5. RECOMMENDED MITIGATION MEASURES

5.1 GEOLOGY AND SOILS

Mitigation of the potential impacts would include those described below and as indicated in Table 69.

Table 69. Mitigation measures for each build option

		Conceptual option[a,b]				
Impact	Mitigation	2.1.1	2.1.2	2.1.3	2.1.4	2.2
Slope stability	Propose and evaluate site specific engineering mitigation measures in the EIS and the design and construction process	Yes	Yes	Yes	Yes	None
Pyritic rocks	Additional sealing during construction	Yes	Yes	Yes, slightly less	Yes	None
Deep weathering	Propose and evaluate site specific engineering mitigation measures in the EIS and the design and construction process	Yes	Yes	Yes, slightly less	Yes	None
Brittle faults	Additional sealing or removal during construction	Yes	Yes	Yes, slightly less	Yes	None
Colluvium	Propose and evaluate site specific engineering mitigation measures in the EIS and the design and construction process	Yes	Yes	Yes, slightly less	Yes	None

[a]"Yes" means mitigation would be needed.
[b]Construct Section 8B with no interchanges (2.1.1), Western Terminus Options (2.1.2), Webb Mountain Options (2.1.3), Operation Timing Options (2.1.4), and No-action (no-build) (2.2).

Construction problems due to the nature of the geology and soils of proposed Section 8B of the Foothills Parkway are anticipated to be relatively small. The main problems likely to be encountered are related to slope stability in moderately to deeply weathered Pigeon Siltstone along the main route, and locally in Great Smoky Group sandstone along the Webb Mountain spur. These problems should be soluble without taking extraordinary engineering measures (e.g., additional bridging along ridge crests or along steep slopes) by incorporating standard mitigation techniques (benching, lower cut slope angle, etc.) into engineering design of cuts (Table 69). An

exception to this assessment might occur where unstable slopes related to construction of the deep cut (rather than the tunnel alternative) on Section 8B west of Cobbly Knob could create both short- and long-term problems if the material being excavated is deeply weathered. Deep weathering is more likely at low elevations than on high ridgetop segments of Section 8B because of the greater availability of water in the deep valley. This was not a problem in construction of the westbound lanes of the four-lane section of U.S. 441 just east of Pigeon Forge, but it remains a problem with the eastbound lanes of the highway in the same area.

The potential exposure of pyritic materials would need to be addressed in only a few places. Both the magnitude (volume) and numbers of places where this problem would arise should be small. These materials, once located, could be effectively sealed throughout the construction period and afterwards so that they should remain stable enough to keep impact on streams to a minimum. Greater impact on streams should be anticipated from improperly controlled sediment derived from construction than from pyritic materials.

Brittle fault zones that would be crossed by the route could cause minor problems with groundwater seepage or, more likely, produce unstable rock during construction. However, they probably would cause no problems. If such problems did arise, the zones could readily be sealed (for groundwater seepage), or excess loose rock could be removed during construction.

5.2 WATER RESOURCES

5.2.1 Construction of the Parkway with no Interchanges

Mitigation measures would be required to protect downslope stream and riparian habitat from alteration by erosion, increased sediment loading, siltation, and major changes in storm- and base-flow discharges. Disturbances that result in increases in surface runoff during storms and reduction in shallow subsurface flow need to be minimized. Compaction of alluvial soils should be minimized during construction. In areas where lateral subsurface flow is intercepted (e.g., by cuts or excavations), it should be recharged into permeable layers of rock constructed under fills.

Surface runoff from paved, grassy, and cut-and-fill slopes should be maintained wherever possible as distributed, downslope sheet flow rather than channelized into narrow swales, gutters, or culverts. Wherever possible, drainage ways should be designed as broad swales that are gently graded to prevent high-energy flows and to direct water into subsurface recharge areas. Sediment detention structures should be constructed where large flows are expected. All streams crossed by the parkway should be bridged where feasible, or routed through box culverts with floors containing rocks if the stream is small and bridging is not feasible.

Erosion and sediment control during and following construction of all cuts and fills is of critical importance for reducing impacts from sediment loading and siltation on downgradient streams. Erosion control is particularly critical for all cuts and fills in the Webb Mountain and Rocky Flats areas to mitigate impacts to Webb Creek, Matthew Creek, and Dunn Creek. Erosion control is also critical in the southwestern end of Big Ridge to mitigate impacts to Carson Branch and its riparian wetlands. New, innovative soil bioengineering techniques involving various combinations of vegetation plantings and structural features are available for enhanced short- and long-term

stabilization and visual improvements of roadway cuts and fills (Gray and Sotir 1996). Such high-quality controls must be implemented early in each phase of construction, particularly in the sensitive areas listed above.

Appropriately sized bridging should be used to mitigate impacts to many of the streams crossed by the roadway. Bridging over Dunn Creek in the Rocky Flats area is particularly critical to protect this high-quality stream. The floodway width of Dunn Creek must be carefully determined to ensure that the bridge over this stream is sufficiently long to accommodate flow easily from the largest floods expected and to prevent the channel downcutting that would ensue if flood waters were laterally constrained by roadway fill or support structures.

To mitigate potential acidification of streams due to exposure of sulfide-bearing rock, rock excavated or exposed in the Webb Mountain area must be inspected by a geologist as construction proceeds. Any sulfide-bearing materials found should be sealed in place from water and the atmosphere, or encapsulated and buried in fill so that the materials are not exposed to drainage water. The geologist and site engineer should jointly determine the disposition of such materials based on the amount and concentration of the sulfide and the options available at that point in construction.

For aesthetic reasons and to reduce potential impacts to the small streams in the Pittman Center/ SR 416 area, a tunnel excavated by boring appears to be the most desirable option. If geologic conditions are not favorable, however, construction and maintenance of a tunnel may not be desirable (e.g., economic safety, or water quality impacts related to exposure of acidic rock). Additional geologic investigation is needed before a decision is made concerning a tunnel.

To mitigate water quality problems resulting from parkway maintenance, the use of pesticides, herbicides, deicing chemicals, and fertilizers should be avoided. Special care should be taken with fuels and lubrication oils to minimize spills or leakage from equipment during construction.

5.2.2 Western Terminus Options

All of the western terminus options would require stabilization and revegetation of cuts and fills early in construction to prevent erosion and sediment loading and siltation of streams, particularly Webb Creek. The easternmost interchange option, involving a steep access road from the parkway on the slopes of Webb Mountain to U.S. 321, would pose a particularly serious problem in this regard; and stabilization of cuts and fills required for this option should involve the most appropriate soil bioengineering techniques implemented early in construction. Even with mitigation, this interchange option may result in significant sediment loading and siltation in Webb Creek.

5.2.3 Webb Mountain Options

The option involving construction of a parking area along the parkway and a trail to the top of Webb Mountain would require stringent erosion control and stabilization of cuts and fills during construction to mitigate erosion and sediment loading to Matthew Creek. Application of soil bioengineering techniques early in construction could mitigate the most serious impacts on this

high-quality stream. If restroom facilities were provided here, wastes should be contained and transported out; a septic system should not be installed.

The option involving construction of a spur road to an overlook facility would have much more serious impacts to Matthew Creek. All cuts and fills along the roadway and parking/overlook facility would have to be stabilized early in construction using appropriate soil bioengineering techniques. Box culverts capable of facilitating the largest floods expected would have to be installed where the roadway crosses Matthew Creek and any of its tributaries. If restroom facilities were located here, all wastes should be collected and transported out of the area, rather than a septic system installed, to minimize the potential for degradation of Matthew Creek water quality from human wastes. During all excavation activities, timely inspection of excavated rock must be conducted by a geologist to determine if any sulfide-bearing rock has been disturbed; if so, the material should be sealed in place, encapsulated, and buried as described in Sect. 5.2.1.

5.2.4 Operational Timing Options

If the operation of parkway Section 8B were delayed until Section 8C were completed, then the road surface should be paved to mitigate erosion and sediment-loading impacts that would ensue with an unpaved roadway. Otherwise, no additional mitigation measures are needed for these options.

5.2.5 No-action Alternative

No mitigation measures are needed for this alternative, assuming that the NPS retains ownership of the ROW and prevents development of it.

5.3 AQUATIC ECOLOGY

Measures to mitigate changes in surface water hydrology are outlined in Sect. 5.2. The mitigation measures suggested in that section to distribute surface runoff as downstream sheet flow should reduce the likelihood of high storm flows (spates) and consequently moderate adverse effects on aquatic habitats from land clearing and soil compaction. An important mitigation measure is to minimize delays in paving the road surface once the roadway is constructed; this will reduce the amount of soil erosion, and turbidity and sedimentation in the streams along Section 8B.

Culverts or other structures that are used to bridge streams should be constructed to ensure that fish movements are not blocked. With the exception of Sheep Pen Branch, all of the streams considered to be most susceptible to changes in hydrology and streambed erosion (i.e., Copeland Creek, Lindsey Creek, Mill Dam Branch, Warden Branch, Butler Branch, Matthew Creek, Carson Branch, Chavis Creek, and Sandy Hollow Creek) support fish. Maintaining fish passage over all stream flows is particularly critical in these smaller streams.

5.4 TERRESTRIAL RESOURCES

5.4.1 Vegetation and Wildlife

Impacts of a non-forested corridor through surrounding forest are unavoidable. The width of the cleared area along the corridor would be determined by the cut and fill areas, grubbing of vegetation along the roadway, and removal of overstory trees. Impacts to existing forest ecosystems could be minimized by keeping these cleared areas as small as possible.

Extensive cut and fill and removal of forest vegetation, as shown on existing road plans, would also change the existing forest by altering the microclimate, which could in turn alter adjacent vegetation and associated wildlife. These changes could be minimized by replanting cleared areas with native forest trees and by bridging drainages rather than leveling them with cut and fill. Soil bioengineering techniques that ensure rapid re-establishment of native woody species should be used where possible (Sotir 1992; Link 1993). Potentially suitable techniques include using live stakes from rapidly growing tree shrub species and fascine bundles to act as traps for seeds of surrounding forest trees.

Mitigation of impacts to wildlife is problematic because some species benefit from wider clearings associated with roadways (i.e., increased habitat, fewer predators, less tendency to cross the roadway, which results in fewer road deaths) while others benefit from narrower clearings (i.e., less effective fragmentation of habitat, fewer predators). Interior species (those that require fairly large expanses of continuous forest, such as many neotropical migrant songbirds) benefit from minimal removal of forest canopy. Because of increasing concern for such species, minimal disturbance of the forest cover is recommended. Cut and fill areas should be replanted with native forest vegetation, rather than low-growing herbaceous or shrub ground cover.

Consideration should be given to not constructing the Spur Road and overlook. This construction would negatively impact forest habitat important to area-sensitive bird species and other wildlife. If the Spur Road is built, however, it should be constructed without grass shoulders to minimize forest fragmentation impacts. Likewise, the overlook facility and parking area should be as small as possible.

5.4.2 Protected Species

Federally protected plants and wildlife. No federally protected plant or wildlife species were found on the ROW. State listed species are discussed below. The Allegheny snaketail dragonfly is discussed with species of interest to the GSMNP.

State protected plants. For the ramp option at the western terminus, the ramp in the Pigeon River floodplain should be sited as far to the west as possible to avoid directly impacting the population of state threatened butternut.

Many native vascular plant species can be transplanted successfully while they are dormant if an adequate root ball is dug (Taylor and Hamblin 1969). Ginseng, for instance, can readily be transplanted if plants are growing directly in the line of construction. Most of the rare plants on the ROW probably can be moved successfully during the dormant season from areas to be affected

by construction to comparable habitat (K. Langdon, GSMNP, personal communication to L. K. Mann, ORNL, Sept. 18, 1996). Survival beyond a few years is unknown, however, because some species do not transplant successfully (Taylor and Hamblin 1969; North Carolina Wildflower Preservation Society 1977; E. E. C. Clebsch, Native Gardens, Greenback, Tennessee, personal communication to L. K. Mann, ORNL, no date). Orchids rarely survive transplanting, so moving the pink lady's-slipper orchid is not practical. Because not all species transplant well, and some rare species may have unique microhabitat requirements, transplanting should be regarded as experimental and may not be successful in the long term (K. Langdon, GSMNP, personal communication to L. K. Mann, ORNL, Sept. 18, 1996; E. E. C. Clebsch, Native Gardens, Greenback, Tennessee, personal communication to L. K. Mann, ORNL, no date). Thus, transplanting or creating new habitat may mitigate impacts to some protected plant species on the ROW, but would not provide adequate mitigation for others because many species of the native flora do not survive or flourish after transplanting. Plants that are moved should be monitored for 1 or 2 years until they appear to be established or are no longer alive.

Mitigation to protect the population of the ash-leaved bush-pea on the Webb Mountain segment of the ROW could consist of moving the plants to newly disturbed sites, but the feasibility of transplanting this species is unknown. The plant is quite showy in bloom and, if it could be re-established, might be threatened by illegal collection as a result of increased access after construction of the parkway. Transplants should be placed where they would not be readily visible from the roadway.

State protected wildlife. No special mitigation measures are anticipated for state listed wildlife other than minimizing native habitat loss.

Wetlands and other special habitats. In all areas where wetlands are located on or near the actual roadway, construction activities, including the travel of heavy equipment, should be avoided as much as possible to minimize impacts to wetlands. To maintain wetland functions and ensure revegetation with hydrophytic plants, the hydrology of areas impacted by equipment traffic during construction should not be permanently changed by alterations to the drainage patterns.

Possible mitigation measures to minimize impacts to overall hydrology of the ROW are discussed in Sects. 5.1 and 5.2. Construction methods that would minimize obstruction of lateral flow of water would minimize impacts to wetlands downslope from the roadway. Mitigation should include the use of mechanical barriers where necessary to prevent accidental heavy equipment travel through sensitive areas, and training equipment operators to avoid wetland areas.

In the Rocky Flats segment, bridging wetlands would minimize long-term impacts to hydrology and sensitive biota of wetlands, streams, and riparian vegetation.

For the Webb Mountain options, a span or large box culvert should be used for crossing Matthews Branch to minimize impacts to the stream and downstream wetlands.

No special mitigation measures are anticipated for special habitats other than wetlands. In all areas where sensitive habitats—cobble bar, talus or boulder slopes, calcareous soil—are located, construction activities, including movement of heavy equipment, should be minimized where feasible.

5.4.3 Additional Species of Interest to NPS

Plants. Mitigation of impacts to the rare bryophytes and the rare hornwort growing in stream channels and wetlands on the ROW could require spanning streams and wetlands. This would be especially desirable in the Rocky Flats segment where the globally rare hornwort is located.

Wildlife. Minimizing stream bottom disturbance and siltation and choosing ramp access options that minimize impacts to streams containing the Allegheny snaketail dragonfly are recommended. If possible, timing of construction impacting these streams should be planned to minimize disruption of the dragonfly's life cycle. Construction that would affect the streams where this species occurs should be avoided during the period when adults are emerging and laying eggs (i.e., mid/late April to early July). Construction during late summer dry periods, when flow is low and less likely to affect habitat and when nymphs are large enough to tolerate some disturbance, should have the least impact to this species (K. Tennessan, Tennessee Valley Authority, personal communication to L. K. Mann, ORNL, Mar. 18, 1996). Disturbance to existing riparian vegetation should be kept to a minimum, and affected stream banks should be stabilized with native riparian species.

Partial mitigation of impacts to interior forest nesting bird species could include minimizing both the removal of mature forest canopy and the establishment of regularly mowed grassy areas along roadsides.

Exotic or alien species. Mitigation to control populations of aggressive exotic plants could entail eradicating existing populations on the ROW prior to construction, monitoring the ROW for at least 3 years following construction, and removing exotic species as they are found. Although it is not on the ROW, eradication of the adjacent population of garlic mustard prior to construction is especially important because of the aggressive nature of this species and the potential for major expansion along the ROW following construction. Kudzu should also be eradicated prior to construction. Control of Japanese grass, honeysuckle, and multiflora rose is probably currently impractical on the ROW, and the impact is, therefore, unavoidable (Clebsch and Wofford 1989, Remaley 1996). Although eradication of existing populations of privet may not be feasible, efforts should be made to prevent its establishment in newly disturbed areas.

5.4.4 Summary

Most impacts to natural resources on the ROW could be mitigated by avoiding accidental construction damage in the vicinity of the resource, modifying the design of drainage systems under the roadway in some locations, and replacing some cut and fill with bridges or other spans. It might not be possible to mitigate impacts to some populations of state protected plant species and other species of interest to NPS. Protection of the rare hornwort liverworts and protected species on the ROW should involve further consultation with experts to develop mitigation options. Successful mitigation to protect sensitive habitats and associated biota would result in few negative cumulative effects to the terrestrial ecology of the region.

5.5 MITIGATION MEASURES FOR METEOROLOGY AND AIR QUALITY

5.5.1 Construction

Mitigation of fugitive dust from road construction can often be accomplished by scheduling to minimize the size of the area disturbed on any particular day. Excavation and earth moving operations, especially operations requiring heavy trucks moving over unpaved surfaces, can be reduced when meteorological conditions are unfavorable (e.g., relatively stable conditions with low wind speeds) and/or when the ground is dry (e.g., when no precipitation has occurred for several days). However, competing economic factors must often be considered. In this case, there may also be competing environmental considerations involving visibility and atmospheric ozone concentrations. Scheduling intense construction activities for the summer months can reduce visibility effects, but summer is the season of highest ozone concentrations and is therefore by far the most likely season for intensive construction activities to contribute to an exceedance of the NAAQS for ozone.

Visibility is most likely to be of concern to visitors during the clear days of October, a month when the number of visitors reaches a peak and the background visibility is likely to be high. Such days are also favorable for construction activities. Scheduling such activities so that fugitive dust would be minimized in October might require more earthwork in summer. However, because of the relatively large number of visitors during the summer months, minimizing construction activities during those months might be desirable to minimize the number of people potentially affected by high ozone levels. It might also reduce plant damage associated with high ozone levels. However, because the amount of ozone resulting from construction activities would be small compared to already existing ozone levels in the area, the positive effects of minimizing construction activities to reduce ozone in summer would be limited and might not outweigh considerations involving the seasonal changes in background visibility.

Sprinkling with water can be an effective method of reducing fugitive dust in a construction area or along an unpaved road. If material must be hauled long distances (greater than about 250 m), the nature of the road is an important consideration. Use of gravel or other material with low silt content can reduce emissions of fine dust particles. Therefore, when possible, it could be environmentally and economically effective to first establish a gravel roadbed for the parkway, and then to use that gravel route for hauling of material by truck. Paved surfaces or other hard surfaces also emit relatively little fine dust. Tarpaulins or other covers should be used whenever possible to reduce dust emissions from loads transported by truck.

More than 8 hours per day of work could be scheduled, especially during the summer when evaporation is highest and therefore dust suppression by watering is least effective. If such work involved disturbing large amounts of surface material, intensive watering might be needed to reduce dust emissions to acceptable levels.

If burning of removed woody plants were permitted along the parkway route during construction, air quality near the fires would be degraded temporarily by particles of incomplete combustion (smoke). Also the risk of widespread fire would be increased. These effects could be eliminated by not permitting any burning of woody materials at the construction site. The wood could be removed from the site and used elsewhere or chipped on-site for use as mulch. Alternative

mitigation measures include attention to fire weather information while scheduling burning operations and the presence of fire-fighting equipment whenever burning operations are conducted. Fires should be completely extinguished before sundown. Smoke from smoldering ashes can lead to high concentrations of airborne particulate matter near the ground during the night, when the atmosphere is very stable and turbulent mixing of pollutants is consequently reduced. An even worse situation could occur if a partially extinguished fire should re-ignite at some point during the night, when no one was present to control it.

5.5.2 Operation

If there was an accident in the proposed tunnel, it could block traffic. It is not likely that such an incident could lead to any life- or health-threatening situations resulting from high CO concentrations, but unhealthy conditions could occur as a result of a serious accident causing blockage of both lanes of the proposed road. If a tunnel were constructed, such risk could be mitigated by signs posted in the tunnel to alert motorists to turn off their engines in case of a stoppage of traffic lasting more than a few minutes.

Exceedances of the NAAQS for O_3 occasionally occur in and near the boundary of GSMNP. Because of the regional distribution of sources contributing to these high existing O_3 concentrations, mitigation must be largely the responsibility of the community outside the boundaries of the park.

Paving any parking areas that might be constructed along the route would greatly reduce local fugitive dust emissions, thereby accommodating persons with respiratory problems and reducing the carry-out of road dust which is a major source of PM-10 emissions from roadways. Reducing PM-10 emissions would also mitigate any contribution of the parkway to visibility degradation in the area.

5.6 SOCIOECONOMICS

Locating the western interchange of Section 8B at Pittman Center Road, as described in Sect. 4.6, could result in substantial socioeconomic impacts, especially in terms of land use and social structure in the Pittman Center community. Any of the other interchange locations or the no-build alternative would avoid most of the growth-related impacts likely to accompany a Pittman Center Road interchange. But if no western interchange at all were built, the pressure for commercial development in the impact area would likely be less than under any of the build options or the no-build alternative, because the result would be less traffic on U.S. 321.

It is recommended that the NPS take appropriate action to mitigate the quality of life impacts that could affect people living in close proximity to the Section 8B ROW. Specifically, steps should be taken—through roadway design, construction techniques, and landscaping—to minimize the visibility of the parkway to area residents, to limit changes in the natural topography and vegetation of the area, and to control the construction and traffic noises to which nearby residents are exposed.

5.7 MITIGATION MEASURES FOR PARKWAY TRAFFIC AND TRAFFIC NOISE

5.7.1 Parkway Traffic Mitigation

In general, completion of Section 8B would not have a significant traffic impact on surrounding roadways from Cosby to Pittman Center, nor would there be any significant traffic impact from the construction process. Furthermore, there should be no cumulative traffic effect if all Foothills Parkway sections built and open to traffic in the future.

Although some roadway sections are projected to operate at unacceptable levels in the future, this would not be due to Parkway traffic, but rather to traffic on existing roads. Also, almost all intersections within the Section 8B area would be reconstructed with Section 8B or would be included in currently planned highway improvement programs. These intersections should be designed and constructed so that all intersections would operate at an acceptable LOS in the future.

In light of these considerations, ORNL feels that no traffic flow mitigation measures would be necessary as long as the Section 8B interchanges were constructed to provide an adequate LOS for the projected traffic volumes.

5.7.2 Parkway Traffic Noise Mitigation

Noise analysis by ORNL indicates that traffic noise resulting from the addition of Section 8B would not significantly affect sensitive receptors in the surrounding areas. Therefore, no traffic noise mitigation measures should be necessary.

5.7.3 Parkway Construction Noise Mitigation

ORNL does not expect any serious noise impacts from the Section 8B construction process. The nearest sensitive receptor would be over 91 m (300 ft) from the proposed centerline of the parkway and should be approximately 76 m (250 ft) from any related construction activity, such as clearing, cutting, or filling. Furthermore, construction activity would be temporary. Still, noise from construction equipment is harsh and annoying, and the relative serenity of the surrounding area likely would make these noises more prominent. Therefore, ORNL suggests that the following FHWA mitigation measures be considered.

Establish effective community relations. Effective communication between NPS and the communities that would be affected by construction is essential. NPS should inform residents and other stakeholders of any potential construction noise impacts, as well as the measures that would be employed to reduce these impacts. NPS should also establish and publicize a responsive complaint mechanism for the duration of the Section 8B construction period and instill an awareness of public attitudes and reactions in construction equipment operators so that unnecessary annoyances may be avoided. Establishing a good rapport with the community could provide high benefits for low cost.

Design consideration. Early coordination and communication with the Foothills Parkway design agency could greatly aid in locating and sequencing construction operations to minimize potential

construction noise impacts at sensitive receptors. Noisy elements (such as compressors and haul roads) should be located in less sensitive areas when possible, making use of any existing natural or artificial features that can shield the construction noise. Permanent noise barriers, if required by the project, should be constructed as early as possible to reduce potential construction noise impacts. Alternative construction methods could also be employed to lessen potential construction noise impacts (e.g., using cast-in-place piles rather than driven piles, or using rubber-tired equipment rather than steel-tracked equipment).

Source control. New construction equipment is generally quieter than older equipment. Special, very quiet types of new equipment are also available. However, specification of the exclusive use of new, quiet construction equipment on Section 8B construction might be very costly and would be justifiable only in cases of extremely severe noise impacts. Control of noise from existing construction equipment is usually limited to requirements for mufflers and continued good maintenance on all equipment. Additional modifications to construction equipment for noise reduction are usually not reasonable because they involve large increases in cost.

Site control. Measures to abate Section 8B construction noise could be to modify the time, place, or method of operation for a particular noise source. NPS could also limit the work hours on a construction site. Careful project planning could aid in locating noisy construction activities as far as possible from sensitive receptors or in areas where natural shielding is possible. Building temporary noise barriers or special equipment enclosures is usually quite expensive and limited to use only in instances of severe construction noise equipment.

5.8 AESTHETIC RESOURCES

5.8.1 Road Cuts and Fills

Treatment of cuts along the proposed parkway is difficult to assess because the rockiness and steepness of the cuts is not known. Vertical rocky cliffs as cuts are much more interesting than graded grassed slopes. Of course, cut stability is the key issue. Wherever possible, rocky cuts should be vertical. Along areas of segment 3 and at the western terminus of Section 8B, stone walls should be considered. Slopes should be re-established using bioengineering techniques as appropriate.

It is recommended that a special effort and plan be initiated to revegetate cuts and fills with natural vegetation as quickly as possible. Seedlings in sufficient quantities would have to be ordered years ahead of time to prepare for the effort. Special effort should go into recognizing the concerns of landowners and residence whose scenery would be significantly affected. Near these areas, attention to seedling planting, survival, and fast growth is important. This may involve repeated applications of fertilizers, weed control, and even soil amendments. Where cuts and fills are particularly conspicuous to large numbers of viewers, the use of retaining wells is recommended, especially near U.S. 321 and to a greater extent than the conceptual plans now call for.

Fills are a more difficult visual element to control. The principle concern is the contrasts fills inflict on the existing landscape. The contrasts are the lighter color, different color, and rougher

(large rock) or smoother texture (gravel or grass) when viewed from a distance. Retaining walls using dark rock can help but become prohibitively expensive. In comparing alternatives, three objectives to minimizing the negative visual impacts should be considered. The first is to minimize the length of downslope by using materials that increase the angle of repose. Several alternatives exist which accomplish this objective such as terracing with posts, rip-rap, and wire mesh. These measures minimize the area of disturbed natural vegetation. The second is to use materials that match surrounding colors and textures to the extent possible. Red dirt and freshly cut limestone (light gray to white) are examples of materials that should not be used for visual reasons. The third is quick establishment of vegetation that matches the green-brown color and general texture of surrounding natural vegetation (i.e., tree tops). Grasses contrast forests because of their brighter yellow-green color and smooth texture. Both shrubs and trees are the best solutions.

Recognizing the above issues, special mitigation efforts on road cuts and fills are needed at several locations:

- In the valley of the Little Pigeon River at the western terminus of Section 8B
- Where the proposed parkway crosses Webb Creek and its associated valley, especially along the east side of the valley where the parkway descends into the valley and where it is also visible from U.S. 321
- Along most of segment 3
- Where the proposed parkway ascends heading west out of Rocky Grove and around a ridge next to U.S. 321
- Along the southwest end of Big Ridge (east side of Rocky Grove) where the parkway can be seen from U.S. 321 at fairly close range

5.8.2 Proposed Parkway Alignment

The conceptual design of the main alignment of the parkway is good. Ways to improve the use of the aesthetic resources are itemized below.

- Develop the Little Pigeon River exit ramp using the north ramp alternative.
- Install the tunnel option east of the Little Pigeon River exit ramp.
- Do not develop an exit ramp near the intersection of U.S. 321 and Webb Creek Road.
- Build the parking loop on top of Webb Mountain.
- Develop the lower parking lot on Webb Mountain which enables the use of the access road to the top loop parking lot on Webb Mountain.
- On the west side of Rocky Flats, develop the valley (lower) alignment to avoid large cuts into the nearby steep hillside.
- At the Cosby exit ramp, utilize the southern exit option to hide the ramp in forest as much as possible.

5.8.3 Development of Pull-Overs and Vegetation Clearing for Views

Specific site developments and clearing of vegetation have been proposed based on a long list of considerations in their development. The purpose of these considerations was to establish a baseline to assess impacts and mitigation measures. After evaluating the impacts, there are some mitigation measures recommended.

- Eliminate the development of either site 1A or 2A. They tend to present the same aesthetic resources and only one is necessary. Site 1A is the prettier of the two but is more congested with the exit ramp. Therefore site 2A is recommended for development and site 1A is recommended not to be developed. This would mean additional treatment of cuts with retaining walls where the parkway comes next to Webb Creek Road near U.S. 321.
- Eliminate some of the recommended areas for vegetation maintenance along site 3C. This would still allow the retention of some good views but reduce the amount of area to constantly maintain.
- Establish a planting and revegetation plan (beyond the initial grassing of slopes) involving native hardy tree species such as Virginia pine, red maple, black locust, sweetgum, hackberry, redbud, and several native shrubs. Apply this to all cuts and fills recognizing the relationships between elevation, slope, and substrate condition. Plant in cuts and fills using nuts and seeds gathered from nearby trees to speed up the recovery process. Monitor survival, growth, and pest plant invasion so corrective actions can be effectively implemented. Replanting can be expected for many areas. Allow the use of herbicides to control exotic pest plants so native plants can get well established (and shade out further pest plant invasions).
- Examine the layout of terrain closely at the top parking lot on Webb Mountain to determine if less forest could be cleared.
- Eliminate site 6A. Although the view is excellent, it is very narrow and somewhat duplicated at site 7A.
- Consider eliminating the development of site 7C (Cosby Creek near exit ramp). The site is close to public roads and development, would be somewhat crowded and congested, and is subject to disturbance from the widening of SR 32 and a new exit ramp.
- Assess the height of trees at all sites considered for aesthetic develop. The vegetation maintenance estimates were based on trees being 25 meters tall. It is likely the trees are not this tall at many sites. If this is so, the maintenance line can be moved closer to the parkway and thereby reduce the area of vegetation maintenance. Further, in some areas it may be appropriate to thin forests rather than totally clear them. A detailed inspection should be conducted to determine if forest clearing and maintenance can be reduced.

5.8.4 Potential for Interpretive Resources

Subjects for interpretation at aesthetic sites are local history, local structures, aquatic habitats, geology, identification of mountains, forest ecology, wildflowers, geology, floral and faunal ecology, Indian culture, seasonal changes, hydrology, local religion, local stone wall construction, and many other topics. These interpretative subjects can be highlighted appropriately across 8 to 11 sites with more than one topic per site. Self-guided tours, especially at 1A, 2A, 3C1, 5A, and 7C would be appropriate.

Sites identified for development have included consideration of cultural, environmental, and other interpretive subject material in their location and design. However the details of the subject matter have not been developed.

5.8.5 Potential for Views of Streams, Valleys, and Distant Views Not Evaluated

Initially, 38 sites were identified as having at least some potential for viewing or interpretive development. Many were eliminated because views were very short, looking across a small valley

into a close, opposing ridge. These could potentially offer opportunities for additional development for special studies and interpretation. The present development plan has a mix of distant panoramic views and close encounters with trees, streams, and fields. These could be expanded at a later date to meet park management goals.

5.9 CULTURAL RESOURCES

Consideration should be given to screening the parkway in such a way that the Tyson McCarter Place is not visually impacted from construction and operation of Section 8B.

Placing the parkway on the eastern side of Big Ridge would avoid visual effects to the Lansford Barn. Placement of the location of the barn on the conceptual design sheets would help identify the potential visual effects of the parkway.

The location and boundary of Sutton Cemetery should be placed on the conceptual design sheets. The cemetery should be protected and access to the public should be maintained.