Ridge escarpment. Thus, highly valued view lots should not be created by Bypass 4A or 4B, and any development generated would tend to be below the elevation of the bypass and more than 1.5 miles away from the Blue Ridge Parkway.

North of the Parkway, Bypass Alternatives 4A and 4B would traverse a rural area where slopes are gentler. This area currently supports a few homes and pastoral uses. A single property is divided through much of this area. With Bypass Alternative 4B, bridges over the land would provide access between the two halves of the divided parcel. With Bypass Alternative 4A, at least one access point would have to be provided at-grade to provide access between the two halves of the property. The introduction of the road into the area would displace the home of one of the two families that live in the area, reduce the quality of life in the area, and adversely affect the rural values that caused valley residents to make their homes in this setting. This loss of values could motivate the property owners to seek an alternative use for the land, such as residential or commercial development. The purchase of the right-of-access, where possible, would reduce or eliminate the potential for commercial development. However, existing Thunder Mountain Road could still be used to reach the area. Consequently, development that did not require direct access could potentially occur. The presence of the bypass and the lack of infrastructure could initially be a limiting factor.

These Bypass Alternatives would have little effect on development projects that are now underway in Blowing Rock or on development trends. The diversion of traffic to the bypass would make it easier for people in developing areas to move around the community, but this would not appear to be an effect that could influence development trends because new development in the Blowing Rock area is occurring in areas away from US 321 and the regular use of US 321 is not essential to persons living in developing areas, as discussed above for the No-Build Alternative. New development of these areas would be expected to proceed to the maximum density allowed by zoning.

Community Impacts

The cumulative community impacts of Bypass Alternatives 4A and 4B primarily would be their direct community impacts taken together with their effect on development patterns in rural Caldwell and Watauga counties. In Blowing Rock, development trends should be unaffected.

Bypass Alternatives 4A and 4B, particularly at their southern and northern ends, would introduce a thoroughfare to a wooded-rural area of isolated homes. The quality of life sought by those who reside in these communities would be adversely affected. Quality of life would be reduced by both the presence of the road and additional development. Additional development would change the character of these areas by increasing the density of development.

Like Bypass Alternatives 1A and 1B, these alternatives would provide for more efficient traffic operations in Blowing Rock. By 2025, however, a less than desirable LOS D would begin to appear on the existing two-lane US 321. With these alternatives, turn lane improvements as a part of a future minor improvement project would be needed on the existing road at Sunset Drive and US 221. Traffic volumes lower than today's would make it easier to enter US 321 from side streets and driveways than with the No-Build Alternative. It would be easier for local traffic to move from one part of the community to another than with the No-Build Alternative. Traffic volumes on existing US 321 south of Sunset Drive, however, would be higher than with Bypass Alternatives 1A and 1B. The opposite, however, would be true north of Sunset Drive. The characteristics of existing US 321 that contribute to high crash rates would remain.

Natural Resources

Water Resources. Reasonably foreseeable water resource impacts of Bypass Alternatives 4A and 4B and induced development would most likely be limited to the Yadkin and New River Basins. Impacts associated with these alternatives would include long-term increases in sedimentation and intensity of runoff flows, as well as deposition of petroleum products, fertilizers, and road salt

into these tributaries. These impacts would in turn result in destabilized stream beds and channels and chemical and biological degradation. Bypass Alternative 4B would reduce the contribution of the bypass to impacts to streams through increased use of bridges. Implementation of this alternative would greatly reduce the chances of adverse effects to downstream stability and quality.

North of the Blue Ridge Parkway, these bypasses would pass through the New River Basin. Impacts of construction in this area would affect Middle Fork South Fork, including Aho Branch near the northern end of the bypasses. Erosion and sedimentation could be expected to continue after road construction activities are complete and while adjacent induced development continues. New development north of the Blue Ridge Parkway could result in substantial impacts to Middle Fork South Fork at a location downstream from the impacts associated with the other alternatives.

Plant Communities. Bypass Alternatives 4A and 4B and associated induced development would have the greatest potential to affect plant communities of all the Bypass Alternatives. Impacts from road construction and associated induced development would include reduction of species diversity from steady-state forest to early-successional vegetation on fill slopes, erosion and sedimentation from unvegetated slopes, and increases in water temperatures from loss of shading vegetation over streams. The disturbed forest edges generated by these alternatives would offer footholds for exotic and invasive species. Less vegetative ground cover would allow more surface runoff following precipitation events and less infiltration into the surficial groundwater. Loss of topsoil would adversely affect the productivity and richness of forest ecosystems. Large canopy gaps above the road and cut-and-fill areas would increase temperatures and decrease humidities, profoundly changing the microclimate within moist cove forests. Many plant species in these coves could be eliminated by these changes.

Plant communities within areas where induced development is possible range from second growth forests and pastureland to fragmented forest sections and maintained residential yards. Continued development would disturb the remaining natural plant communities and result in further canopy fragmentation and loss of plant species diversity.

Wetlands and Open Waters. Impacts to open waters in the Yadkin and New Basins would result from development projects currently underway and planned for the project area. Like with the other alternatives, impacts to wetlands are expected to be minimal because so few exist in the project area. Construction of Bypass Alternatives 4A and 4B could influence the location of planned development at the southern and northern ends of the alternatives. An increase in development in either of these areas would entail increased impacts to headwaters of the Yadkin and New Rivers. Development along Aho Road would introduce new disturbances to the adjacent Aho Branch. These waters are currently relatively undisturbed, and all support wild trout populations.

These alternatives would introduce a large amount of new impervious surface to the Yadkin River watershed because of the very large cut-and-fill areas required on the steep slopes of the escarpment, particularly with Bypass Alternative 4A. The impervious surface area introduced by Bypass Alternative 4A would be much greater than that introduced by residential development, or by any other Build Alternative. Erosion, sedimentation, pollutant runoff, and more intense flows after precipitation would affect stream systems for a great distance downstream. These changes would degrade the splash-pool bed structures of the streams, scour banks, and possibly redirect some stream channels. Destabilization of hillside soil and rocks would be possible. Revegetation would help mitigate these impacts.

Bypass Alternative 4B would reduce cumulative stream impacts by its use of bridges. The increased use of bridging structures would reduce the need for cut-and-fill areas. Changes in headwater drainage caused by culverting or filling of streams would be minimized for Bypass Alternative 4B.

Expected cumulative impacts to New River Basin headwaters can be expected to be less severe than impacts to the Yadkin headwaters, as slopes north of the Parkway are gentler than on the escarpment south of the Parkway. Cut-and-fill areas for the bypass would be less expansive. Stream gradients and velocities are less severe. However, cumulative impacts associated with an increase in impervious surfaces from both the bypass and induced development would affect Aho Branch and Middle Fork South Fork at the northern terminus of the project corridor. No ponds currently exist in this area.

Fish and Wildlife Populations. Bypass Alternatives 4A and 4B would both result in the fragmentation of large portions of forested areas on the Blue Ridge escarpment. Bypass Alternative 4A in particular would present an imposing barrier to migration of wildlife. Suitable habitat on each side of the road would become isolated. Forested habitat that would remain to the west of the road, near Blowing Rock, would become a small island of cover and forage inhospitable to forest interior species. Animals that do cross the road would suffer increased mortality from passing cars. Bypass Alternative 4B would have a lesser fragmentation effect, as bridges are planned for most of the stream crossings along the bypass. Such stream bank corridors are often used by animals for migration routes.

After road construction is complete, traffic noise and a large, continuous canopy gap would remain on the escarpment. More reclusive forest wildlife would be forced to retreat to more secluded areas of habitat.

Induced development would introduce scattered canopy fragmentation, noise, and other disturbances to wildlife to the same affects caused by the bypass itself. These effects would most likely be surpassed by the impacts of the bypass itself.

Impacts to aquatic fauna arising from these two alternatives and associated induced development would include ongoing stream degradation from sedimentation and from pollutants draining from the roadway. Bypass Alternative 4A, in particular, would have severe effects on stream structure, hydrology, channel profiles, amount of flow, and water temperature, clarity, and chemistry on the Blue Ridge escarpment. Prey organisms for trout and other aquatic fauna and vegetation would be adversely affected. Bypass Alternative 4B would incur fewer impacts, although some streams still would be degraded by increased sediment and pollutant loads and higher runoff rates following precipitation events.

Stream crossings at Aho Branch and Middle Fork South Fork would cause similar effects, but to a lesser extent because of gentler slopes. Wild trout inhabit Aho Branch, and Middle Fork South Fork maintains hatchery bred trout populations. Any induced development at the Aho Road intersection would introduce more sources of stream degradation in this area. In addition to sedimentation and introduction of toxic materials into open waters, such development would likely remove streamside vegetation. Alteration and channelization of streams also would be possible.

4.15.5 Blue Ridge Parkway Cumulative Impacts of Highway Projects

Environmental documents, feasibility studies, and the State Transportation Improvement Program (TIP) were reviewed to identify state highway improvement projects that cross or closely parallel the Blue Ridge Parkway. Table 3-16 in Chapter 3 listed 13 NCDOT projects since 1976 that cross or end at the Blue Ridge Parkway. None of the projects involves or involved new crossings of the Parkway. Most are in the Asheville or Boone areas. Only three of these projects were found to have an adverse effect on the Parkway or appear that they could have an adverse effect: the widening of US 321 (TIP Project R-67 in the late 1970s), the widening of US 421 (TIP Project R-529 completed in 2004), and the widening of US 221 (TIP Project R-2595 for which environmental impact studies have not started). The impacts of the crossings of US 321 and US 421 were confined to the area adjacent to the Parkway. They did not involve alteration of long-distance views from the Parkway. The remaining ten projects either upgraded the road without widening, ended at the parkway, involved a ramp realignment, or required no new right-of-way.

The replacement bridge built to take the Parkway over the widened US 321 in the late 1970s was criticized because it was not designed to imitate the stone arch bridges elsewhere along the Parkway. There is no expectation on the part of either the NCDOT or Parkway officials that this approach will ever be repeated. A new double-barreled stone arch bridge is being built in association with the US 421 project. For US 74, the project's five-lane typical section was narrowed to four lanes at the Blue Ridge Parkway overpass so that the project would stay within the existing right-of-way. Other mitigation used at projects at the Parkway have included special signal heads and poles, signage, adding retaining walls, avoiding cuts and fills where possible, landscaping and re-vegetation, and acquiring replacement property for the Parkway.

The nature of these projects combined with current design policies of the NCDOT and National Park Service do not indicate a reasonably foreseeable trend of individually minor impacts that become collectively significant over a period of time. In all but the 1976 case, either the projects would not adversely affect the Parkway or the changes were or could be mitigated in a way that maintains the character of the Parkway. For the same reasons, when these projects are added to the impacts of the Build Alternatives, the impacts do not compound to create an impact more significant than the sum of the individual impacts.

Two additional items are of note. First, all but one of the 13 projects were planned or programmed in the 1990s or in 2000. This factor reflects recent population, tourist, and population growth for counties along the Parkway. Although the projects reasonably foreseeable to date do not become collectively significant over time, this trend indicates a need for caution as these projects are developed and new projects are proposed, since the potential exists for projects to become collectively significant at some unforeseen future date.

Second, the US 321 improvements project, particularly the Bypass Alternatives, introduces new man-made features into important views from the Blue Ridge Parkway. In the case of Bypass Alternatives 4A and 4B, these impacts would rise to the level of an Adverse Effect under Section 106 of the National Historic Preservation Act of 1966. The Bypass Alternatives would introduce a type of impact different from that of the other projects, in terms of the characteristics of the impact and the opportunities to mitigate the impact. Although not reasonably foreseeable at this time, multiple projects of this type in combination with any secondary development they might generate and other development in the Blue Ridge Parkway viewshed have the potential for becoming collectively substantial.

4.15.6 Cumulative Impacts of Improvements to US 321 from NC 168 at Patterson to Blowing Rock

As described in Section 2.1.1 of Chapter 2, the proposed improvements to US 321 at Blowing Rock were originally considered as a part of a larger study for improvements to US 321 beginning at NC 268 in Caldwell County and ending the northern terminus of the project assessed in this FEIS. This section examines the potential cumulative impacts of the Preferred Alternative and the widening of US 321 from NC 268 to Blackberry Road, the southern terminus of the Preferred Alternative for this project, TIP Project R-2237C.

The total length of the two projects would be approximately 15.3 miles, 11.2 miles between NC 168 and Blackberry Road (TIP Nos. R 2237A and B) and 4.1 miles for the Preferred Alternative (TIP No. R 2237C). The 1994 Finding of No Significant Impact stated that approximately 265 acres of additional right-of-way was required to accommodate the improvements from NC 268 to Blackberry Road. The acreage was primarily natural plant communities with some residential lawns and properties, open or cultivated fields, and commercial and other non-residential developed properties. The Preferred Alternative of TIP Project R-2237C would affect an additional 27 acres of natural plant community. The need for additional right-of-way was minimized by widening the existing road.

No archaeological sites of significance are within the project area between NC 268 and the northern terminus of the Preferred Alternative. One structure is eligible for the National Register of Historic Places, the McCaleb Coffey House, between NC 268 and Blackberry Road at SR 1560, approximately 8.8 miles south of Blackberry Road. TIP Project R-2237A was found to have no adverse effect on the McCaleb Coffey House. A visual effect was mitigated through landscaping on the highway right-of-way. The Preferred Alternative of TIP Project R-2237C would adversely affect the Green Park Historic District. There is, however, no historical connection between the McCaleb Coffey House and the District so the adverse impact on the Green Park Historic District would not create an adverse effect on the McCaleb Coffey House. No recreation areas are between NC 268 and Blackberry Road to add to the Preferred Alternative's impact on the Blowing Rock Country Club.

No disruption or division of neighborhood cohesion was expected between NC 268 and Blackberry Road and no community services were to be adversely affected that would be added to the impact of the Preferred Alternative of TIP Project R-2237C. Like the Preferred Alternative, the widening from NC 268 and Blackberry Road was not expected to generate new development in the region. Rather it would support development already included in the regional economic development and population forecasts by serving the traffic such development is expected to generate. The combined projects in association with past four lane improvements would create a four-lane US 321 from Hickory, NC at I-40 to Boone, NC. The combined projects are not expected to generate additional development that would cause regional population and economic forecasts to change. Population and employment forecasts for the region presume the improvement of regional thoroughfares to accommodate projected growth.

Approximately 52 families and eight businesses were expected to be relocated between NC 268 and Blackberry Road. Included among the families to be displaced were expected to be a small number of persons or families who could have special problems relocating, but no major problems were foreseen in relocating them. Sufficient business properties and sites appeared to be available to relocate those businesses that were expected to be displaced. The Preferred Alternative would displace an additional 12 homes and 5 businesses for a total of 64 homes and 13 businesses. Given that the implementation of the projects is occurring over a more than 10-year period (half the improvement between NC 268 and Blackberry Road is already built and

construction began in December 2004 on the other half), the combined projects will not increase the difficulties of relocation. The displaced homes are in multiple communities or neighborhoods and the businesses south of Blowing Rock generally serve a different market. Thus, the combined displacement would not result in unsustainable remnant neighborhoods or business communities.

Using the existing corridor would minimize natural resource impacts from NC 268 to the northern terminus of the Preferred Alternative. There would be minor stream and drainage modifications accompanying some culvert extensions. There would be no substantial constraints to flow in the floodways and no affect to flood stage upstream. About 1.56 acres of wetlands was expected to be filled by the widening from NC 268 to Blackberry Road. The Preferred Alternative for TIP Project R-2237C would add 0.07 acre for a total of 1.63 acres. With a small total wetland impact that would occur across different wetland systems, the combined impact would not adversely affect the function of area wetlands such that the combined impact is greater than the sum the individual impacts. Wetland impacts would be mitigated. Stringent erosion and sedimentation control measures would be used to minimize water quality impacts. No adverse effects to federally protected species would likely result from the proposed improvements.

Carbon monoxide concentrations would not exceed the National Ambient Air Quality Standards. From NC 168 to Blackberry Road, it was found that future noise levels would approach or exceed the FHWA Noise Abatement Criteria at 56 homes and six businesses. The project's noise levels were expected to be slightly lower (1 dBA) at one home. The Preferred Alternative for TIP Project R-2237C would add 28 homes that approach or exceed the Noise Abatement Criteria. Noise abatement measures were considered not feasible from NC 268 to the northern end of the Preferred Alternative and therefore none was recommended.

As a whole, the widening of US 321 and the associated cuts and fills would noticeably change the appearance of US 321 from NC 268 to the northern terminus of the Preferred Alternative. Visual change from NC 168 to Blackberry Road (TIP Project R-2237A and B) has occurred or will occur with the wider pavement, cuts and fills that are shallower than those that existed before project construction, and loss of vegetation. This change was and is to be mitigated by revegetation. The nature of the visual impact with the Preferred Alternative for TIP Project R-2237C would be primarily changes in the appearance of the Green Park Historic District and the resort character of Blowing Rock as a whole. A landscape plan would be developed and implemented to mitigate visual change in Blowing Rock.

Three underground petroleum storage tanks were removed during the R-2237A widening project. No underground storage tanks will be removed for R-2237B. Minor soil contamination exists at five locations along R-2237B, which was not a factor in right-of-way acquisition. Four underground storage tanks would be associated with the Preferred Alternative for R-2237C for a total of seven for the three projects. For the Preferred Alternative (R-2237C), a study would be completed during right-of-way acquisition to determine the presence of contaminated soils so any contaminated soils could be properly disposed. The underground storage tanks are in a series of small separate sites. It is not anticipated that leakage would be found at most tanks. Overall, soil contamination has been a minimal problem along the three projects.

4.16 Construction Impacts

Any major construction project, public or private, transportation or non-transportation, will inconvenience or disturb the residents, businesses, and business customers adjacent to that construction project. Without proper planning and implementation of controls, construction

could adversely affect the comfort and daily life of residents and visitors. In developing and implementing its construction projects, the NCDOT endeavors to minimize inconveniences and disturbances and would do so with any Build Alternative selected for construction.

The unique character of the Town of Blowing Rock and its environs poses unusual challenges for the construction of any of the Build Alternatives. For example, construction of the Preferred Alternative would require the contractor to manage effectively traffic maintenance, noise, blasting in close proximity to businesses and residences, and complex utility relocations concurrent with roadway construction. Construction of the Preferred Alternative would cause the public to experience more construction traffic delays than with any other alternative. Construction of Bypass Alternative 1A would necessitate construction through an existing residential neighborhood proximate to Green Hill Road, Wonderland Drive, and Goforth Road. In improving the existing horizontal curve at Gideon Ridge, Bypass Alternative 1B would involve a 200-foot-deep cut for the removal of the east end of Gideon Ridge, a temporary bridge to carry existing traffic over the new roadway, and the construction of a new bridge approaching 200 feet in height across the valley north of Gideon Ridge. With Bypass Alternative 4A, providing construction equipment access to the alignment would be challenging. It would involve a major blasting and earthwork program. Because Bypass Alternative 4B is predominantly structure, the contractor would need to bring substructure units (foundations and piers) and materials to their erection point via existing topography. The existing topography is so challenging that it would require the contractor to construct access roads outside of the right of way with associated temporary impacts to streams and habitat.

The Town of Blowing Rock and the NCDOT have entered into a Memorandum of Understanding (MOU) relating to the US 321 Improvements project. The NCDOT, the USACE, and the State Historic Preservation Officer have also entered a Section 106 Memorandum of Agreement (MOA). Both documents are included in Appendix G. These documents include guidelines for the construction of the Preferred Alternative. Chapter 2, in Section 2.4, described for each alternative the expected sequence of operations, focusing on the challenges of each alternative, the timing of operations, traffic control and maintenance of access. This section addresses construction impacts and procedures to control those impacts, including those contained in the MOU and MOA for the Preferred Alternative and other potential control procedures that could be considered in construction period planning, under the following categories:

- Construction contract specifications;
- Potential special contractor incentives;
- Innovative techniques;
- Excavation procedures (including blasting);
- Procedures for handling blasting materials;
- Earthwork borrow and waste;
- Erosion control;
- Air quality;
- Noise control;
- Tree protection;
- Utility relocation; and
- Geodetic survey markers.

4.16.1 Construction Contract Specifications

Contractors would be required to observe and comply with all federal, state, and local laws, ordinances, and regulations that affect the conduct of the construction work. In addition, standard procedures contained in *Standard Specifications for Roads and Structures* (July, 1995) that pertain to environmental protection would be followed. The specifications that relate to this type of highway improvement include:

- Legal relations and responsibilities to public (Section 107);
- Protection and restoration of property (Section 107-12);
- Control of erosion, siltation, and pollution (Section 107-13);
- Hazardous, contaminated, and/or toxic material (Section 107-26);
- Clearing and grubbing (Section 200);
- Demolition of buildings and appurtenances (Section 210);
- Roadway excavation (Section 225);
- Comprehensive grading (Section 226);
- Borrow excavation (Section 230);
- Disposal of waste and debris (Section 802);
- Borrow material (Section 1018);
- Landscape development materials (Section 1060);
- Temporary silt fence (Section 1605);
- Brush barriers (Section 1608);
- Stone for erosion control (Section 1610); and
- Temporary mulching (Section 1615).

These procedures could be incorporated as General Conditions in the construction contract documents, and the contractor's manager and NCDOT Resident Engineer would be responsible for enforcing compliance. The MOU and MOA agreements specify that the contractor will not place a construction office or a staging area in the Green Park Historic District.

4.16.2 Potential Special Contractor Incentives

Project owners, in this case, the NCDOT, most frequently use contractor incentives to compress the schedule. This strategy works best when the project enjoys strong community support and the public is willing to accept a higher level of construction impact so that the contractor can maximize production. Before considering an early completion incentive, the owner should have control or a high level of confidence in project variables such as community goals, subsurface conditions, potential utility conflicts, and potential third party delays.

The following incentives could reduce the community impact by compressing the contractor activities and construction elements that tend to create adverse conditions for the public:

- Lane Rental. For projects with multiple lane closures, a lane rental contract provision can motivate the contractor to minimize lane closures. Under a lane rental approach, the owner designates a fixed dollar amount that is available to the contractor to spend to close all, or a portion of, the existing travel way. As part of the contract provision, the owner creates a rental table for each closure type so that the contractor pays most for those closures that have the most impact to traffic. With each closure, the contractor draws down the lane rental funds. At the end of the contract, the money remaining in the rental fund belongs to the

contractor. The value of a lane rental provision is that the contractor has an incentive to minimize the number and duration of closures.

- **Quality Bonus Program.** Another incentive to consider is a quarterly quality bonus. Each quarter, the owner would score the contractor on a predetermined list of factors, such as effective management of blasting, coordination of utility relocations to minimize disruption of service, dust control, maintenance of access to businesses and residences, erosion control, and safety. A bonus would be awarded to the contractor based on the quality score.
- **Milestone Incentive/Disincentive Provisions.** In some instances, it is advantageous for the owner to provide an incentive/disincentive provisions in the contractor's contract for certain critical elements. A good example is the need to minimize the length of time that a detour would be in service. By establishing a 30-day duration for the detour and by providing an incentive/disincentive of \$5,000 per day, for instance, the contractor would receive \$5,000 for each day less than 30 days that the detour was in service, but would be penalized \$5,000 for each day more than 30 days that the detour was in operation.

The NCDOT will consider these and other potential incentives as applicable to the alternative being implemented in developing construction contracts. The paragraphs that follow describe the applicability of these incentives to each of the Build Alternatives.

Preferred Alternative

The Preferred Alternative does not fit the classic project model for schedule compression, yet there are other incentives that would fit the Preferred Alternative. The timing of operations and traffic control would both lend themselves to contractor incentives. Specifically, the Preferred Alternative would be an excellent project for the use of a lane rental provision. An incentive/disincentive special provision would be a part of any potential detour. Lastly, a quality bonus provision is suitable to the Preferred Alternative. Criteria for measuring bonus eligibility could include such items as effectively managing blasting, minimizing disruption of utility services, controlling dust and erosion, maintaining access to businesses and residences, and maintaining a good safety record.

Bypass Alternatives 1A and 1B

Because Bypass Alternative 1A and 1B would cross, rather than parallel, existing roadways for most of their length, lane rental would apply only to the section that would involve widening the existing road at the south end. Lane rental would be advantageous during blasting to encourage the contractor to reopen the roadway promptly after blasting. Another approach would be to create a milestone completion date for the widening portion and add an incentive/disincentive on the milestone. This would encourage the contractor to expedite completion of the portion of the project that would most affect the traveling public.

The quarterly quality bonus incentive also is applicable to Bypass Alternatives 1A and 1B. The score for the quarterly bonus incentive could include the contractor's handling of the community impacts associated with construction through a residential development, including controlling noise, maintaining access, maintaining pedestrian corridors, and controlling dust.

Bypass Alternatives 4A and 4B

Motivation for early completion is different here than with other alternatives; because the contractor would have a largely unencumbered alignment with these alternatives, there would be an opportunity to create reasonable early completion incentives. One effective variation would be

to include an alternative bid for completion by an earlier date than the base bid. This would allow the contractor to establish the premium amount for acceleration in a competitive bid situation without committing the owner to the incentive option. A quality incentive program also would be applicable.

4.16.3 Innovative Techniques

The unique challenges of the US 321 Improvements Project require innovative solutions. The techniques described in this section could be applied by the NCDOT to the construction of the Build Alternatives. In the MOU and MOA agreements, the NCDOT has committed to using “Smart Zone” techniques in the maintenance of traffic during construction. These techniques include items such as advance notification of delays, closures, real time monitoring, and use of digital messaging systems. The NCDOT also committed to implementing a construction period public information program, including a project web site and a pre-construction kick-off meeting to introduce the contractor and the construction process to area residents.

Integrated Construction Management

An integrated Construction Management (CM) approach involves a multi-disciplinary team. For the Preferred Alternative, an integrated team would consist of highway designers (for roadway alignment and drainage), structural engineers (for bridges, retaining walls, and major drainage structures), landscape architects (for landform development, re-vegetation, and streetscaping), geologists/geotechnical engineers (for subsurface investigation, rock slope design, and foundation design), traffic engineers (for intersection and traffic control plans), right-of-way agents (for property acquisition and relocation), construction engineers (for constructability evaluation), specification engineers, cost estimators, and other specialists as required. A resident engineer, who would serve as the construction project manager, would have the authority to direct all project resources and bear responsibility for project outcomes.

Early Resident Engineer Involvement

The NCDOT’s Division 11 staff, including the resident engineer, would be involved throughout the design effort, providing input regarding recent experience with projects in the mountains of North Carolina. Having the resident engineer involved early would increase the constructability of the design and would provide the needed continuity as the project moves from design to construction. The NCDOT’s Division Construction Engineer and the resident engineer in Boone were consulted in the preparation of the EIS.

Public Outreach Program

Public outreach or information program is the link that sustains the dialogue between the NCDOT and its customers. A construction public outreach program provides timely and accurate information to the public and promotes interaction with the public, both of which are needed to build trust and credibility. Public outreach is the tool that can engage the public in the project process and make them part of the solution. In the MOU and MOA agreements, the NCDOT agreed to a public information plan for project construction.

Because of the number of businesses, the sensitivity of the community to traffic disruption, and the amount of traffic along this project, an intensive public outreach program would be implemented during construction.

The key elements of the community awareness plan could be:

- A project mailing list;
- A local government and business advisory team;
- Pre-construction open house meetings;
- A project web site;
- Informational publications that may include regular news releases, “Dear Neighbor” letters, fliers, and newspaper columns on contractor personnel (“a day in the life of”);
- A 24-hour information line;
- Speaking engagements by construction managers;
- Attendance at project meetings between the NCDOT and the contractor by those responsible for informing the public; and
- Public information regarding blasting.

Mailing List. All businesses and residents within the project limits could be included on the list. In addition, businesses and residents just outside the project limits could be added to the list because they will see the construction daily and will be curious about any potential impacts to them. The local chamber of commerce and merchants’ association membership list and US 321 study mailing list could be included. Local government officials, law enforcement and emergency management agencies, school officials, civic groups/organizations and any community traffic safety team or similar group also could be part of the mailing list. The mailing list also could include local media organizations. Anyone who asks to be on the list could be added.

Local Government and Business Advisory Team. A Local Government and Business Advisory Team (LGBAT) made up of local officials (representing the public) and business representatives could be created to contribute to construction planning and to maintain communication between the construction team and local officials and the business community throughout the construction period. The LGBAT could be formed early in construction planning as an aid to the NCDOT’s consideration of local government and business concerns during the development of bid packages.

Discussion items for an LGBAT could include lane closure schedules, utility impacts, drainage details, and accessibility impacts. Several types of accessibility impacts are: installation of raised medians, installation of storm sewer pipe beneath driveway connections, and traffic signal changes. Often, the primary accessibility issue is business access during construction. For concerns that arise between meetings, a familiar, single point-of-contact who can provide reliable and specific information is essential.

Pre-Construction Open House Meetings. Prior to the start of construction, a public open house or kick-off meeting would be held. The NCDOT committed to holding such a meeting in the MOU and MOA. To maximize participation and attendance, a letter could be distributed to the persons and businesses on the mailing list, and a news release could be distributed to local media. The open house would be an informal gathering where project personnel and selected NCDOT project team members, are on hand to answer questions about the project. To make visualizing the project easier, display boards could be used to show changes in traffic patterns, new sidewalks, landscaping, and other aspects of the project. A fact sheet about the project, produced by the NCDOT, could also be distributed as a take-away reminder. Project personnel would be prepared to answer questions pertaining to such issues as drainage, blasting, accessibility, maintenance of traffic, lane closures, and work schedules.

Project Web Site. The existing project web site would be maintained and updated through design and until completion of construction. A web site is included in the MOU and MOA. It would include current information on the schedule and development of the project, project progress, project contract information, and notification of any anticipated delays based on scheduled construction activities. Using the project web site to publish information during the construction contractor bid phase could provide important information to bidders using a process that is transparent to the public. In addition, there is an opportunity to communicate more broadly by enlisting the support of other appropriate web sites to create links to the project web site.

Project Information Publication Program. Prior to the start of construction, the construction project's on-going public information program would begin. The NCDOT could distribute a letter to everyone on the project mailing list. The letter would outline construction dates, as well as specific information regarding project impacts to traffic. The NCDOT could distribute a news release to the local media organizations, as well as a Critical Impact Group made up of law enforcement, emergency management agencies, the US Postal Service, and local school officials. The release would include the project start date, pertinent project information, and specific traffic impact details. Each week throughout construction, the NCDOT could distribute news releases to the media giving traffic impact details. This information also could be given directly to the Critical Impact Group. The releases would specify lane closure locations and times, as well as work schedules. The NCDOT also could maintain a media clips file, take calls from citizens and the media, and ride through the project regularly.

24-Hour Information Line. Throughout construction, even after hours, it is important for motorists and residents to have accurate and up-to-date information available. A 24-hour information line could provide this information. During regular office hours, the NCDOT could respond to questions and calls from residents, motorists, and media representatives. After regular business hours and when NCDOT staff are out of the office, a detailed, recorded message could be left. The message would give lane closures and work schedules, as well as a brief overview of the general project.

Speaking Engagements. The NCDOT project representatives could be available to make presentations to community groups and civic clubs/organizations regarding the design, impact, and construction status.

Pre-Blast Information. Public concern about blasting is an important issue that needs special attention. As pre-blast assessments begin on the project, the NCDOT could arrange a pre-blast public meeting. At the meeting, the NCDOT would address the planned process, procedures, timing, and anticipated effect of the contractor's blasting program. The intent would be to inform the public and respond to citizen concerns regarding what to expect.

Rapid Response Crew

A rapid response crew lump sum bid item is a concept that has proven effective on projects in residential areas where the risk of public impact after hours is a major concern and could be used. The intent is to create an incentive for the contractor to leave the site each day in a proper condition and to provide a mechanism for the contractor to remedy promptly items that are an immediate issue. An example would be a driveway entrance that becomes inaccessible to a homeowner because the contractor failed to compact temporary fill properly. The concept is to define a contract bid item for a rapid response crew that would provide manpower and equipment that the contractor would be required to mobilize rapidly (within 4 hours) after receiving a call from the NCDOT of a problem. Should the NCDOT mobilize the contractor for out-of-scope work, the contractor would receive full compensation for the crew based upon actual labor and

pre-agreed hourly rental rates plus mobilization costs. Should the NCDOT mobilize the contractor for in-scope work and the contractor responds within the stipulated period with the stipulated resources, then the contractor would not receive compensation for the crew. Should the contractor fail to respond within the stipulated period or with the stipulated resources for in-scope work, then the contractor would not receive compensation for the crew and would lose a pre-defined percentage of the rapid response crew lump sum bid amount.

4.16.4 Excavation Procedures (Including Blasting)

This section describes construction period excavation procedures, particularly those associated with blasting. The MOU and MOA Agreements commit the NCDOT's Geotechnical Engineering Unit to developing a vibration monitoring plan for the project. They also state that the NCDOT and its contractor would limit blasting to specific times and those times would be posted on the project web site. In addition blasting activities would be announced in the media. Finally, the pre-construction surveys of all structures adjacent to US 321 within the Green Park Historic District would be conducted to record a "before" condition so any construction-related damage can be accurately identified.

Geologic Investigations and Excavation Strategies

As a precursor to excavation, a thorough geologic investigation would be conducted before the completion of final design in order to predict the likely subsurface conditions with the necessary level of accuracy. A thorough rock slope-engineering program would be conducted. Contractors would use the sub-surface geological information to estimate quantities of overburden and rock that can be reasonably excavated by a dozer with a ripper attachment ("ripable rock"), and to design appropriate benching schemes for safely excavating rock slopes.

Excavation Procedures

In general, the contractor is likely to use dozers on navigable slopes to cut, rip and push down cut material. Large track excavators or front-end loaders would load rock trucks to haul to project fill locations. For blasting shots adjacent to the existing roadway, the contractor would close the roadway for the time required to shoot and load the spoil ("muck out") into rock trucks using articulated, rubber-tired, front-end loaders. Loading operations would likely proceed behind temporary concrete barrier in areas of limited shoulder width. Flag persons would likely control traffic exiting the loading area at the cut and entering the dumping area at the fill location.

Blasting Procedures and Controls

Serious incidents involving the legal use of explosive materials are rare. When concerns are expressed about blasting, it is often suggested that alternative methods might be used to excavate hard rock. Because of the large quantities of rock, using mechanical excavation methods would not be reasonable for any of the Build Alternatives. The cost of excavation work would be prohibitively expensive and more importantly, the impacts on the community because of a greatly extended construction schedule would be unacceptable. If Hoe-rams or impact rippers were used to excavate rock near businesses and homes, people would be subjected to months of continuous hammering noise and other construction effects, instead of feeling limited instances of blasting vibrations lasting only a few seconds.

Blasting programs in urban areas must control flyrock (rock that flies into the air as a result of blasting), vibration, and air-overpressure (the increase in air pressure caused by blasting), whereas, the project in rural areas would likely have strict environmental controls on water

quality and animal impacts. The following blasting risk management measures could be implemented:

- Define pre-qualification requirements to ensure that only contractors capable of successfully performing the work are allowed to bid it.
- Create blasting specifications that clearly define the performance, environmental, and safety requirements.
- Develop general and specific blast plans.
- Hire experienced construction managers and inspectors to oversee blasting work.
- Conduct a community relations program whereby information about blasting can be appropriately conveyed to the community and media.

Requiring the contractor to submit a general blasting plan and specific plans for individual blasts would promote blasting safety and would minimize the risk of impacts on neighbors and structures caused by blast vibration and air-overpressure. These plans could be reviewed and approved by the NCDOT's resident engineer or designee. General blasting plans could be submitted well in advance to allow reviews and approvals before any blasting is allowed to proceed. For specific blasting plans, a geotechnical engineer should prepare a pre-blast assessment of potential blast effects and how to avoid them. The Town of Blowing Rock could also request further hydrological and geological studies, as well as test wells, if deemed necessary.

In addition, a program designed to monitor blast-induced ground vibration and air overpressure would be implemented to ensure that nearby property and occupants are not damaged or unduly disturbed by blasting. The MOU and MOA commit the NCDOT's Geotechnical Engineering Unit to developing a vibration monitoring plan for the project. Should monitoring reveal that the contractor exceeded specification levels, the NCDOT could shut down the contractor's blasting operation and require the contractor to submit a blasting resumption plan that describes how the incidents leading to non-compliant levels would be prevented on future blasts.

Pre-blast surveys of nearby buildings and infrastructure would be conducted for all properties within 600 feet of blasting locations. In the MOU and MOA, the NCDOT committed to conducting pre-construction surveys of all structures adjacent to US 321 within the Green Park Historic District. Pre-blast inspection reports generally include written comments concerning observed defects and general property condition. They can also include diagrams; crack survey sketches, audio and/or video notes, and photographs. To ensure adequate documentation of existing structural defects for resolution of potential claims, specifications generally include detailed requirements concerning the collection and archiving of pre-blast survey data. Existing defects generally are photographed with high-quality color film or recorded on videotape.

Town of Blowing Rock Requirements

The Town of Blowing Rock requires contractors to obtain a license for blasting work occurring within the town limits. Blasting for the Preferred Alternative would occur within 100 feet of numerous occupied structures, utilities and other property. Blasting permit requirements for the Town of Blowing Rock require pre-blast inspection of all structures and facilities within 500 feet of proposed blast locations. As described in the previous section, the NCDOT specifications for

this particular project would include other blasting limitations and require significant monitoring of blast-induced vibration and noise.

Town rules prohibit blasting after 5:00 PM, so a variance from this rule would be needed if nighttime blasting were needed. Blasting at night would only be practical if the intensity of vibration and noise could be kept below levels that would disturb sleeping or resting occupants in the residences nearest to the blast areas. Blasting engineers can make this determination by using scaled-distance formulas to predict vibration and air-overpressure levels, which would in turn be compared to historically accepted limits and then integrated into the project's special provisions to cover nighttime blasting.

Blasting Considerations for Each Build Alternative

Preferred Alternative. Managing the blasting work for the Preferred Alternative would be the most challenging of all the Build Alternatives. Potential blasting impacts would be evaluated in detail during final design. This study would first identify all features that blasting work might influence. Identified impacts might include but are not limited to effects on people during daytime and nighttime hours, traffic patterns, structures, utilities, environmental resources, and business activities. Once the impacts are identified, practical controls and mitigation efforts designed to minimize blasting impacts would be recommended on a case-by-case basis.

It would be imperative to ensure that flyrock, ground vibration, and air overpressure is controlled for all blasting work. A variety of limitations in the project specifications could be used to control blast effects. For example, vibration could be controlled by requiring contractors to meet a minimum scaled-distance value that would control the intensity of ground motion near all structures of concern. Rock movement and blast noise could be limited by covering blasts with mats or earth and by mandating the use of cautious amounts of crushed-stone stemming (non explosive material that is placed in a blast hole in between or on top of explosives to confine vertical blast energy). Blast impacts also could be controlled by limitations on shot size, charge diameter, and bench height. The size of blasts and the impacts of blasted rock on lane closures could be controlled by developing clear constraints in the project specifications. The specific controls would be guided by the project's prime goals. For instance, if it is decided that both lanes of US 321 can be closed for certain periods at night, then relatively large blasts that temporarily cover portions of the existing lanes with blasted rock might be allowed. Alternatively, if it is decided that the blasting should occur during daylight hours, with limited single-lane-closures, then the specifications would limit shot size and shot direction to ensure fast clean up of blasted rock that might spill (swell) into the lane left open for traffic. Blasters can use a variety of measures to control how much rock lands on roadways. For instance, the delay timing of blast holes could be sequenced to aim blasted rock away from temporarily closed lanes. Also, specifications could require that a minimum amount of rock (burden) be kept between rock faces and open lanes to minimize rock swell onto roadways. Furthermore, time needed to reopen roadways swiftly after blasting could be minimized by requiring contractors to have adequate rubber-tired loaders and trucks standing by to remove quickly any rock that might spill over onto open road lanes.

The contract documents and pre-bid/pre-construction communications with contractors would emphasize that all blasting operations must be performed with extreme care. The MOU and MOA for the Preferred Alternative state that the NCDOT and its contractor would limit blasting to specific times and those times would be posted on the project web site. In addition blasting activities would be announced in the media.

Bypass Alternatives 1A and 1B. Most of the concerns and controls discussed in the Preferred Alternative section would also apply to the blasting work needed for Bypass Alternatives 1A and 1B. Blast scheduling would not be as difficult with this alternative and the potential for blasting impacts on existing utilities and structures would not be as great as with the Preferred Alternative. However, the blasting required for this option would create much deeper cuts, which would require additional specifications and blast management measures designed to prevent blast-damage to the final, exposed surface of the rock cuts. Blast damage to rock cuts increases the potential for future rock slides.

Bypass Alternatives 4A and 4B. Because the alignment for Bypass Alternatives 4A and 4B is completely new, blasting work, except for tie-in sections with the existing US 321, would not interfere with current traffic flow. The remoteness of the work would also ease constraints on blast size and scheduling, and it would lessen the need for monitoring blast effects (vibration and air-overpressure). This alternative, however, would require the blasting and excavation of very large surface cuts, as well as blasting for a tunnel beneath the Blue Ridge Parkway. Extensive geotechnical investigations of the rock in the high-cut and tunnel areas would be needed to provide for an adequate design of excavation and ground support measures.

Procedures for Handling Blasting Materials

For the Preferred Alternative and Bypass Alternatives 1A and 1B, American-Table-of-Distance restrictions would preclude storing explosives near the work. In cases like this, the contractor or the contractor's explosive supplier would establish an explosive magazine site at an approved rural area outside of town or, if practical, daily deliveries would be made from the suppliers' permanent magazine (explosive storage) site. In either case, explosives would be transported in and out of the town limits on a daily basis. When explosives and detonators are brought to the site, either they are transferred to "day boxes" for temporary storage on site or they are kept in the delivery truck that "stands by" while blasts are loaded.

Regardless of what option is used, the US Department of Transportation and the Occupational Safety and Health Administration (OSHA) regulations have many rules that must be followed to ensure that explosives and detonators are safely transported and handled on site. Cautious and detailed controls would be written into the specifications that would clearly define how explosives must be handled for this work and that would reiterate all applicable regulations. There are many areas outside Blowing Rock where temporary explosive storage magazines could be safely established for this project in compliance with the applicable regulations.

Because of the remoteness of the route with respect to the occupied areas of Blowing Rock, it is likely that storage magazines could be established on-site with Bypass Alternatives 4A and 4B. Establishing an on-site magazine would lessen exposure caused by numerous explosive-transport-trips over public roads and would lessen explosive handling costs. Tunnel blasting would require a separate explosive-materials handling system conforming to OSHA rules for underground work. These rules are defined in *Code of Federal Regulations* title 29, part 1926, subpart U "Blasting and the Use of Explosives," section 1926.903, "Underground Transport of Explosives." Inspectors employed and trained by the NCDOT's construction manager would normally oversee compliance with regulations and specifications for tunneling work.

Construction blasting operations in general are regulated by federal, state, and local government agencies. The Federal Bureau of Alcohol Tobacco and Firearms (ATF) and the OSHA regulate various aspects of construction blasting activities. In most states, other statewide or local agencies also regulate explosive handling, storage, and use activities. State governments and cities may also regulate explosive activities.

There are specific issues pertaining to the risk of bulk spills of ammonia and nitrate explosives. Relatively small concentrations of ammonia in water are very detrimental to fish, particularly to most trout species. The toxicity of ammonia varies with pH and temperature. In aqueous solutions, ammonia exists in two forms: free ammonia, which carries no ionic charge (NH_3), and ammonium, which carries a positive charge (NH_4^+). The free ammonia is the more toxic of the two. The EPA ambient water quality criterion is 0.02 mg/l free ammonia. For blasting work near trout streams, specifying the use of packaged explosives and mandating stringent clean-up procedures of spilled explosives can prevent this contamination. Contract specifications would contain a section outlining explosive use and clean-up procedures.

4.16.5 Earthwork Borrow and Waste

Earthwork involves moving rock and soil to construct a project. “Unclassified excavation” is the total estimated quantity of rock and soil that the contractor must move. A “balanced” earthwork project is one on which the construction contractor performs all of the unclassified excavation and neither needs additional rock and soil (borrow) nor has excess rock and soil (waste). Waste must be disposed of outside the project limits, and borrow must be acquired from outside the project limits. The best procedure for managing disposal of waste material is not to generate any net waste. It is important to adjust a roadway design such that the earthwork balances or runs a slight surplus. Except for Bypass Alternative 1B, the Build Alternatives being evaluated could balance the earthwork as close as possible for a preliminary design, although borrow or surplus (waste) material is a part of all alternatives. Further work to balance earthwork would be done during final design of the preferred alternative.

With Alternative 1B, the combination of the alternative’s alignment between Gideon Ridge and Green Hill, the large cut into Gideon Ridge, and the series of cuts that occur as the bypass passes through Blowing Rock make it more difficult to balance the earthwork than with Bypass Alternative 1A. With Bypass Alternative 1A, the waste from the series of cuts that occurs as the bypass passes through Blowing Rock is used in part to create the large fill that would occur between Stations 653+00 and 668+00, thus bringing the earthwork of this alternative nearly in balance. With Bypass Alternative 4B, a bridge would be used instead of a fill at this general location. With Bypass Alternative 1A, fill is the more reasonable approach because the alternative continues to follow the side of the hill as it moves towards Green Hill. Bypass Alternative 1B, passes across a valley between existing US 321 and Green Hill, making a bridge the more reasonable approach.

Preliminary earthwork computations for Bypass Alternative 1B show that there would be approximately 2.1 million cubic yards of unclassified excavation, no borrow, and 1.4 million cubic yards of surplus material. The logistics involved with disposal of 1.4 million cubic yards of earth are daunting. A surplus of this magnitude would require the input of the community to identify potential projects or developments that would represent a beneficial use to the Town of Blowing Rock and Caldwell County. To achieve maximum benefit (and least cost), the disposal location should be adjacent to the Bypass Alternative 1B project corridor. The contractor could then use rock trucks or scrapers (specialized, self-propelled, earth moving equipment that is bottom loading and bottom dumping) to transport the surplus. One possible location in the project corridor for disposal of this waste would be next to US 321 just north of where the bypass leaves the cut into Gideon Ridge and begins to proceed towards Green Hill, the same general area of the large fill used with Bypass Alternative 1A. The area affected would probably be larger than with Bypass Alternative 1A fill since the waste disposed would be a combination of waste from the Gideon Ridge cut and the series of cuts that occur as the bypass passes through Blowing

Rock. The disposal of waste would create additional wildlife habitat loss and additional visual impact.

If hauled off-site on area highways, tandem dump trucks would be used, carrying approximately nine cubic yards of material each. Moving this much surplus along are highways would require approximately 155,000 trips.

In theory, a balanced project does not generate any waste or borrow. In practice, even balanced projects actually net a surplus or borrow because of changed site conditions. In addition, there is always a potential that the contractor could encounter unsuitable material. Unsuitable material is earth or rock that does not meet owner specifications for roadway fill. Clay that yields under load and organic material are examples of unsuitable material. Because unsuitable material is acceptable for non-structural fills, the first use of unsuitable material would be for non-structural project fills like raised medians and landscaping areas, where possible based on available right of way and final grading plans. Another solution is to consciously create in the design one or more areas for widening fill slopes beyond what is necessary and stipulate that the contractor must place any potential surplus at the designated location(s). The geotechnical investigation associated with final design of the preferred alternative would provide information needed to estimate the quantity of unsuitable material, and the final design plans would designate the areas for placement within the project limits. The MOU and MOA state that waste deposits and borrow pits will not be allowed within the Green Park Historic District. Should the volume of unsuitable material exceed the planned areas for its use, it would be necessary to acquire either sufficient right-of-way or a temporary easement beyond the toe (bottom) of fills.

4.16.6 Erosion Control

Erosion and sedimentation can be controlled during most land-disturbing activities by using appropriate Best Management Practices (BMPs). An Erosion Control Management and Maintenance Plan would be prepared during final design and carried out during construction of the preferred alternative. The plan would comply with the North Carolina Sedimentation Pollution Control Act of 1973. Requirements of the plan would include:

- Minimize the areas of exposed earth;
- Provide temporary and permanent seeding and landscaping as soon as practicable;
- Perform temporary seeding and mulching immediately upon completion of a section;
- Provide silt fences or other erosion control devices at the base of all fill slopes;
- Provide storm drain inlet protection at all catch basins or other areas where sediment may enter storm drainage systems;
- Provide rock silt check dams and/or sediment basins on the downstream side of all large cross drain locations;
- Provide check dams in ditches;
- Provide temporary sediment basins; and
- Install temporary slope drains to protect cut and fill slopes.

Non-traditional materials that may be applicable for this project include coir (100 percent coconut fiber fabric) to promote vegetation on mixed rock and soil slopes without the use of synthetic materials, continuous wire fencing (chicken wire) to back silt fence, and turbidity curtains for work in the proximity of live streams.

In addition, the contractor must develop, for NCDOT approval, a soil erosion schedule. It would describe the time relationship between phases of the work that must be coordinated to reduce erosion, the construction practices and temporary control measures that would be used to minimize erosion, and a plan for the disposal of waste materials. Permanent erosion control work would be incorporated into the project at the earliest practicable time and coordinated with temporary measures to yield economical, effective, and continuous erosion control. Every reasonable precaution would be taken to prevent pollution of water bodies.

The substantially greater earthwork needed for Bypass Alternative 4A would make erosion control a key element of constructing this alternative. Erosion control would be very important from early in the contract when the contractor provides for equipment access to the construction site. Additional techniques for erosion control particularly applicable to steep slopes would include slope drains, incremental benches to channelize runoff to permanent or temporary drainage ways at the cut/fill intercept points, use of fresh cut willow stakes along stream channels and seeps, rock-lined drainage ditches, and rock facing on sensitive slopes.

For Bypass Alternative 4B, erosion control would be most important early in the contract when the contractor creates the access road and cuts finger accesses (described in Section 2.4.3 of Chapter 2 under “Construction Period Procedures and Options – Bypass Alternative 4B”) to substructure units. Following substructure construction and the cut and fill work, however, the contractor could proceed very quickly with final restoration of many areas around substructure elements.

The NCWRC recommends the following measures for construction occurring over trout waters:

- Adequate sedimentation and erosion control measures must be implemented prior to any ground disturbing activities to minimize impacts to downstream aquatic resources. Temporary or permanent herbaceous vegetation should be planted on all bare soil within 15 days of ground disturbing activities to provide long-term erosion control.
- Construction in the stream channel is prohibited during the trout-spawning period of November 1 to April 15 in order to protect the egg and fry stages from sedimentation.
- Only clean, sediment-free rock should be used as temporary fill, and should be removed without excessive disturbance of the natural stream bottom when construction is completed.
- Under no circumstances should rock, sand, or other materials be dredged from the stream channel during installation of a temporary crossing. Culverts for temporary crossings should not be embedded in the stream bottom and existing stream bottom material should be left in place.
- All work in or adjacent to surface waters should be conducted in a dry work area. Sandbags, cofferdams, or other diversion structures should be used where possible to minimize excavation in flowing water. Any drilling sediments and drilling fluids should be contained and pumped to an upland retention basin.

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- Existing shrub vegetation in the area of the temporary crossing should not be grubbed. Rootstock should be left in place to stabilize soils and sprout following construction.
 - Shrub and tree vegetation on the banks of the creek must be restored following removal of any temporary crossing.
 - Riprap placed for bank stabilization should be limited to the stream bank below the high water mark, and vegetation should be used for stabilization above the high water elevation.
 - All mechanized equipment operated near surface waters should be regularly inspected and maintained to prevent contamination of stream waters from fuels, lubricants, hydraulic fluids, or other toxic materials.
 - Stormwater should be routed to bioretention areas and not be discharged directly to the stream.

Additional conditions may be requested depending on specific circumstances.

4.16.7 Air Quality

Construction related effects of the project on air quality would be limited to short-term increased fugitive dust and mobile source emissions during construction. The MOU and MOA specify that all construction trucks traveling faster than 25 miles per hour will cover their truck beds in order to reduce the amount of dust and debris.

Fugitive Dust Emissions

Fugitive dust is airborne particulate matter, generally of a relatively large particulate size. Construction-related fugitive dust would be generated by haul trucks, concrete trucks, delivery trucks, and the other earth moving vehicles operating around the construction sites. This would primarily result from particulate matter resuspended (“kicked up”) by vehicle movement over paved and unpaved roads, dirt tracked onto paved surfaces from unpaved areas at access points, and material blown from uncovered haul trucks.

Generally, the distance that particles drift from their source depends on their size, emission height, and the wind speed. Small particles (30 to 100 microns) can travel several hundred feet (meters) before settling to the ground, depending on wind speed. Most fugitive dust, however, is made up of relatively large particles (i.e., particles greater than 100 microns in diameter). These particles are responsible for the reduced visibility often associated with construction. Given their relatively large size, these particles tend to settle within 20 to 30 feet of their source.

Controlling dust would be a challenge for all the Build Alternatives and most important for the Preferred Alternative and Bypass Alternatives 1A and 1B because of their proximity to development. Because the most objectionable dust conditions tend to occur in hauling and spreading earth, the most effective time to control dust is during these activities.

Control measures that could be implemented include:

- Use watering trucks to minimize dust including keeping watering trucks on site;
- Cover trucks when hauling dirt (an MOU and MOA commitment);

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- Stabilize the surface of dirt piles if not removed immediately;
 - Use windbreaks to prevent any accidental dust pollution;
 - Use dust suppressants on traveled paths that are not paved (calcium chloride is effective in allaying dust on non-paved haul roads by bringing moisture to the surface and holding it; it is particularly ideal on roads used for extended periods);
 - Minimize dirt track-out by washing or cleaning trucks before leaving the construction site; and
 - Pave 50 feet or more of unpaved construction roads and parking areas where such roads and parking areas exit the construction site to prevent dirt from washing onto paved roadways.

Mobile Source Emissions

Since emissions of CO from motor vehicles increase with decreasing vehicle speed, disruption of traffic during construction (such as the temporary reduction of roadway capacity and the increased queue lengths) could result in short-term elevated concentrations of CO. In order to minimize the amount of emissions generated, every effort should be made during the construction phase to limit disruption to traffic, especially during peak travel periods. Disruption of traffic during construction would be the greatest with the Preferred Alternative. (See the Chapter 2 discussions on control of traffic for each Build Alternative in Section 2.4.) Construction equipment would use emission control equipment specified by law.

4.16.8 Noise Control

Construction noise would vary greatly with the type of equipment in use at any particular time and with the phase of construction activity. Noise levels during construction, therefore, would fluctuate greatly from day to day and hour to hour.

Construction noise sources include truck and equipment engines; equipment noise from scraping, ripping, and excavating; back-up alarms; the slam of truck tailgates as asphalt truckers knock the last bit out of their dump beds; impact wrenches on structural bolts for bridges; rock drilling; and blasting. Control of construction noise at the source is the most effective approach to reducing noise. Construction equipment would comply with the noise standards adopted by OSHA. Construction equipment would be required to have effective mufflers, have efficient silencers on air intakes of equipment, and to be properly maintained. The contractor can reduce noise by lining the beds of haul trucks with conveyor belting or other similar material to lessen noise made by loaders dropping rock into the trucks and by using spotters rather than back-up alarms. Other noises are best handled by indirectly managing the activities through decibel restrictions. Construction operations, and associated noise, would be generally restricted to daytime hours.

4.16.9 Tree Protection

Trees outside the construction limits could be protected from construction-related damage such as:

- Skinning of tree trunks from heavy equipment operations;
- Exposure and injury to feeder roots and heavy equipment operations;

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- Placing of fill dirt around the base of trees that would smother and eventually kill the tree; and
 - Accidental spilling of petroleum products near the base of trees that could cause mortality.

In the MOU and MOA, the NCDOT agreed to make a special effort to preserve trees of particular value identified by the Town of Blowing Rock that are outside the clear recovery area.

4.16.10 Utility Relocation

The relocation of utilities would be included in final design plans. NCDOT would coordinate construction activities with the appropriate officials to minimize damage or disruption of existing service. Utility relocations are described in Section 4.14.

4.16.11 Geodetic Survey Markers

Any geodetic survey markers in the project area would be properly relocated.

4.17 The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

This chapter describes a range of direct, secondary, and cumulative impact analyses that identify the local short-term uses of man's environment by five Build Alternatives and their relationship to the long-term productivity of that environment. Long-term productivity is defined in two ways. It is first defined by the two purposes of the project: 1) improve traffic flow and LOS on US 321 from Blackberry Road to US 221; and 2) to reduce the potential for crashes on US 321 within Blowing Rock. Second, in accordance with local land use plans, natural resource or plans, cultural resource, and village preservation goals contained in local, state, and federal legislation also define what is desired in terms of long-term productivity. All of the Build Alternatives would meet the purpose of the project. In terms of the other long-term productivity goals in the region, the use of the environment by each Build Alternative would be consistent or inconsistent with these goals in different ways.

4.17.1 Preferred Alternative

From the perspective of the project's purpose and need, the Preferred Alternative would be consistent with the maintenance and enhancement of long-term productivity in the Blowing Rock area. It would maintain a desirable peak hour LOS on US 321 through the 2025 design year. It would contribute to the reduction of crashes on US 321 by altering current roadway design features that tend to contribute to higher than average crash rates. All US 321 traffic would benefit from these design changes.

The Preferred Alternative also would be consistent with natural resource preservation goals. Because it would follow the existing road, it would use the least acreage of natural vegetation and have the least impact to wildlife. It would not fragment wildlife habitat. Its impacts to streams and wetlands would be modest, and adequate opportunities exist in the project area to mitigate those impacts. On-going development trends in natural areas east of Blowing Rock are expected to continue with associated potential for impacts to area water resources, plant communities, and wildlife.

The Preferred Alternative, which includes a wider pavement through the district, displacement of one contributing structure, and loss of stone walls and vegetation would not be consistent with cultural resource preservation goals given its adverse impact on the Green Park Historic District. The appearance of the District would be altered at two of its most significant features, the Green Park Inn and the Blowing Rock Country Club's golf course.

The Preferred Alternative also would not be consistent with local goals to maintain the village character of Blowing Rock. In addition to the visual change in the Green Park Historic District, the Preferred Alternative would straighten curves on US 321 in the Country Club Drive and Norwood Circle areas. Straightening these curves is consistent with the goal of increasing the safety of the road, but the combination of straighter curves, wider pavement, shallower side slopes, and displacement of homes would change the character of this area. US 321 in the vicinity of Country Club Drive, Norwood Circle, and the Green Park Historic are the only places on US 321 where the traditional village character of Blowing Rock can be viewed by the general traveler. Finally, citizen representatives have expressed the opinion that a four-lane road anywhere in Blowing Rock is inconsistent with the community's village character.

4.17.2 Bypass Alternatives 1A and 1B

From the perspective of the project's purpose and need, Bypass Alternatives 1A and 1B generally would be consistent with the maintenance and enhancement of long-term productivity in the Blowing Rock area. They would have a desirable peak hour LOS through the 2025 design year. By 2025, however, a less than desirable LOS D would begin to appear on the existing two-lane US 321. With these alternatives, turn lane improvements on the existing road as a part of a future minor improvement project would be needed at Sunset Drive. These alternatives would contribute to the reduction of crashes on US 321. They would accomplish this by shifting a portion of US 321 traffic off the existing road onto the bypass, a road whose design characteristics should allow for a lower crash rate than occurs on existing US 321. Traffic remaining on US 321 would still use the narrow lanes and experience the poor sight distances of the existing road, but volumes on US 321 would be substantially less than they are today.

Bypass Alternative 1A, however, would include a major exception to the project's horizontal design criteria. Two sharp curves would remain on a road that otherwise meets the alternative's 50 mph design speed. Although such curves could be marked to warn drivers to slow, their presence would violate the expectations of southbound drivers who would up to that point have experienced mostly gentle curves on the bypass and would be traveling downhill on a steep (six percent) grade. Northbound travelers would be traveling to reach these curves uphill on a seven percent grade on a generally curvier road, similar to what exists today.

Bypass Alternatives 1A and 1B also generally would be consistent with natural resource preservation goals. They would use more acreage of natural vegetation than the Preferred Alternative. They would pass, however, through an already disturbed area. Approximately 0.5 mile of both alternatives would result in fragmentation of natural forests on the Blue Ridge escarpment but this new fragmentation is in proximity to areas that are currently disturbed. They would have the least impact to streams and no impacts to wetlands. Development in natural areas east of Blowing Rock is expected to continue with its associated potential for impacts to area water resources, plant communities, and wildlife. The presence of the road, however, would likely make these areas less desirable to certain kinds of uses (e.g., residential development) which could shift some future development to other parts of undeveloped Blowing Rock area and the edges of Blowing Rock.

Bypass Alternatives 1A and 1B would be consistent with cultural resource preservation goals. They would not adversely affect any historic resources listed on or eligible for inclusion in the National Register of Historic Places.

Bypass Alternatives 1A and 1B would not be wholly consistent with local goals to maintain the village character of Blowing Rock. They would avoid roadway improvements in the older areas of Blowing Rock. They would not affect the Green Park Historic District or the Country Club Drive/Norwood Circle area. However, these alternatives would involve the introduction of a thoroughfare to an existing and developing residential area with resulting substantial negative noise, community cohesion, and visual impacts. Bypass Alternative 1B also would include a large cut into Gideon Ridge.

4.17.3 Bypass Alternatives 4A and 4B

From the perspective of the project's purpose and need, the Bypass Alternatives 4A and 4B generally would be consistent with the maintenance and enhancement of long-term productivity in the Blowing Rock area. They would have a desirable peak hour LOS through the 2025 design year. By 2025, however, a less than desirable LOS D would begin to appear on the existing two-lane US 321. With these alternatives, turn lane improvements on the existing road as a part of a future minor improvement project would be needed at Sunset Drive and US 221. These alternatives would contribute to the reduction of crashes on US 321. They would accomplish this by shifting a portion of US 321 traffic off the existing road onto the Bypass, a road whose design characteristics should allow for a lower crash rate than occurs on existing US 321. Traffic remaining on US 321 would still use the narrow lanes and experience the poor sight distances of the existing road, but volumes on US 321 would be substantially less than they are today.

Bypass Alternative 4A, and to a lesser extent Bypass Alternative 4B, would not be consistent with natural resource preservation goals. Bypass Alternative 4A would have the greatest effect on ecological resources in the project area, crossing 20 streams (six bridged), using 93 acres of natural plant communities, and involving the greatest fragmentation of habitat. Erosion, sedimentation, pollutant runoff, and more intense flows after precipitation would affect stream systems for a great distance downstream. These impacts would in turn result in destabilized streambeds and channels and chemical and biological degradation. Bypass Alternative 4A would present an imposing barrier to migration of wildlife. Suitable habitat on each side of the road would become isolated. Forested habitat that would remain to the west of the road, near Blowing Rock, would become a small island of cover and forage inhospitable to forest interior species. Animals that do cross the road would suffer increased mortality from passing cars. The introduction of bridges to create Bypass Alternative 4B would bridge 14 instead of six streams and would use 38 acres instead of 93 acres of natural plant communities. Habitat fragmentation and impacts to streams also would be reduced.

Bypass Alternatives 4A and 4B would be consistent with the cultural resource preservation goals of the Town of Blowing Rock, but their visual impacts would be inconsistent with the viewshed preservation goals of the Blue Ridge Parkway. The visual impacts of Bypass Alternative 4A would be at a level such that they would diminish the integrity of the Parkway's significant historic features and create an adverse impact to this historic resource. Bypass Alternative 4B also would have a visual impact on the Parkway, although not a substantial as with Bypass Alternative 4A.

Since Bypass Alternatives 4A and 4B would be outside the Town of Blowing Rock, they would be consistent with local goals to maintain the village character of Blowing Rock. They would introduce, however, at their southern and northern ends, a thoroughfare into small rural communities.

4.18 Irreversible and Irretrievable Commitments of Resources

Implementation of the Build Alternatives would involve commitment of a range of natural, physical, human, and fiscal resources. Land used in the construction of the Build Alternatives would be an irreversible commitment. Although the land used could be converted to another use in the future, there is no reason to believe such a conversion would ever be necessary or desirable. Restoring altered cultural, natural, and village resources would be difficult.

Construction of the Build Alternatives would expend considerable amounts of fossil fuels, labor, and highway/bridge construction materials. Additionally, the Build Alternatives would use large amounts of labor and natural resources in the fabrication and preparation of construction materials. These materials are generally not retrievable. They are not in short supply, and their use would not have an adverse effect on continued availability of these resources. The construction of the Build Alternatives also would require a substantial one-time expenditure of State funds.

The commitment of these resources is based on the concept that residents and visitors of Blowing Rock, Caldwell and Watauga counties, and northwest North Carolina would benefit overall by improving the transportation system of the area. These benefits would include those described in the statement of purpose and need in Chapter 1.

This commitment of resources and funds would vary substantially by alternative. The construction costs by alternative (in constant 2001 dollars) would be:

- Preferred Alternative: \$22.7 million;
- Bypass Alternative 1A: \$50.6 million;
- Bypass Alternative 1B: \$67.0 million;
- Bypass Alternative 4A: \$161.2 million; and
- Bypass Alternative 4B: \$241.4 million.

All of the alternatives would meet the purpose and need of the project, although with the Bypass Alternatives some sections of the existing road would again begin to see less than desirable levels of service during peak periods by 2025. All the alternatives would have adverse impacts to important community, cultural, and ecological resources. The nature and degree of these impacts vary from alternative to alternative. Thus, a decision to commit a larger amount of resources and funds would be based on a decision that a larger commitment of funds and resources would be appropriate to achieve the best balance between community, cultural, and ecological resource impact trade-offs. The No-Build Alternative would require no commitment of materials.

Residents of Blowing Rock have questioned the prudence of building the Preferred Alternative. They argue that future traffic eventually would render even a widened US 321 obsolete, and that a bypass of a widened US 321 would be required anyway. They state that an advantage of a bypass is that, ultimately, fewer resources would be used and fewer impacts would occur, since only a bypass would have been implemented, as opposed to both a widening and later a bypass of the widening. When considering this point, the following factors should be kept in mind:

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- The planning horizon of 20 to 25 years is used for planning projects statewide. The difficulty of reasonably estimating what happens beyond 20 to 25 years does not just apply to Blowing Rock but to the rest of the region and the state.
 - Continued growth in population and motor vehicle travel in the region beyond the 2025 design year, particularly at the same rate, is not a forgone conclusion. The traffic forecasts are based on population and employment projections, which become more tenuous the further removed in time they are. A common planning horizon is 20 to 25 years.
 - Even if a Bypass Alternative were implemented, continued growth of local traffic generated by new development in the Blowing Rock area at some point still could necessitate widening of the existing road. Several segments of the existing road are expected to operate at less than desirable levels of service in 2025 with the Bypass Alternatives.
 - The conclusion could be reached that the impacts of the Bypass Alternatives are so great, and the costs of Bypass Alternatives 4A and 4B are so high that it is unlikely that they would ever be implemented, even if congestion were to return to a widened US 321.