

IV. Environmental Consequences

IV. ENVIRONMENTAL CONSEQUENCES

The environmental consequences chapter describes the potential beneficial and adverse effects of the ICC Build Alternatives to the affected environment, and documents methodologies used in the evaluation. The information generated in this process has been used to formulate a comparison of the alternatives and aid in the selection of a Preferred Alternative from the No-Action (or No-Build) and Build Alternatives presented in this FEIS. This comparison of potential effects also fulfills the FHWA's obligation under 23 U.S.C. § 109(h) to "fully consider" the proposed alternatives' possible adverse economic, social and environmental effects and to make a decision in the "best overall public interest" when balancing the need for safe and efficient transportation in the study area and the costs of eliminating or minimizing adverse environmental and community impacts. The No-Action Alternative for the ICC would result in no ICC project-related impacts. As discussed in Chapter III, the No-Action Alternative for the ICC assumes implementation of (and impacts associated with) the transportation improvements identified in TPB's CLRP for 2003 to be in place by 2030. This Environmental Consequences section also discusses the avoidance, minimization, and compensatory mitigation measures that will be undertaken to lessen potential adverse impacts to the affected environment should any of the Build Alternatives be selected as a result of the ICC study. Impacts discussed in this chapter include impacts associated with the highway, the bicycle/pedestrian route where it coincides with the ICC Right of Way (ROW), and maintenance facilities.

A. Avoidance and Minimization of Impacts Techniques Summary

Avoidance, minimization, and mitigation measures have been incorporated as a part of the Intercounty Connector (ICC) Project. These include such measures as depressing the roadway to minimize noise and visual impacts to communities, development of Erosion and Sediment Control Plans, incorporation of stormwater management (SWM) facilities, shifting alignments to avoid communities and sensitive resources, limiting forest clearing, avoiding skewed stream crossings where possible, and reducing typical roadway section widths near sensitive resources where feasible. In addition, the ICC Study Team has developed more advanced avoidance and minimization measures to ensure a high level of protection to community, natural, and cultural resources within the study area.

The development of ICC project alternative alignments has been conducted with attention to the avoidance and minimization of community, natural, and cultural resources. The following outlines some of the many design efforts developed to accomplish this (more detailed information is provided in the individual resource discussions in the remainder of the Chapter):

1. Reduced Project Footprint

- Using steeper side slopes for cuts and fills (2:1 side slopes) and reduced median widths to avoid/minimize impacts in environmentally sensitive areas which include: communities, cultural resources, and natural resources.

- Using retaining walls in lieu of slopes where practicable. Retaining walls serve to reduce the overall footprint of the proposed Build Alternatives and thereby reduce impacts to adjacent resources.
- In selected locations where practicable, SWM facilities have been placed beneath the roadway surface avoiding impacts to parks and natural resources that would have occurred from more traditional SWM locations along the outside limits of the roadway.
- SWM facilities in more traditional locations have been shifted and or reconfigured from earlier design phases to minimize the greater impacts to wetlands and other resources.

2. Context Sensitive Design Solutions

Context sensitive design means using roadway design criteria that promote sensitivity to the surrounding social, cultural, and natural environment affected by the ICC for both the ICC's highway and bridge facilities, and are consistent with SHA's Thinking Beyond the Pavement Philosophy (which is inherent in the project's plans, and design). General goals for the ICC that are being studied/implemented to minimize the effects to visual and aesthetic quality include the following:

- Minimize the visual intrusion of the highway into residential areas by keeping the roadway at grade and avoiding deep cuts and high fills
- Lower profiles of the ICC beneath community roads to maintain current access and mobility and to avoid or minimize community separations introduced by highway construction
- Minimize visual intrusion of the highway to adjacent neighborhoods with visual buffering and ornamental enhancements
- Use decorative finishes on publicly visible highway features/structures in keeping with the overall highway theme and surrounding vernacular
- Provide reforestation plantings adjacent to existing forest tracts, and use plant species native to the area
- Limit hardscape elements to necessary areas only to accommodate environmental avoidance, minimization, and stewardship features
- In instances where hardscape elements are used (e.g., retaining walls, overpasses, box culverts, riser structures, etc) in publicly visible areas, allow for rustic finishes such as timber, staining or formlining to affect the visual aesthetics
- Minimize the roadway footprint to reduce environmental impacts

- Incorporate the ICC Aesthetic Guidelines, which were developed to promote visual continuity throughout the corridor and context sensitive design solutions.

3. Longer Bridge Lengths, Using Bridges versus Culverts

Federal, State, and local resource agencies have agreed upon methods to preserve natural areas at several locations. Longer bridge lengths than hydraulically required in certain areas and consideration of natural bottom culverts in certain areas have been incorporated into the preliminary design of the proposed Build Alternatives. These measures will increase the potential for vegetation and habitat to be maintained while facilitating wildlife passage beneath the roadway. They will also serve to maintain wildlife connectivity between linear parklands through the ICC corridors under study. In many environmentally sensitive areas, spanning streams and floodplains with bridges rather than with culverts is being used to avoid and minimize impacts and will also allow for a greater level of natural lateral stream migration to occur than with a shorter bridge. Additionally, in some locations, the wing-walls on bridge abutments have been extended beyond what is necessary for the bridge design to minimize the encroachment of fill in the stream valley and further reduce impacts to wetlands.

In areas where culverts are planned, culvert bottoms would be constructed to be lower than the natural stream bed wherever feasible to allow a natural stream bottom to form within the culvert in accordance with MDE requirements. Culverts should be designed to the geomorphic characteristics of stable local streams to avoid downstream scour, channel degradation, and reduce the potential for creating fish blockages. The Lead Agencies have worked closely with local resource managers to identify culvert crossings where fish passage is of particular concern and where additional measures beyond those required by MDE may need to be investigated when culverts are designed. Techniques will also be utilized to align culverts, bridge piers, and abutments to better conform to the natural geometry of the streams to the extent practicable.

In addition to longer bridge lengths and natural bottom culverts in certain locations, context sensitive design solutions, such as decorative finishes, will also help reduce visual impacts by providing more aesthetically pleasing structures.

The following is a summary of measures either committed to or under study to avoid and/or minimize impacts at large and small drainage crossings:

- Consider stream channel dimension and channel materials where culverts are planned
- Design culverts to address specific geomorphic needs of the stream to avoid downstream scour and channel degradation and promote long term channel stability. Culvert bottoms will be buried to provide a natural channel bottom and a smooth bed transition from upstream to downstream
- Perform all in-stream work in compliance with stream closure requirements for the stream class designation

- Provide fish relocation from dewatered work areas to reduce fish mortality
- Use bridges, rather than culverts, at all crossings where naturally reproducing brown trout are present to avoid impact to trout habitat, and lengthen bridges to reduce floodplain impacts
- Design a stormwater conveyance system into bridges to prevent untreated bridge runoff from directly entering streams where naturally reproducing brown trout are present
- Provide a continuous bridge over Gum Springs and Paint Branch to reduce fill on the knoll between the two streams to protect water quality and brown trout populations
- Employ stringent erosion and sediment control measures, along with on-site environmental inspectors to protect water quality and aquatic (brown trout) habitat
- Design bridges with adequate underpass space for wildlife and consider installation of fencing on entire length of the ICC to better direct wildlife to the crossings
- Design larger box culverts than hydraulically necessary in some cases to accommodate wildlife passage for large and small mammals as well as amphibians
- The Interagency Review Process applied throughout the planning process has yielded agreement from a wide variety of agency representatives on the basic dimensions of the bridges and culverts carrying the proposed ICC over sensitive environmental resources. As the project moves into the next phases of the highway development process, the study team will continue to investigate refinements to further reduce impacts and strengthen the principles of environmental stewardship. The Interagency Review Process will continue with the local, State and Federal agencies.

4. Exceeding State Water Quality Regulations

If a Build Alternative is selected, state-of-the-art SWM methods/facilities will be implemented to avoid and minimize direct and indirect impacts of increased imperviousness on receiving water resources. Many of these techniques exceed State SWM regulations for treatment of stormwater runoff.

SWM techniques would be implemented to minimize impacts to water quality in accordance with Maryland Department of the Environment (MDE) requirements and as presented in the *2000 Maryland Stormwater Design Manual* (MDE, 2000) for both quantity and quality of stormwater. In the SPA's special "enhancements" will be used to provide additional water quality benefits beyond those typically required, as discussed below and in *Chapter IV.F.5.a*. Techniques to be used for the ICC include grassed swales, infiltration practices, bioretention and filtering, ponds, underground storage, and other best management practices (BMPs)) in accordance with MDE guidelines. The ICC Study Team is also committed to protecting or improving existing stream conditions in sensitive areas by exceeding the minimum regulatory

requirement for water quality control by providing water quality control for a 1.5-inch rainfall event rather than the required 1.0-inch rainfall event. Treatment of the 1.0-inch event is mandated by MDE in order to capture and treat the “first flush” of runoff from all storm events, where the greatest concentration of pollutants is found. Treatment of the 1.5-inch event would then be expected to provide a greater degree of water quality benefit beyond the “first flush”. This approach to SWM will capture and treat more than 95 percent of all rainfall events, as opposed to the 90 percent of events captured under present MDE requirements. Water quantity treatment will be provided in accordance with MDE requirements that focus on stream channel protection volumes that aim to reduce the erosive potential of high storm flows from impervious surfaces.

In Use III watersheds, stormwater flows may be diverted to other watersheds to minimize thermal impacts. For runoff that is not diverted, SWM facilities will be designed to infiltrate a portion of the heated runoff and allow underground cooling to reduce potential temperature impacts. A linear SWM approach has been specifically developed to address water quality treatment in SPAs. This approach is designed to minimize runoff into aquatic resources. Sediments and attached pollutants will be removed from runoff as stormwater passes by sheet flow through vegetation and then into linear bioretention or sand filtration systems. These systems will be placed in the median and roadway side ditches and will be small but numerous to limit the individual drainage area treated at each individual facility. These systems are also being designed to provide vital heat dissipation to avoid potential temperature impacts at the discharge point. Additional information regarding impacts to temperature sensitive species is discussed per watershed in *Chapter IV.F.5*. Stormwater quantity control in SPAs and other Use III or IV watersheds will be accomplished by providing 12-hour channel protection volume (Cpv) (MDE 2000) in either underground pipes or surface ponds depending on constraints such as parkland impacts, subsurface soil conditions, or steep slopes. More information on these techniques is provided in *Chapter IV.F.5.a*.

The Rocky Gorge watershed is the primary drinking water supply for 550,000 to 650,000 people and the back-up water supply to approximately 900,000 more. In addition to providing treatment of 1.5 inches of rainfall, in the Rocky Gorge watershed, an additional 10,000 gallons of stormwater storage as well as isolation valves would be provided in each stormwater treatment pond. The additional storage and valves are intended to provide containment in the event of a liquid material spill on the highway during a rainfall event, to prevent deleterious material from moving downstream to the reservoir. Public spill control response plans will also be an integral part of stormwater designs in this watershed. See *Chapter IV.F.5.c*, for more information regarding spill control devices.

5. Stormwater Management Facilities

As noted, MDE’s SWM regulations, guidelines, and 2000 *Maryland Stormwater Design Manual* (MDE, 2000) will be applied by the Lead Agencies to the selection and implementation of SWM techniques throughout the project. Under CWA § 402(p), stormwater discharges that are regulated as municipal storm sewer point sources must have a National Pollutant Discharge

Elimination System ("NPDES") Permit that "requires controls to reduce the discharge of pollutants to the maximum extent practicable..." The Lead Agencies anticipate that a variety of SWM techniques and measures will ultimately be employed for the project under a future NPDES Permit that implements these requirements of the CWA.

In this regard, the following is a summary of measures either committed to or under study to avoid and/or minimize impacts of uncontrolled runoff from the ICC on receiving waters. More detailed information on SWM techniques is provided in *Chapter IV.F.5*.

- Disconnect impervious surface runoff from direct discharge into waterways by promoting sheet flow through vegetation and using grass channels that improve water quality and promote infiltration
- Implement thorough erosion and sediment control plans
- Exceed minimum regulatory requirements and specifications for stormwater treatment by providing water quality treatment for a 1.5-inch rainfall event throughout the study corridors
- Meet Montgomery County Department of Environmental Protection (MCDEP) SPA requirements for stormwater management review
- Protect all infiltration areas during construction
- Control and treat both road and bridge deck runoff in SPAs
- Base design on field infiltration tests at design depths to provide actual rates of infiltration rather than potentially less accurate rates obtained from disturbed samples in the lab
- Provide groundwater recharge by employing sheet flow of runoff through grass and use of grassed channels to convey runoff
- Control stormwater quality as well as quantity
- Route runoff out of sensitive areas for stormwater treatment where possible
- Incorporate temperature sensitive design into SWM facilities wherever feasible in Use III and Use IV watersheds
- Develop SWM inspection and maintenance protocols for any SWM facilities constructed on the ICC to ensure long term effectiveness
- Equip facilities within Rocky George watershed with spill controls and integrate these controls into the emergency response plan to protect the drinking water supply

- Pursue designating US 29 a HAZMAT-restricted route based on the provisions of the Hazardous Materials Transportation Act (49, U.S.C.A 5101 et seq.; 49 C.F.R.397.61 et seq.).
- Design facilities within temperature sensitive watersheds to infiltrate heated runoff after treatment and accommodate opportunities for underground cooling prior to discharge to protect brown trout and other temperature sensitive species
- Use continuous, linear SWM facilities in SPAs to treat water quality, and 12-hour channel protection volume in either underground chambers or surface ponds to address water quantity control requirements
- NPDES Permits for stormwater discharges are likely to contain requirements related to the Total Maximum Daily Load ("TMDL") provisions of the CWA. U.S. EPA regulatory requirements for TMDLs in NPDES-regulated stormwater discharges are set forth in 40 C.F.R. § 130.2, and are further addressed in EPA's policy guidance entitled "Establishing Total Maximum Daily Load ("TMDL") Wasteload Allocations (WLAs) for Stormwater Sources and NPDES Permit Requirements Based on Those WLAs, " (November 22, 2002) ("EPA's TMDL Stormwater Policy"). The Lead Agencies anticipate that future NPDES permit requirements for stormwater discharges associated with the ICC project will address TMDLs and require conformance with them, specifically in the form of Best Management Practices ("BMPs") implementation, as set forth in EPA's TMDL Stormwater Policy.

6. Redundant Erosion & Sediment Control Measures

During construction, which will also be subject to a stormwater construction NPDES permit, state-of-the-art sediment and erosion control procedures to control both coarse and fine sediment will be implemented. These measures will be in compliance with MDE regulations, and will exceed MDE regulations in designated SPAs. Redundancy of controls will be included in the Upper Rock Creek SPA, Paint Branch SPA, and the Rocky Gorge watershed to minimize potential control failures that could deliver sediment-laden runoff to these sensitive tributary streams. Examples of redundant controls include faster response to implementing stabilization measures than regulations require. Other examples may include placing two rows of silt fence to stabilize an area or one row of silt fence and the placement of a sediment trap as well. All in-stream work for culverts and bridges will be carried out in compliance with MDE requirements related to stream closure periods for the designated use class of all streams in the study area for the protection of aquatic species. An important element to the design process will be to identify opportunities to incorporate redundant erosion and control measures. Details of such measures will be developed in continued coordination with the Interagency Review Process.

7. Environmental Management Program

The Lead Agencies have committed to the implementation of an Environmental Management (EM) plan for the duration of design, construction, and post construction monitoring of the ICC

and its related compensatory mitigation and environmental stewardship projects. The primary purpose of the EM program is to insure that all environmental commitments made throughout the NEPA and permitting processes are fully met in design, construction and post construction activities, and that agency coordination and review of project elements continues through all phases of the project. The program will be implemented by an Environmental Management Team (EMT) and will include the following components. The program may be expanded as needed to address unforeseen needs later in the project.

- **Public Liaison** - The EMT will work to provide up-to-date information on program elements, successes and challenges, compliance levels, and overall project progress to the public.
- **Agency Coordination** - The EMT will work to provide up-to-date information on design, construction and post construction activities as needed. The IAWG (or the P+1) has committed to maintain a partnership to assure that the avoidance, minimization, mitigation and environmental stewardship efforts accomplished through the NEPA process are carried through design, construction and post construction monitoring of a build alternative. If a build decision is selected, the parties will enter into a memorandum of agreement setting forth the processes which will take advantage of and operate within the Design Build Process and construction schedules.
- **ROD Commitments/Permit Tracking Database (CTD)** - A CTD will be developed to follow all environmental commitments through design, construction and post-construction monitoring. The IAWG will be provided with access to the regularly updated database to monitor environmental commitments as the project moves forward.
- The database will include, but is not limited to, all permit conditions (U.S. Army Corps of Engineers - Section 404 Permit; Maryland Department of the Environment- Sediment and Erosion Control Plan, SWM Plan, Water Quality Certification, Coastal Zone Consistency and Nontidal Wetland and Waterways Permit; Maryland Department of Natural Resources- Scenic and Wild Rivers Plan, Reforestation Plan and Roadside Tree Permit) and will be used to track authorized impacts throughout design and construction.
- The CTD will be created using a computer platform that can be expanded, divided, or queried to suit the needs of the Project. Beyond logically housing all commitments, the CTD is used to generate contract specific compliance reports to be used by the EMT to efficiently track and ensure compliance during the design and construction phases. The reports can also be disseminated to designers, contractors, and agencies to be used as an excellent quick-reference tool. Though compliance will be checked daily, formal compliance reports will be completed during designated design milestones and quarterly during construction. In addition, the CTD tracks permitted impacts in the field as construction progresses. Final reports are produced at the end of each contract or phase to document compliance with commitments, permit conditions, and permitted impacts and are submitted to the regulatory agencies and the Project team.

- **Design Review and Permit Compliance** An environmental design review team will work closely with the engineering design team to insure that all commitments are met during the design process and that all possible avoidance and minimization measures continue to be explored as design moves forward. Review of final design plans will be conducted before construction begins on any section to once again ensure compliance with ROD commitments and permit conditions for that area. Updates of the design plans will be coordinated with LAWG.

The partnering process that was established in the planning studies for the ICC will continue throughout the project development process. Whereas the traditional process for building a project like the ICC include distinct design and construction phases where engineers first completely design the project and then turn it over to contractors to construct, the ICC will be delivered using the Design-Build process. The Design-Build process joins designers and contractors in teams shortly after the planning process, allowing a collaborative demonstration of talents and experiences. The designers receive the benefits of contractors "field" experiences and the contractors can positively affect the design making the construction phase more efficient. The Design-Build process has been applied in hundreds of projects, large and small, throughout the country, including several here in Maryland. The results from the application of this partnership have been outstanding. In many cases, this collaborative process between professionals with a common goal have yielded projects being constructed quicker and with fewer environmental impacts than expected as a result of partnering.

Specifically for the ICC, design-build teams (consisting of designers and constructors) will be contracted by SHA to finalize the design and construct segments of the entire project. A team of engineers, planners, environmental scientists and other professionals will work directly with the SHA and MdTA as "General Engineering Consultants" to help monitor and guide the design/construction process toward completion. The GEC will also help ensure that the highest standard of care is applied in meeting environmental, human and natural, commitments.

- **Environmental Construction Management** –the Lead Agencies will provide a full-time, on-site environmental construction inspection team with expertise in environmental science and knowledge of construction processes and sequences, particularly erosion and sediment control, SWM, and working in sensitive areas. The Environmental Construction Inspectors (EIs) will have an understanding of the construction plans, permit-defined limits of disturbance, the approved erosion and sediment control plans, and all permit requirements. The EIs will work closely with the contractors and construction inspectors to foresee and avoid potential problems. The EI team will identify, react to and resolve unforeseen issues in the field and will produce weekly inspection reports, erosion and sediment control rating reports, and quarterly compliance reports.

- **Mitigation Implementation and Monitoring** – the Lead Agencies will closely coordinate and track the implementation of all mitigation and stewardship commitments until their completion to insure that individual projects are successful in meeting mitigation and stewardship goals established in the Mitigation and Stewardship packages. The Lead Agencies will conduct mitigation monitoring in compliance with all permit requirements, which typically stipulate five years of post-construction monitoring to insure project success. An agency field tour of these mitigation sites during construction and after construction will be conducted every 6 months, or as necessary.
- **Independent Environmental Monitor (IEM)** – the Lead Agencies will provide an Independent Environmental Monitor (IEM) with no affiliation with the design, permitting, or construction aspects of the project to review the final design plans as they are developed and monitor the implementation of the design during construction. The IEM would be a full-time, on-site extension of the regulatory agencies. The IEM would communicate issues concurrently to the sponsoring agencies so that all parties are informed and involved in the solution process. In addition the IEM will attend the monthly IAWG to provide design and construction updates, review periodic compliance reports prepared by the EIs, and provide guidance and/or assistance in addressing agency and/or public compliance issues.

Similar environmental management approaches have been very successful on other environmentally sensitive projects in the State. This approach will allow for the highest level of compliance and clear accountability throughout project design, construction and post construction monitoring.

8. Wildlife Passages

The ICC corridors pass through four stream valleys that are known to have exceptionally high deer concentrations. Wildlife passages, described in more detail below, are being studied that allow deer and other wildlife to safely cross beneath roadways, minimizing the impact of the proposed Build Alternatives on wildlife. The study team has proposed several deer passage cells where culverts are proposed in order to augment deer passage that will be attained with bridge crossings. In addition, the study team and its wildlife passage specialists will continue to coordinate with similar specialists from local, State, and Federal agencies to determine the best locations and methods to maintain passage for not only deer but small mammals, amphibians, and fish.

Special wildlife crossings will be considered during roadway design to provide protection for communities and wildlife. These structures are crossings that help maintain the connectivity between wildlife communities, and enable wildlife to maintain their range of habitat by allowing safe passage through areas that will otherwise be bisected and isolated by a new roadway.

The following is a summary of measures committed to or under study to avoid and/or minimize impacts to forests, and wildlife in general:

- Consider deer passages and installation of fencing along the ICC to better direct wildlife to the crossings in order to reduce human/deer interactions
- Conduct literature search for appropriate structures for reptile and amphibian passages

9. Environmentally Sensitive Construction

Implementing environmentally sensitive construction techniques will aid in the minimization of impacts to natural, cultural, and socioeconomic resources. The primary technique to minimizing forest loss will be through compliance with the Maryland Reforestation Law, which requires every reasonable effort to minimize the cutting or clearing of trees. Only the minimum number of trees may be cut or cleared, and sound design practices must be utilized.

Efforts are ongoing to avoid or minimize impacts to ecologically significant areas (ESAs), rare species, and cultural resources. Avoidance efforts for these resources have included coordination with agency representatives. See *Chapter V: Final Section 4(f) Evaluation* for more information on parks and cultural resources that have been avoided.

Additionally, all excess excavation, wood, trash debris and other foreign matter as a result of construction would be removed from the right of way and disposed of at suitable locations. Disposal would be in conformance with all Federal, State and local ordinances. All applicable permits would be acquired prior to disposal. Coordination will continue with agencies and all applicable permits would be acquired prior to disposal of excess material.

throughout the development of the DEIS and FEIS. ICC alternatives have been redesigned or shifted to avoid and/or minimize impacts to these resources and have resulted in the Engineering Plates for Corridors 1 and 2 in *Appendix A*. Subsequent to the DEIS, SHA has continued consultations with the MHT/MD SHPO, FHWA, ACHP, property owners and representatives and other consulting parties to resolve the project's adverse effects on historic properties and has executed an MOA for the undertaking, pursuant to 36 CFR §800.6. On July 15, 2005, the ACHP notified FHWA that based on the documentation reviewed and information provided, ACHP does not believe that their participation in consultation to resolve adverse effects is needed (*Appendix B*).

Section 106 consultations have included adequate opportunities to involve relevant Consulting Parties including affected property owners and representatives, the Certified Heritage Areas and representatives, and the public in the process. The resolution of adverse effects in the executed MOA includes stipulations that specify the negotiated mitigation measures for specific resources, as well as the process for ongoing consultation to assess effects to historic properties from the ancillary actions, and to resolve effects on archeological sites pending the completion of the identification and evaluation studies.

Appendix J contains the executed MOA. Pursuant to 36 CFR §800.6(b) (iv), FHWA has filed the executed MOA with the ACHP to complete the requirements of Section 106 of the NRPA for the ICC project. A copy of the filing letter is included in *Appendix J*.

F. Natural Environment

I. Topography, Geology, And Soils

a. Topography

Direct Impacts

The No-Action Alternative would have no ICC project related impact on topography within the study area. Predicted impacts to topography associated with various alternatives are unavoidable, as the study area has numerous slopes, ranging from slight to steep. **Table IV-48** shows the slope classifications and impacts within the proposed ROW of each corridor and option. The majority of the slopes along both Corridor 1 and Corridor 2 are classified as 0 to 15 percent.

Depending on which options are selected, the total acreage of steep slopes greater than 25 percent crossed by either Corridor 1 or Corridor 2 range between 89.0 and 99.2, and 92.3 and 112.6 respectively.

Corridor 1 would cross the steepest slopes along Rock Creek, North Branch Rock Creek, Northwest Branch, and Paint Branch. Rock Creek Option A encounters more steep slopes than any of the other options.

Table IV-48
Slope Classifications within ROW

Corridor	Slope Classification		
	Slope	Steep Slope	
	0-15 % (acres)	15-25 % (acres)	> 25 % (acres)
No-Action Alternative	0.0	0.0	0.0
Corridor 1 and 2 West of MD 97 Mainline Segments	199.9	16.2	17.6
Corridor 1 and 2 Rock Creek Options (select one)			
Rock Creek A	61.2	12.9	8.4
Rock Creek C- Oldé Mill Run Grade Separation	90.4	8.6	4.0
Rock Creek C- Oldé Mill Run Cul-de-Sac	88.2	7.4	3.6
Corridor 1 Mainline Segments (MD 97 to I-95)	446.9	36.9	20.6
Corridor 1 Northwest Branch Options (select one)			
Northwest Branch A- with Interchange at Layhill Road	86.7	14.6	5.1
Northwest Branch A- without Interchange at Layhill Road	81.5	14.3	5.1
Northwest Branch B- with Interchange at Layhill Road	81.0	7.9	3.6
Northwest Branch B- without Interchange at Layhill Road	79.9	7.7	3.7
Corridor 1 I-95 Interchange Options (select one)			
I-95 Interchange Option A (terminate ICC at US 1)	480.9	74.4	47.5
I-95 Interchange Option B (terminate ICC at I-95)	376.3	68.3	43.6
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)			
Corridor 2- with Interchange at Layhill Road	275.8	27.8	16.9
Corridor 2- without Interchange at Layhill Road	253.6	27.7	16.8
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)			
Norbeck A	135.8	7.0	2.3
Norbeck B- with ICC over Willow Grove	137.1	6.1	2.0
Norbeck B- with Willow Grove Access at Mt. Everest Lane	136.5	6.1	2.2
Spencerville A- with Burtonsville A	163.1	15.2	6.0
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	146.9	31.6	15.5
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	145.2	31.6	15.6
Spencerville A- with Burtonsville X	155.7	15.2	6.0
Spencerville B- with Burtonsville A	156.9	15.1	6.0
Spencerville B- with Burtonsville B	149.6	31.7	15.8
Spencerville B- with Burtonsville X	167.5	15.2	6.0
Spencerville C- with Burtonsville A	173.8	15.3	6.4
Spencerville C- with Burtonsville B	140.6	31.3	15.3
Spencerville D- with Burtonsville B	131.0	33.0	15.5
Fairland A	90.2	6.5	2.8
Fairland B	57.4	5.0	4.0
Corridor 2 I-95 Interchange Options (select one)			
I-95 Interchange Option A (terminate ICC at US 1)	473.6	73.2	47.6
I-95 Interchange Option B (terminate ICC at I-95)	368.1	66.9	43.5
Corridor 1 Range of Impacts	1,164.2 – 1,304.8	136.5 – 155.0	89.0 – 99.2
Corridor 2 Range of Impacts	1,209.8 – 1,408.0	144.4 – 176.6	92.3 – 112.6

Note: Total impacts for corridors are calculated for **Corridor 1** by selecting the **Corridor 1 and 2 West of MD 97 Mainline Segments** and adding one **Corridor 1 and 2 Rock Creek Option**, adding the **Corridor 1 Mainline Segments (MD 97 to I-95)**, adding one **Corridor 1 Northwest Branch Option** and one **Corridor 1 I-95 Interchange Option**, or for **Corridor 2** by selecting the **Corridor 1 and 2 West of MD 97 Mainline Segments** and adding one **Corridor 1 and 2 Rock Creek Option**, adding one **Corridor 2 Mainline Segments (MD 97 to I-95)**, one of each of the desired **Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options**, and adding one **Corridor 2 I-95 Interchange Option**.

Corridor 2 would cross the steep slope terrain of the Patuxent River tributaries and the steep slopes of Rock Creek and North Branch Rock Creek. Burtonsville Option B encounters a substantially higher amount of steep slopes than any of the other options in Corridor 2.

Indirect Impacts

Potential indirect impacts could occur with any of the Build Alternatives depending on the level of earthmoving required, and may include changes to small drainage patterns associated with redirecting surface runoff. These changes are impossible to predict at this stage of design, but are expected to be minimal. In addition, unpredictable changes in micro-topography could result in minor localized changes in shallow groundwater movement. However, these effects should be minimal and be offset by proposed facilities. These potential indirect impacts apply to both corridors.

Avoidance, Minimization, and Mitigation

To prevent soil erosion from work areas and sediment transport into nearby waterways, both during and after construction, proper slope and soil stabilization techniques would be used. In compliance with Maryland Department of the Environment (MDE) regulations, sediment and erosion controls, and SWM practices would be in place. A grading plan, which includes measures to prevent erosion in highly susceptible areas such as steep slopes, will be prepared and implemented in accordance with MDE regulations. During construction, disturbance to steep slopes would be minimized using rapid stabilization techniques such as diversion dikes, velocity dissipaters, temporary seeding, mulching, and stabilization matting. Sedimentation into streams would be limited through the use of sediment traps and basins.

h. Geology

Direct Impacts

The No-Action Alternative would have no ICC project related impact on geology within the study area.

Physiography

Local topography would be altered by the excavation and grading required for project construction. These impacts are expected to be local and are not anticipated to cause substantive changes in surface water or shallow groundwater drainage.

Stratigraphy

Since the subsurface geologic materials have little value as a mineral resource, minimal impact is anticipated for either corridor.

Rock Structure/Joints

Joint patterns within the study area should be documented and addressed when cut slopes in bedrock are proposed. This may be effective in identifying areas where post construction slope failures could occur.

Faults and Shear Zones

Corridor 1 would cross the Rock Creek Shear Zone in the area of Northwest Branch Park. Corridor 1 and 2 would cross the Brinklow Thrust Fault east of Norbeck.

The existence of faults and shear zones implies that an assessment of rock quality may be required in the vicinity of these features. Faults and shear zones create zones of potentially weaker rock and, due to grinding effects, increase fracturing and weathering. However, these features should not be a substantial impediment to roadway construction.

Lineations

Corridors 1 and 2 would cross lineations 6 and 7 (*Figure II-10*). The base alignment of Corridor 1 would cross lineations 3, 4, and 8. Rock Creek Option A and Option C would cross lineation 1. Northwest Branch Option A and Option B would cross lineation 2. The base alignment of Corridor 2 would cross lineations 4 and 5. Burtonsville Option A and Option B would both cross lineation 6.

Like shear zones, lineations, especially fracture traces, could be areas of compromised rock quality. Standard geotechnical testing would likely detect such conditions allowing for appropriate modifications to roadway or structural designs.

Shallow Bedrock

Mechanical excavation of bedrock has little effect on the environment. Blasting bedrock has few long-term effects other than potentially increasing rock permeability within the blast zone. Some short-term effects are possible, which are discussed in *Chapter IV.F.1.c*. Recent advances in blasting techniques may minimize potential short-term effects, such as vibrations, flyrock and damage to remaining in-situ rock.

Fossils

The site within Prince George's County known to contain fossils is outside any of the corridors under study. Therefore, construction activities associated with the roadway are not likely to disturb any known fossil remains.

Indirect Impacts

No indirect impacts associated with either corridor are anticipated.

Avoidance, Minimization, and Mitigation

Areas of incompetent rock, which could occur near a lineation, fault, or the shear zone would need to be identified prior to construction. Special construction techniques may be required in these areas.

A blasting plan would be designed to reduce the potential effects of blasting. This plan would identify the best techniques for use during construction, as well as monitoring permits and license requirements. Detailed geotechnical studies would be conducted during final design to allow for any vertical alignment adjustments.

c. Soils

Direct Impacts

The No-Action Alternative would have no ICC project related impact on soils within the study area.

The primary impact to soils from both Corridor 1 and Corridor 2 would be the direct loss due to construction activities. In addition, there is the risk of soil erosion within the study area both during and after construction. Potential impacts from the ICC on highly erodible soils would occur primarily during construction as permanent stabilization would occur in areas after construction.

When the vegetation is cleared from highly erodible soil, there is a high potential for loss of soil and sedimentation of surrounding surface waters. Hydric soil impacts as a result of the ICC would be due to the need to increase the bearing strength of the surface of hydric soils. Hydric soils, due to water saturation, have reduced aggregate stability and associated increases in microbial waste products, which reduce the soil shear strength and associated bearing capacity. This can be compensated for by adding subsurface drains to the area or by filling the area with a granular fill. Upon identifying hydric soils and highly erodible soils within the project ROW, roadway construction within these areas will be appropriately designed to account for these soils. Impacts to hydric soils and highly erodible soils are described in more detail below.

Hydric Soils

Hydric soils occur along both Corridor 1 and Corridor 2, primarily within the floodplains of Rock Creek, North Branch Rock Creek, Northwest Branch, and Paint Branch (*Table IV-49*). Corridor 1 would impact between 133.4 and 153.1 acres of hydric soils and Corridor 2 would impact between 118.7 and 136.7 acres, depending upon which options are selected. Undrained hydric soil, in combination with hydrophytic vegetation and hydrology, is one of three attributes that define wetlands. More detailed wetland information can be found in *Chapter IV.F.7*.

Table IV-49
Hydric and Highly Erodible Soil Acreage in the ROW

Corridor	Hydric Soils (acres)	Highly Erodible Soils (acres)
No-Action Alternative	0.0	0.0
Corridor 1 and 2 West of MD 97 Mainline Segments	30.8	49.7
Corridor 1 and 2 Rock Creek Options (select one)		
Rock Creek A	6.0	41.2
Rock Creek C- Olds Mill Run Grade Separation	5.5	39.8
Rock Creek C- Olds Mill Run Cul-de-Sac	5.6	35.1
Corridor 1 Mainline Segments (MD 97 to I-95)	27.3	124.8
Corridor 1 Northwest Branch Options (select one)		
Northwest Branch A- with Interchange at Layhill Road	19.4	52.9
Northwest Branch A- without Interchange at Layhill Road	19.5	50.7
Northwest Branch B- with Interchange at Layhill Road	30.3	34.3
Northwest Branch B- without Interchange at Layhill Road	30.3	33.8
Corridor 1 I-95 Interchange Options (select one)		
I-95 Interchange Option A (terminate ICC at US 1)	58.7	3.8
I-95 Interchange Option B (terminate ICC at I-95)	50.4	0.8
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)		
Corridor 2- with Interchange at Layhill Road	15.6	83.0
Corridor 2- without Interchange at Layhill Road	14.9	81.5
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)		
Norbeck A	13.6	26.3
Norbeck B- with ICC over Willow Grove	13.5	18.5
Norbeck H- with Willow Grove Access at Mt. Everest Lane	14.0	19.8
Spencerville A- with Burtonsville A	5.3	49.7
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	3.0	85.0
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	2.8	85.0
Spencerville A- with Burtonsville X	5.7	50.3
Spencerville H- with Burtonsville A	6.6	49.6
Spencerville H- with Burtonsville H	2.2	85.6
Spencerville B- with Burtonsville X	6.7	50.3
Spencerville C- with Burtonsville A	6.9	49.7
Spencerville C- with Burtonsville B	2.2	85.6
Spencerville D- with Burtonsville B	4.2	96.4
Fairland A	1.3	12.3
Fairland B	4.7	6.4
Corridor 2 I-95 Interchange Options (select one)		
I-95 Interchange Option A (terminate ICC at US 1)	58.7	3.8
I-95 Interchange Option B (terminate ICC at I-95)	50.5	0.8
Corridor 1 Range of Impacts	133.4 - 153.1	244.2 - 271.4
Corridor 2 Range of Impacts	118.7 - 136.7	241.6 - 311.7

Note: Total impacts for corridors are calculated for Corridor 1 by selecting the Corridor 1 and 2 West of MD 97 Mainline Segments and adding one Corridor 1 and 2 Rock Creek Option, adding the Corridor 1 Mainline Segments (MD 97 to I-95), adding one Corridor 1 Northwest Branch Option and one Corridor 1 I-95 Interchange Option, or for Corridor 2 by selecting the Corridor 1 and 2 West of MD 97 Mainline Segments and adding one Corridor 1 and 2 Rock Creek Option, adding one Corridor 2 Mainline Segments (MD 97 to I-95), one of each of the desired Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options, and adding one Corridor 2 I-95 Interchange Option.

Highly Erodible Soils

Corridor 1 would impact between 244.2 and 271.4 acres of highly erodible soils and Corridor 2 would impact between 241.6 and 311.7 acres, depending upon which options are selected. The northernmost options along Corridor 2 have the highest amount of highly erodible soils (*Table IV-49*). This directly correlates to the steep slopes found in this area.

Indirect Impacts

Potential indirect impacts to this resource would primarily be a result of soil compaction associated with heavy equipment over non-paved areas used during construction or for maintenance purposes. Indirect effects of soil compaction could include reduced infiltration rates causing additional surface water runoff or ponding in depressional areas. Both reduced infiltration rates and ponded water could result in changes to vegetation community composition. Ponded water could modify the soil characteristics and result in changes to vegetation from a more upland community to a wetland-species-dominated system. Reduced infiltration rates, combined with more rapid surface water runoff, could also result in a shift in the plant community to species that are more adapted to dry conditions due to the reduction in available moisture (wetland to upland). Other indirect impacts could include root zone impacts, resulting in the mortality of woody vegetation and a shift in animal species relying on pre-construction habitat conditions. In addition, chemicals leaching into soils from general maintenance or accidental spills could impact soil chemistry and vegetation growth. These potential indirect impacts apply to both corridors.

Avoidance, Minimization, and Mitigation

Construction of the ICC project would require that certain soils such as unstable or erodible as well as steep slopes be further considered during the final design of the project. These soils and steep slopes have been reviewed throughout the corridors for their compatibility with roadway and bridge construction. In addition, an Erosion and Sediment Control Plan (ESCP) would be developed and administered in order to minimize the soil erosion associated with steep slopes and unstable and highly erodible soils.

The ESCP would be prepared during final design in accordance with the guidelines provided by the MDE, and would include erosion and sediment control devices such as sediment traps, silt fence, sedimentation basins, interception channels, rip-rap, matting, and seeding and mulching to minimize the impacts associated with soil erosion. In addition to the aforementioned control measures, onsite evaluations by a certified sediment and erosion control inspector would be performed throughout the duration of the project. Pre-design permeability testing would be needed along the corridor to determine the effectiveness of infiltration as a SWM technique.

2. Groundwater

a. Direct Impacts

The No-Action Alternative would have no ICC project related impact on groundwater within the study area.

Groundwater impacts from construction projects would generally occur as quantity and/or quality alterations.

Quantity Impacts

There is no appreciable difference in potential quantity impacts between the various ICC corridors as they are similar in overall footprint on the landscape. Construction of the ICC project could reduce infiltration into the shallow portions of aquifers, reducing or redirecting available hydrology for wetlands and streams.

These effects could be localized and could involve short reaches of streams and small areas of wetlands. For example, in areas where existing substrate will be altered, it is anticipated that localized changes in hydrology will occur. However, these impacts are not expected to change the overall sub-watershed or watershed hydrology. Effects of a new roadway on deep groundwater reserves would be indistinguishable from the overall effects of suburban to ultra-urban development.

A new roadway would locally impact groundwater in the vicinity of a rock lineation by reducing infiltration due to the added impervious surface. However, proposed rock lineation crossings are mostly perpendicular, which greatly reduces the quantity of impervious surface on the rock lineation when compared to a situation where a roadway is routed directly along a rock lineation. In addition, rock lineations are very long compared to the width of the roadway; therefore, the realized infiltration reduction would likely be immeasurable. Although rock lineations would not likely have an impact on actual construction, rock quality should be investigated near rock lineations, as it could be relatively weak due to higher weathering rates and secondary porosity.

Constructing the ICC could impact the quantity of recharge that enters the Patuxent Aquifer by virtue of increased impervious surface which redirects potential groundwater recharge to surface water bodies. However, the actual effect would likely be immeasurable because the recharge zone is significantly larger than the quantity of impervious surface of the ICC. Like the fractured rock aquifers, widespread suburban, urban, or ultra-urban development could affect water levels.

Quality Impacts

Quality impacts are the increased concentrations of undesirable or harmful substances in groundwater above background levels. Impacts to groundwater quality from either of the corridors would likely be negligible because roadway contaminants would be of low concentrations and would likely be retained in vegetation found in SWM facilities. For example,

Nitrates generated are soluble and, therefore, could pass through to the shallow groundwater. However, the Potomac River Basin study (Duigon, et al., 2000) indicates that a transportation facility by itself would not contribute an appreciable amount of nitrates, provided that fertilizers are not used in the ROW.

As with any roadway, accidents involving the transport of petroleum or chemical products along the ICC could release pollutants to the environment. A chemical release could migrate vertically and enter shallow groundwater, or flow into other surface water resources. However, because spills are acute isolated events, as opposed to chronic long-term events, contaminant concentrations would decrease naturally by bacterial activity, dispersion, advection, and absorption. Depending on the proximity of a particular resource to the proposed roadway, actual realized contaminant loads to the particular resource will vary.

Data collected from numerous stormwater sampling programs have found that the contribution of most roadway contaminants, such as total petroleum hydrocarbons (diesel and gasoline range organics), lead, and cadmium is often inconsequential. These parameters are rarely found in stormwater or are found at extremely low concentrations. Typical stormwater pollution would likely partition to the soil of the swales and SWM facilities resulting in immeasurable contaminant concentrations. A direct release of gasoline (such as a fuel spill) could result in temporary pollution of groundwater from some of the more soluble and mobile components (e.g., MTBE).

Road salt may be applied periodically as a deicer. Road salt is generally comprised of 60 percent chloride and 40 percent of a cation such as sodium and to lesser extents calcium, potassium, and magnesium. When dissolved, the chloride and cations disassociate, and the cations may partition to soil particles or be metabolized biologically. However, the chloride ion is resistant and can accumulate in watersheds. Approximately 55 percent of road salt chloride is transported in surface runoff and 45 percent infiltrates into the groundwater. Chlorides enter the groundwater system by vertical infiltration or by flow into surface waters. There is a potential for ecosystem damage if chloride concentrations enter and accumulate in areas such as wetlands. The effects of road salt may be mitigated by using anti-icing techniques. The use of non-chloride compounds, such as urea and ethylene glycol, to optimize the performance of road salt has proven effective both at the SHA and national level. The feasibility of utilizing these compounds on the ICC project will be explored further during the operational/maintenance phases of the project.

Well and Septic System Impacts

As detailed in the Existing Conditions section, approximately 2,532 wells are located within the Montgomery County portion of the study area. In addition, 4,007 septic systems are recorded within this same area. However, the number of wells and septic systems in actual use may be significantly lower. Coordination with Prince George's County is ongoing to identify impacts to wells and septic systems within the Prince George's portion of the study area. Of the 2,504 wells located within the Montgomery County portion of the study area, Corridor 1 and its associated

options would impact between 4 and 10 wells and Corridor 2 would impact between 5 and 17 wells (*Table IV-50*). Septic system impacts would range between 5 and 11 for Corridor 1 and between 7 and 32 for Corridor 2 (*Table IV-50*). Impacted wells and septic systems would be treated in the construction phase in accordance with MDE regulations.

b. Indirect Impacts

In addition to the direct impacts described above, indirect impacts to groundwater could result from any of the build alternatives. One potential indirect impact would be localized changes to groundwater movement and the effect on domestic wells. However, this impact is unlikely because most wells are deeper than the subsurface resources that would accrue most of the impacts. These potential indirect impacts apply to both corridors.

c. Avoidance, Minimization, and Mitigation

Properly designed SWM facilities along the roadway would be used to minimize any potential groundwater quantity and quality impacts. SWM facilities would be designed to infiltrate a portion of the runoff to maintain recharge levels to stream and wetland hydrology. SWM facilities would also be designed using materials such as mulch, wood chips, or compost that would reduce the amount of nutrients, metals, and heavier petroleum products that could migrate through the soil column and pollute groundwater.

When chemical spills occur, these substances enter the environment by direct runoff into a stormdrain or stream or by infiltration into the subsurface. As they infiltrate the soil column, many chemicals adsorb or absorb to soil particles preventing significant quantities of the contaminant from reaching the groundwater. Such chemicals include PCBs, heavy-grade oils, and metal solutions. The quantity of adsorption or absorption depends on the concentration of the spilled chemical and soil properties.

Generally, chemical spills would not likely result in appreciable groundwater pollution. Chemicals need time and precipitation to infiltrate into the groundwater system. Spills are generally remediated before infiltrating into the groundwater system. Furthermore, as part of any spill remediation exercise, contaminated soils are generally removed and replaced by clean fill, thereby, removing the groundwater contamination source. If contamination entered the groundwater system, it would likely be in minute concentrations and would either flush (Piedmont aquifers) or disperse (Coastal Plain aquifers) quickly.

Any chemical spills along the ICC would likely concentrate in roadside ditches. Ditches would be designed with storm drain inlets that convey runoff to storm drains and finally to a larger SWM facility (i.e., sand filter, pond). Because the ditches would be vegetated, much of the liquid would be bound and detained within the vegetation and soil with relatively little contamination reaching the sand filters and ponds. Fires associated with some chemical spills, may require water to extinguish, which would serve to disperse the contaminants over a larger area. Blocking storm drains before or during fire fighting would prevent large amounts of contaminated water from entering the larger SWM facilities.

Table IV-50
Well and Septic Impacts in the ROW

Corridor	Wells (Number impacted)	Septic Systems (Number impacted)
No-Action Alternative	0	0
Corridor 1 and 2 West of MD 97 Mainline Segments	2	3
Corridor 1 and 2 Rock Creek Options (select one)		
Rock Creek A	1	0
Rock Creek C- Old Mill Run Grade Separation	0	0
Rock Creek C- Old Mill Run Cul-de-Sac	5	6
Corridor 1 Mainline Segments (MD 97 to I-95)	2	2
Corridor 1 Northwest Branch Options (select one)		
Northwest Branch A- with Interchange at Layhill Road	0	0
Northwest Branch A- without Interchange at Layhill Road	0	0
Northwest Branch B- with Interchange at Layhill Road	0	0
Northwest Branch B- without Interchange at Layhill Road	1	0
Corridor 1 I-95 Interchange Options (select one)		
I-95 Interchange Option A (terminate ICC at US 1)	0	0
I-95 Interchange Option B (terminate ICC at I-95)	0	0
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)		
Corridor 2- with Interchange at Layhill Road	3	10
Corridor 2- without Interchange at Layhill Road	3	4
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)		
Norbeck A	1	1
Norbeck B- with ICC over Willow Grove	1	1
Norbeck B- with Willow Grove Access at Mt. Everest Lane	0	0
Spencerville A- with Burtonsville A	10	9
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	0	2
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	0	5
Spencerville A- with Burtonsville X	1	12
Spencerville B- with Burtonsville A	7	9
Spencerville B- with Burtonsville B	0	1
Spencerville B- with Burtonsville X	0	0
Spencerville C- with Burtonsville A	7	4
Spencerville C- with Burtonsville B	0	1
Spencerville D- with Burtonsville B	1	3
Fairland A	0	1
Fairland B	0	0
Corridor 2 I-95 Interchange Options (select one)		
I-95 Interchange Option A (terminate ICC at US 1)	0	0
I-95 Interchange Option B (terminate ICC at I-95)	0	0
Corridor 1 Range of Impacts	4 - 10	5 - 11
Corridor 2 Range of Impacts	5 - 17	7 - 32

Note: Total impacts for corridors are calculated for Corridor 1 by selecting the Corridor 1 and 2 West of MD 97 Mainline Segments and adding one Corridor 1 and 2 Rock Creek Option, adding the Corridor 1 Mainline Segments (MD 97 to I-95), adding one Corridor 1 Northwest Branch Option and one Corridor 1 I-95 Interchange Option; or for Corridor 2 by selecting the Corridor 1 and 2 West of MD 97 Mainline Segments and adding one Corridor 1 and 2 Rock Creek Option, adding one Corridor 2 Mainline Segments (MD 97 to I-95), one of each of the desired Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options, and adding one Corridor 2 I-95 Interchange Option.

3. Floodplains

a. Direct Impacts

Pursuant to 23 CFR 650.111, location hydraulic studies were performed, using FEMA National Floodplain Insurance Program maps and information to ascertain the locations and extends of floodplains. This information became the baseline for analyses and models used in the studies. This allowed hydrologic and hydraulic analyses for existing (baseline) and predicted ultimate development conditions for the various proposed ICC major waterway crossings based on a 100-year design return period. Larger drainage basins were divided into subareas where necessary to better estimate times of concentration and to account for varying land use and soil conditions. Hydrology models were developed using the information from the models and field investigations. Existing and ultimate development conditions were analyzed for various return periods. These hydrologic reports were then submitted to MDE for review and concurrence.

The baseline hydraulic models were used to provide baseline water surface elevations, energy grade line elevations, velocities and shear stresses that will be compared with proposed hydraulic models to determine if the proposed crossings meet or exceed the accepted hydraulic design criteria. To the extent practicable, longitudinal encroachments have been avoided to both minimize floodplain impacts and potential stream instability affects on the proposed roadway alignments.

Hydraulic cross sections were surveyed on all waterways on both Corridor 1 and Corridor 2 that were either a potential bridge crossing or a potential major culvert crossing (i.e., greater than a 6-ft x 6-ft box culvert). These cross sections were then used for hydraulic modeling. Using this cross section data, channel Manning's n values, and flow data from the hydrologic modeling, baseline condition models were developed for the purposes of establishing the existing floodplain. Any existing crossing or structure within the analyzed reach was shown in the model (structures were field surveyed).

Preliminary proposed conditions were developed for the bridge or major culvert crossings of Corridor 1 and Corridor 2. Initially minimum hydraulic structure sizes were determined. Subsequently, structure sizes and lengths (but not types or configurations) that have been committed were modeled for the purpose of determining if the committed lengths met regulations.

Geomorphic studies were performed for all of the bridge and major culvert crossings of Corridor 1 and Corridor 2. This work was completed to determine the possible extent of lateral migration and vertical degradation that may occur within the proposed crossing locations and how these instabilities may affect potential foundation designs.

The No-Action Alternative would have no ICC project related impact on floodplains within the study area.

Table IV-51 shows the acres of possible floodplain impacts for each corridor and option. Floodplain impacts presented below are estimated fill areas associated with the construction of the ICC project. The options considered here include options that are representative of all the options being considered. With the exception of the I-95 truncated option, the options have only slight variations from the alignment options presented. The truncated option that would terminate the ICC at I-95 would reduce the length of both corridors by about one mile. This option would result in measurably less impacts. Difference in total impacts due to the additional option variations will be negligible. Details on the variations in impacts for each Corridor from these options including the truncated option are provided in the *Summary*.

Corridor 1 would result in the filling of 29.4 to 42.4 acres of the 100-year floodplain, depending upon which options are selected. Corridor 2 would result in the filling of 35.7 to 48.3 acres of the 100-year floodplain, depending upon which options are selected. Should the decision be made to truncate the project at I-95, there would be a reduction of approximately 3 acres of floodplain impacts for both corridors..

Muddy Branch Watershed

No impact to FEMA-designated 100-year floodplains would occur within the Muddy Branch watershed.

Upper Rock Creek Watershed

Corridors 1 and 2, within the Upper Rock Creek Watershed, would perpendicularly cross the 100-year floodplain three times resulting in 7.8 acres of impact. In addition, Rock Creek Option A (*Appendix A, Plate 4*) would have two perpendicular crossings of the 100-year floodplain and would impact 5.1 acres. Rock Creek Option C- Olde Mill Grade Separation and Rock Creek Option C - Old Mill Run Cul-de-Sac, (*Appendix A, Plates 7 and 10*) would each have two perpendicular crossings of the 100-year floodplain of Rock Creek and would impact 1.1 and 1.7 acres, respectively.

North Branch Rock Creek Watershed

Corridors 1 and 2, between the Rock Creek Options and the Norbeck Options (*Appendix A, Plates 8 and 11-13*), would perpendicularly cross the 100-year floodplain of North Branch Rock Creek four times for a total impact of 9.4 acres.

Northwest Branch Watershed

Both sub-options for Northwest Branch Option A (*Appendix A, Plates 17-19*) would perpendicularly cross the 100-year floodplain of Northwest Branch three times for a total impact of 5.8 acres. Both sub-options for Northwest Branch Option B (*Appendix A, Plates 21-22*) would longitudinally cross the 100-year floodplain of Northwest Branch two times, for a total impact of 11.8 acres.

Table IV-51
Summary of Direct Floodplain Impacts

Corridor	Floodplains (Acres)
No-Action Alternative	0
Corridor 1 and 2 West of MD 97 Mainline Segments	15.5
Corridor 1 and 2 Rock Creek Options (select one)	
Rock Creek A	5.1
Rock Creek C- Old Mill Run Grade Separation	1.1
Rock Creek C- Old Mill Run Cul-de-Sac	1.7
Corridor 1 Mainline Segments (MD 97 to I-95)	2.0
Corridor 1 Northwest Branch Options (select one)	
Northwest Branch A- with Interchange at Layhill Road	5.8
Northwest Branch A- without Interchange at Layhill Road	5.8
Northwest Branch B- with Interchange at Layhill Road	11.8
Northwest Branch B- without Interchange at Layhill Road	11.8
Corridor 1 I-95 Interchange Options (select one)	
I-95 Interchange Option A (terminate ICC at US 1)	8.0
I-95 Interchange Option B (terminate ICC at I-95)	5.0
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)	
Corridor 2- with Interchange at Layhill Road	10.5
Corridor 2- without Interchange at Layhill Road	9.7
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)	
Norbeck A	2.6
Norbeck B- with ICC over Willow Grove	1.2
Norbeck B- with Willow Grove Access at Mt. Everest Lane	0.6
Spencerville A- with Burtonsville A	3.8
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	6.6
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	6.6
Spencerville A- with Burtonsville X	3.8
Spencerville B- with Burtonsville A	3.8
Spencerville B- with Burtonsville B	6.6
Spencerville B- with Burtonsville X	3.8
Spencerville C- with Burtonsville A	3.8
Spencerville C- with Burtonsville B	6.6
Spencerville D- with Burtonsville B	6.6
Fairland A	0.0
Fairland B	0.0
Corridor 2 I-95 Interchange Options (select one)	
I-95 Interchange Option A (terminate ICC at US 1)	8.0
I-95 Interchange Option B (terminate ICC at I-95)	5.0
Corridor 1 Range of Impacts	29.4 – 42.4
Corridor 2 Range of Impacts	35.7 – 48.3

Note: Total impacts for corridors are calculated for Corridor 1 by selecting the Corridor 1 and 2 West of MD 97 Mainline Segments and adding one Corridor 1 and 2 Rock Creek Option, adding the Corridor 1 Mainline Segments (MD 97 to I-95), adding one Corridor 1 Northwest Branch Option and one Corridor 1 I-95 Interchange Option; or for Corridor 2 by selecting the Corridor 1 and 2 West of MD 97 Mainline Segments and adding one Corridor 1 and 2 Rock Creek Option, adding one Corridor 2 Mainline Segments (MD 97 to I-95), one of each of the desired Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options, and adding one Corridor 2 I-95 Interchange Option.

Two proposed options for Corridor 2, Norbeck Option A (*Appendix A, Plates 42-43*) and Option B (*Appendix A, Plates 45-46*), would each have two perpendicular crossings of the 100-year floodplain. Option A would impact 2.6 acres of the Northwest Branch floodplain. Northwest Branch Option B - with Willow Grove Access over ICC, would impact 1.2 acres and Northwest Branch Option B - with Willow Grove access at Mt. Everest Lane, would impact 0.6 acres.

Corridor 2 (*Appendix A, Plates 42, 43, and 45-47*), between MD 97 and MD 650, would have three crossings (two perpendicular and one longitudinal) of the 100-year floodplains of Northwest Branch. Corridor 2 with the interchange at Layhill Road would impact 10.5 acres and Corridor 2 without the interchange at Layhill Road would impact 9.7 acres.

Paint Branch Watershed

Corridor 1 (*Appendix A, Plates 26 and 27*) would have three perpendicular crossings of the 100-year floodplain of Paint Branch for a total of 2.8 acres. Burtonsville Option A of Corridor 2 would have one perpendicular crossing impacting 1.4 acres. Both Spencerville Option A to Burtonsville X and Spencerville Option B to Burtonsville X would have one perpendicular crossing, each impacting 1.3 acres.

Little Paint Branch Watershed

Corridor 1 (*Appendix A, Plates 31 and 32*) would have one perpendicular crossing of the 100-year floodplain of Little Paint Branch for a total impact of 1.5 acres.

The proposed improvements to I-95 from either of the Corridor 1 and 2 I-95 Interchange Options (*Appendix A, Plates 31, 32 and 34*) would have one longitudinal crossing of the Little Paint Branch floodplains for a total impact of 0.1-acre.

Indian Creek Watershed

Proposed Corridor 1 and 2 interchange improvements to I-95 (*Appendix A, Plate 34*) would occur within the floodplain of Indian Creek with both Interchange Option A and B. The I-95 Interchange Option A would impact 7.4 acres. The I-95 Interchange Option B would impact 4.4 acres.

Rocky Gorge Watershed

Burtonsville Option A (*Appendix A, Plate 70*) would have two perpendicular crossings, impacting a total of 2.4 acres of the 100-year floodplain. Burtonsville Option B (*Appendix A, Plates 72 and 73*) would have five crossings (one longitudinal and four perpendicular) of the 100-year floodplain for a total impact of 6.6 acres. Both Spencerville Option A to Burtonsville X and Spencerville Option B to Burtonsville X would have two perpendicular crossings, each impacting 2.5 acres.

Upper Patuxent River Watershed

Both I-95 Interchange Option A and B would occur within the floodplain of Upper Patuxent. Each option would have an impact of 0.5-acre. Improvements to I-95 include an interchange, which would be built within the floodplain.

b. Indirect Impacts

Indirect impacts are expected to be similar to those described in the surface waters section (*Chapter IV.F.5*); however, they are expected to be minimal due to extensive SWM implementation.

c. Avoidance, Minimization, and Mitigation

To the extent possible, longitudinal crossings have been avoided because they would result in more floodplain filling, which could affect conveyance. In addition, many of the currently proposed bridge lengths are well in excess of the minimum hydraulic openings required to pass the design flood flows. These measures would allow vegetation and habitat to be maintained, promoting water quality filtration and wildlife passage under the roadway. Because of the extensive presence of stream valley protection practiced by Maryland National Capital Park & Planning Commission, almost all affected waterways are parklands, preserving vegetative cover and precluding any incompatible floodplain development, further minimizing any risks to floodplains associated with the proposed project. Proposed parkland acquisition associated with stewardship opportunities and mitigation efforts for this project will further enhance floodplain values. Final hydrology and hydraulic design will be performed for the selected alignment during the final design process using final FEMA models, at which time structure type, span configuration, pier placement, etc. that cost effectively best fits the environment (total structure length, ROW limits, etc.) will be determined and coordinated with MDE as part of the MDE Non-tidal Wetlands and Waterways Construction Permit process. FEMA coordination will also be performed at that time to determine the impacts to regulated floodplains and floodways and potential mitigation measures.

4. Prime and Unique Farmland Soils, Soils of Statewide Importance, and Farmland Properties

a. Direct Impacts

The No-Action Alternative would have no ICC project related impact on Prime or Unique Farmland Soils, Soils of Statewide or Local Importance, or existing farmland properties. Both corridors of the ICC would directly impact several individual farmland properties, as well as other areas mapped as Prime Farmland Soils or Soils of Statewide Importance, that may or may not be presently used for farming. No Unique Farmland Soils or Soils of Local Importance would be impacted by either of the corridors. Corridor 2 would traverse through Montgomery County's established Agricultural Preserve while Corridor 1 would not.

Prime Farmland Soils

Corridor 1 would impact between 359.6 to 414.7 acres of Prime Farmland Soils, depending upon which options are selected (**Table IV-52**). With approximately 53.1 acres, Rock Creek Option C would impact a substantially higher amount of Prime Farmland Soils than Rock Creek Option A, impacting 23.9 acres..

Corridor 2 would impact between 356.3 to 465.0 acres of Prime Farmland Soils, depending upon which options are selected. The highest concentration of Prime Farmland Soils impacts would occur near the Burtonsville and Spencerville Options.

Soils of Statewide Importance

Corridor 1 would impact between 251.4 to 299.7 acres of Soils of Statewide Importance, depending upon which options are selected (**Table IV-52**). Each of the options would impact a relatively similar amount of Soils of Statewide Importance. Corridor 2 would impact between 222.7 to 276.7 acres of Soils of Statewide Importance, depending upon which options are selected. Burtonsville Option B and Spencerville Option D would impact the highest amount of Soils of Statewide Importance among any of the options.

Farmland Properties

Table IV-52 lists the impact acreage of farmland properties. Impacts were calculated based on the amount of farmland property directly within the total ROW of each corridor and option.

Corridor 1 would impact between 10 to 11 individual farmland properties. The acreage of impact would range from 61.6 to 66.2 acres. For approximately half of these farms, Corridor 1 would impact the perimeter of the property, with minimal impacts to existing access. For these properties, the remaining land is expected to still be farmable. At four individual farm properties (two located west of MD 97 and two located east of MD 97), the impacts of Corridor 1 would render the property non-farmable and would impact the existing access. All of the farm properties impacted by Corridor 1 would be located outside of Montgomery County's Agricultural Wedge and most are zoned or proposed for development.

In comparison, Corridor 2 would impact 19 to 23 individual farmland properties. The acreage of impact would range between 105.2 to 121.8 acres, approximately double the amount of farmland affected by Corridor 1 (**Table IV-53**). For approximately half of the impacted farm properties, Corridor 2 would cross near the perimeter of the property and would have minimal impacts on existing access. For several other farmland properties, the impacts of Corridor 2 would render the properties non-farmable and would impact existing access to the properties. Of the 19 to 23 farms, 6 to 8 farms would be located within the Agricultural Wedge, an area identified in Montgomery County's General Plan for agricultural and low-density residential use with large areas of open space and small rural centers. While many of the farm properties outside of the Agricultural Wedge are zoned or proposed for development, only two of the farms within the Agricultural Wedge are currently proposed for development.

Table IV-52
Summary of Prime Farmland Soils, Soils of Statewide Importance, and Farmland Properties within ROW

Corridor	Prime Farmland Soils (Acres)	Soils of Statewide Importance (Acres)	Farmland Properties (Acres)
No-Action Alternative	0.0	0.0	0.0
Corridor 1 and 2 West of MD 97 Mainline Segments	86.9	37.4	26.9
Corridor 1 and 2 Rock Creek Options (select one)			
Rock Creek A	23.9	23.6	18.6
Rock Creek C- Olde Mill Run Grade Separation	52.6	29.9	23.2
Rock Creek C- Olde Mill Run Cul-de-Sac	53.1	25.7	23.1
Corridor 1 Mainline Segments (MD 97 to I-95)	214.3	111.7	16.1
Corridor 1 Northwest Branch Options (select one)			
Northwest Branch A- with Interchange at Layhill Road	20.8	41.5	0.0
Northwest Branch A- without Interchange at Layhill Road	18.3	38.4	0.0
Northwest Branch B- with Interchange at Layhill Road	14.9	32.6	0.0
Northwest Branch B- without Interchange at Layhill Road	13.9	32.5	0.0
Corridor 1 I-95 Interchange Options (select one)			
I-95 Interchange Option A (terminate ICC at US 1)	39.6	79.2	0.0
I-95 Interchange Option B (terminate ICC at I-95)	20.6	46.2	0.0
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)			
Corridor 2- with Interchange at Layhill Road	99.0	60.9	28.0
Corridor 2- without Interchange at Layhill Road	95.7	59.7	27.9
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)			
Norbeck A	68.4	23.7	4.4
Norbeck B- with ICC over Willow Grove	76.7	17.2	0.0
Norbeck B- with Willow Grove Access at Mt. Everest Lane	74.8	18.4	0.0
Spencerville A- with Burtonsville A	85.8	30.3	24.8
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	53.8	35.3	28.7
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	52.1	35.4	28.3
Spencerville A- with Burtonsville X	88.9	31.2	23.7
Spencerville B- with Burtonsville A	88.8	30.3	25.9
Spencerville B- with Burtonsville B	53.0	35.8	29.3
Spencerville B- with Burtonsville X	90.2	31.2	24.8
Spencerville C- with Burtonsville A	86.5	30.3	25.3
Spencerville C- with Burtonsville B	48.5	35.8	28.3
Spencerville D- with Burtonsville B	46.7	45.4	28.4
Fairland A	13.0	16.8	8.1
Fairland B	17.7	7.0	10.0
Corridor 2 I-95 Interchange Options (select one)			
I-95 Interchange Option A (terminate ICC at US 1)	41.4	72.4	0.0
I-95 Interchange Option B (terminate ICC at I-95)	21.7	37.7	0.0
Corridor 1 Range of Impacts	359.6 – 414.7	251.4 – 299.7	61.6 – 66.2
Corridor 2 Range of Impacts	356.3 – 465.0	222.7 – 276.7	105.2 – 121.8

Note: Total impacts for corridors are calculated for **Corridor 1** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding the *Corridor 1 Mainline Segments (MD 97 to I-95)*, adding one *Corridor 1 Northwest Branch Option* and one *Corridor 1 I-95 Interchange Option*; or for **Corridor 2** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding one *Corridor 2 Mainline Segments (MD 97 to I-95)*, one of each of the desired *Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options*, and adding one *Corridor 2 I-95 Interchange Option*.

Table IV-53
Individual Farmland Property Impacts

Total Property Acreage	Impact Acreage	Type of Impact
Upper Rock Creek Watershed		
17.1	3.9	Eastern half of property within Corridors 1 and 2 ROW.
10.6	0.0	N/A
7.3	1.2	Eastern edge of property within Corridors 1 and 2 ROW.
13.0	3.4	Corridors 1 and 2 bisect property.
17.5	9.6	Southern half of property within Rock Creek Option A ROW.
	2.7	Northern tip within Rock Creek Option C – Olde Mill Run Grade Separation ROW.
	2.7	Northern tip within Rock Creek Option C – Olde Mill Run Cul-de-Sac ROW.
3.7	1.4	Southern edge of property within Rock Creek Option A ROW.
12.5	6.0	Southwestern half of property within ROW of both Rock Creek Option C sub-options.
13.8	6.1	Western half of property within ROW of both Rock Creek Option C sub-options.
20.8	5.4	Southern and eastern edge of property within Corridors 1 and 2 ROW.
	2.2	Southern edge within Rock Creek Option A ROW
	9.6	Southern edge within ROW of both Rock Creek Option C sub-options.
7.2	5.4	Rock Creek Option A bisects property.
	5.7	Northern half within Rock Creek Option C – Olde Mill Run Grade Separation ROW.
	5.6	Northern half within Rock Creek Option C – Old Mill Run Cul-de-Sac ROW.
255.5	12.9	Southern edge of property within Corridors 1&2 ROW.
Northwest Branch Watershed		
48.2	15.4	Corridor 1 bisects property.
	4.4	Northern edge within Norbeck Option A ROW.
29.0	1.9	Both sub-options of Corridor 2 would impact the southern edge.
20.4	0.1	Corridor 2 with the interchange at Layhill Road would impact the southern edge.
Paint Branch Watershed		
5.2	2.0	Southern half within Spencerville Option A to Burtonsville Option A ROW.
	3.1	Southern half within Spencerville Option A to Burtonsville Option B (Relocated Good Hope Road ROW.
	2.7	Southern half within Spencerville Option A to Burtonsville Option B (ICC over Good Hope Road) ROW.
	2.0	Southern half within Spencerville Option A to Burtonsville Option X ROW.
	3.1	Northern half within Spencerville Option B to Burtonsville Option A ROW.
	3.8	Northern half within Spencerville Option B to Burtonsville Option B ROW.
	3.1	Northern half within Spencerville Option B to Burtonsville option X ROW.
	2.5	Northern half within Spencerville Option C to Burtonsville Option A ROW.
53.0	2.9	Northern half within Spencerville Option C to Burtonsville Option B ROW.
	0.0	N/A
Rocky Gorge Watershed		
14.0	2.9	Bisected by Spencerville Option D.
12.5	5.0	Bisected by both sub-options of Spencerville Option A to Burtonsville Option B.
	6.0	Bisected by Spencerville Option B to Burtonsville Option B ROW.
	6.0	Bisected by Spencerville Option C to Burtonsville Option B ROW.
	4.9	Bisected by Spencerville Option D.
86.5	19.4	Bisected by Burtonsville Option B.
12.9	9.7	Bisected by Burtonsville Option A.
19.6	13.1	Southern half of property within Burtonsville Option A ROW.
57.1	1.7	Bisected by Corridor 2.
	8.1	Bisected by Fairland Option A.
	10.0	Bisected by Fairland Option B.
15.8	4.6	Bisected by Corridor 2.
17.1	11.1	Eastern half of property within Corridor 2 ROW.
10.1	8.6	Northeastern half of property within Corridor 2 ROW.

IV. Environmental Consequences – F
5. Surface Water Resources
6. Aquatic Biota

Corridor 2 would also impact more horticultural businesses, such as nurseries, than Corridor 1. While the impacts to these properties are quantified as business impacts instead of farmland, these businesses, especially along MD 198 in the Corridor 2 Alternative, are indicative of the rural character of this portion of Montgomery County.

b. Indirect Impacts

Indirect impacts would be similar to those discussed in the groundwater and soils sections due to compaction, increased runoff, and additional impervious surfaces within the ROW. Indirect impacts to farmland under Corridor 2 could also occur due to potential zoning changes made possible as a result of Maryland's Change or Mistake Rule. Under this regulation, property owners would be able to request re-zoning due to substantial change in character of this portion of the county.

c. Avoidance, Minimization, and Mitigation

Due to the linear nature of the proposed roadway and the extensive coverage of the study area by these soils, avoidance of Prime Farmland Soils and Soils of Statewide Importance is not possible. A reduction in the right-of-way of the alignment minimized impacts to farmland resources along both corridors, particularly to prime farmland soils and soils of statewide importance. The largest reduction occurred in the Muddy Branch and Upper Rock Creek watersheds where impacts were minimized to some farmland properties and prime farmland soils. Just compensation will be provided to farm owners whose property is within the required ROW (FPPA, 1981). If impacts were to interrupt viable farm operations, financial compensation would be considered as a mitigation option. However, it should be noted that the majority of farmlands identified are proposed for residential or commercial development.

5. Surface Water Resources

a. Stream Channels and Geomorphic Assessments

Impacts

The No-Action Alternative would have no ICC project related impact on surface waters within the study area.

Both Build Alternatives (Corridors 1 and 2) have the potential to affect surface waters in the ICC study area. Direct and indirect impacts to stream channels are summarized and discussed in detail below, as well as in *Chapter IV.F.7 (Waters of the U.S. Including Wetlands)*.

Direct Impacts

Direct impacts to study area stream channels are primarily the result of constructing culverts or other drainage structures, which would convey existing streams under the ICC. Most of the larger stream crossings are accomplished on bridge structures, which avoid direct impacts. These

do however have the potential to indirectly impact streams by the placement of fill, retaining walls, and piers in floodplains, which may inhibit or accelerate lateral channel migration. In many cases, even these impacts have been avoided and/or minimized with longer bridge lengths that avoid fill in floodplains. These measures are discussed in more detail in the *Chapter IV.F.6.b. Avoidance, Minimization, and Mitigation*.

Temporary impacts include those that are likely to occur during construction of a Build Alternative in the vicinity of stream channels, such as potential bank erosion due to exposed soil, and loss of riparian vegetation during grading operations and construction of bridges and culverts. Grading and construction operations would expose soil to erosion during storm events, possibly leading to sedimentation of project area waterways. Temporary impacts could also occur from construction access activities such as a stream crossing for a temporary haul road or utility installation. The landscape would be restored to a natural condition after construction, however, short-term impacts could still occur. All necessary measures will be undertaken to minimize these short-term impacts.

Excess sediment deposited in area stream channels can also have an adverse effect on stream stability, leading to longer-term impacts on water quality and aquatic habitat that persist well beyond completion of construction. Direct impacts of both of the Build Alternatives, are presented in *Table IV-54*. For more detailed information on impacts in individual subwatersheds, refer to the table in *Appendix K*.

As illustrated in the *Table IV-54*, depending upon which options are selected, Corridor 1 would result in between 32,667 and 39,158 linear feet of direct impacts to perennial and intermittent streams, and Corridor 2 would result in between 24,525 and 37,584 linear feet of direct impacts to perennial and intermittent streams. Overall, these impacts are less than those presented for stream channels in the DEIS. The primary reason for the reduction is that impacts in the DEIS were calculated based on the limits of right of way, while impacts presented in this document are based on a conservative estimate of limits of disturbance. Additional reductions in impacts have also been realized through avoidance and minimization measures implemented since the DEIS. For more information on specific reductions to individual streams, see the avoidance and minimization table presented in *Appendix M*.

The combination of options that would result in the most impact under Corridor 1 would include Rock Creek Option C (with Old Mill Run Grade Separation), Northwest Option B (with or without interchange at Layhill Road), and I-95 Interchange Option A (terminate ICC at US 1) (39,158 linear feet), while the combination with the least impact would include Rock Creek Option A, Northwest Option A (with or without interchange at Layhill Road), and I-95 Interchange Option B (terminate ICC at I-95) (32,667 linear feet). The combination of options under Corridor 2 that would result in the highest amount of direct impacts overall (37,584 linear feet) is Corridor 2 with Rock Creek Option C (with Old Mill Run Grade Separation), Norbeck Option A, Spencerville Option A, Burtonsville Option B (with relocated Good Hope Road), Fairland Option A, and I-95 Interchange Option A (terminate ICC at US 1). The Corridor 2 combination with the least impact (24,525 linear feet) includes Rock Creek Option A, Norbeck

Option B (with Willow Grove access over ICC), Spencerville Option A, Burtonsville Option A, Fairland Option B, and I-95 Interchange Option B (terminate ICC at I-95).

Muddy Branch Watershed

No direct ICC project related impacts to Muddy Branch will occur in either Corridor 1 or 2, consequently, Muddy Branch is not included in *Table IV-54*.

Upper Rock Creek Watershed

Corridor 1 and 2 (*Appendix A, Plates 3-11*) will have the same impacts on the Upper Rock Creek watershed: between 5,699 and 6,315 linear feet from 11 to 12 stream crossings. As shown in the table in *Appendix K*, the affected subwatersheds include Crabbs Branch, Mill Creek, South Mill Creek, and Lake Needwood. The majority of the impacts would occur in the Mill Creek subwatershed, while the least impacts would occur in the Crabbs Branch subwatershed. In addition to the baseline alignment, two options exist for the alignments within the Upper Rock Creek watershed: Rock Creek Option A (*Appendix A, Plates 3-5*) (1,303 linear feet of impact) and Rock Creek Option C (*Appendix A, Plates 6-11*) (with Olde Mill Run Grade Separation (1,919 linear feet of impact) or (with Olde Mill Run cul-de-sac) (1,639 linear feet of impact). Options A and C impact the Mill Creek, South Mill Creek and Lake Needwood subwatersheds. Option A includes two bridges (one over the Rock Creek mainstem and one over a tributary to Mill Creek) and Option C includes one bridge over the Rock Creek mainstem that would minimize stream impacts. As discussed previously, these subwatersheds currently have bank stability problems (MCDEP, 1998 and 2003) making them more susceptible to the increased erosion generally associated with direct stream impacts. Increased impacts in this subwatershed may accelerate this pre-existing channel stability problem, causing bank and channel erosion, instream sedimentation, and downstream sedimentation in Lake Needwood. A higher amount of impact is associated with Option C, which therefore would be expected to result in a greater amount of impact to stream stability, though SWM, erosion and sediment control, and other avoidance and minimization measures will greatly reduce these impacts.

North Branch Rock Creek Watershed

Both Corridor 1 and Corridor 2 (*Appendix A, Plates 12, 13*) would result in 1,645 linear feet of impacts to North Branch Rock Creek watershed from four stream crossings. These impacts would occur in the Brooke Manor subwatershed, which has existing Fair stream conditions (MCDEP, 1998) and the Lower North Branch B subwatershed, which has existing Excellent stream conditions (MCDEP, 1998). The majority of the impacts would occur in the Brooke Manor subwatershed; however, a bridge is proposed over the Brooke Manor tributary that would not contribute to additional stream impacts. A bridge is also proposed over the mainstem of North Branch Rock Creek. Current data collected in the North Branch Rock Creek watershed indicate increased stream channel dimensions over the previous years and, therefore, channel erosion. Impacts resulting from Corridor 1 or Corridor 2 may initiate further channel erosion, instream sedimentation, and downstream sedimentation in Lake Frank, though SWM, sediment and erosion control, and other avoidance and minimization measures will greatly reduce these impacts.

Table IV-54

Summary of the Number of Perennial and Intermittent Stream Crossings and Linear Feet of Impacts by Corridor and Watershed

Corridor	Watershed ¹																	
	Upper Rock Creek		North Branch Rock Creek		Northwest Branch		Paint Branch		Little Paint Branch		Indian Creek		Rocky Gorge		Upper Patuxent		Total	
	#	l.f.	#	l.f.	#	l.f.	#	l.f.	#	l.f.	#	l.f.	#	l.f.	#	l.f.	#	l.f.
No-Action Alternative	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corridor 1 and 2 West of MD 97 Mainline Segments	7	4,396	4	1,645	-	-	-	-	-	-	-	-	-	-	-	-	11	6,041
Corridor 1 and 2 Rock Creek Options (select one)																		
Rock Creek A	5	1,303		-	-	-	-	-	-	-	-	-	-	-	-	-	5	1,303
Rock Creek C- Olde Mill Run Grade Separation	4	1,919		-	-	-	-	-	-	-	-	-	-	-	-	-	4	1,919
Rock Creek C- Olde Mill Run Cul-de-Sac	4	1,639		-	-	-	-	-	-	-	-	-	-	-	-	-	4	1,639
Corridor 1 Mainline Segments (MD 97 to I-95)	-	-	0	0	9	7,817	7	1,478	11	7,286	-	-	-	-	-	-	27	16,581
Corridor 1 Northwest Branch Options (select one)																		
With Northwest Branch A- with Interchange at Layhill Road	-	-	-	-	8	2,534	-	-	-	-	-	-	-	-	-	-	8	2,534
With Northwest Branch A- without Interchange at Layhill Road	-	-	-	-	8	2,534	-	-	-	-	-	-	-	-	-	-	8	2,534
With Northwest Branch B- with Interchange at Layhill Road	-	-	-	-	9	3,731	-	-	-	-	-	-	-	-	-	-	9	3,731
With Northwest Branch B- without Interchange at Layhill Road	-	-	-	-	9	3,731	-	-	-	-	-	-	-	-	-	-	9	3,731
Corridor 1 I-95 Interchange Options (select one)																		
I-95 Interchange Option A (terminate ICC at US 1)	-	-	-	-	-	-	-	-	-	-	10	9,976	-	-	4	910	14	10,886
I-95 Interchange Option B (terminate ICC at I-95)	-	-	-	-	-	-	-	-	-	-	7	5,298	-	-	4	910	11	6,208
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)																		
Corridor 2- with Interchange at Layhill Road	-	-	-	-	7	932	-	-	2	407	1	154	5	3,819	-	-	15	5,312
Corridor 2- without Interchange at Layhill Road	-	-	-	-	6	980	-	-	2	407	1	154	5	3,819	-	-	14	5,360
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland																		

Table IV-54

Summary of the Number of Perennial and Intermittent Stream Crossings and Linear Feet of Impacts by Corridor and Watershed

Corridor	Watershed ¹																	
	Upper Rock Creek		North Branch Rock Creek		Northwest Branch		Paint Branch		Little Paint Branch		Indian Creek		Rocky Gorge		Upper Patuxent		Total	
	#	l.f.	#	l.f.	#	l.f.	#	l.f.	#	l.f.	#	l.f.	#	l.f.	#	l.f.	#	l.f.
Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)																		
Norbeck A	-	-	-	-	8	4,482	-	-	-	-	-	-	-	-	-	-	8	4,482
Norbeck B- with Willow Grove Access Over ICC	-	-	-	-	4	1,529	-	-	-	-	-	-	-	-	-	-	4	1,529
Norbeck B- with Willow Grove Access at Mt. Everest Lane	-	-	-	-	4	1,918	-	-	-	-	-	-	-	-	-	-	4	1,918
Spencerville A- with Burtonsville A	-	-	-	-	1	206	1	301	-	-	-	-	4	2,987	-	-	6	3,494
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	-	-	-	-	1	187	1	395	-	-	-	-	10	7,318	-	-	12	7,900
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	-	-	-	-	1	191	1	337	-	-	-	-	10	7,318	-	-	12	7,846
Spencerville A- with Burtonsville X	-	-	-	-	1	206	3	597	-	-	-	-	4	3,003	-	-	8	3,806
Spencerville B- with Burtonsville A	-	-	-	-	1	206	1	636	-	-	-	-	4	2,987	-	-	6	3,829
Spencerville B- with Burtonsville B	-	-	-	-	1	161	1	241	-	-	-	-	10	7,318	-	-	12	7,720
Spencerville B- with Burtonsville X	-	-	-	-	1	206	3	928	-	-	-	-	4	3,003	-	-	8	4,137
Spencerville C- with Burtonsville A	-	-	-	-	1	206	3	1,144	-	-	-	-	4	2,987	-	-	8	4,337
Spencerville C- with Burtonsville B	-	-	-	-	1	174	-	-	-	-	-	-	10	7,318	-	-	11	7,492
Spencerville D- with Burtonsville B	-	-	-	-	1	290	-	-	-	-	-	-	11	7,512	-	-	12	7,802
Fairland A	-	-	-	-	-	-	-	-	1	283	1	713	-	-	-	-	2	996
Fairland B	-	-	-	-	-	-	-	-	1	263	1	713	-	-	-	-	2	976
Corridor 2 I-95 Interchange Options (select one)																		
I-95 Interchange Option A (terminate ICC at US 1)	-	-	-	-	-	-	-	-	-	-	10	9,976	-	-	4	910	14	10,886
I-95 Interchange Option B (terminate ICC at I-95)	-	-	-	-	-	-	-	-	-	-	7	4,960	-	-	4	910	11	5,870
Corridor 1 Range of Impacts for each Watershed	11-12	5,699-6,315	4	1,645	17-18	10,351-11,548	6	1,478	11	7,286	7-10	5,298-9,976	-	-	4	910		
Corridor 1 Range of Impacts																	61-64	32,667-39,158
Corridor 2 Range of Impacts for Each	11-	5,699-	4	1,645	12-	2,622-	0-	0-	3	670-	9-	5,827-	9-	6,806-	4	910		

Summary of the Number of Perennial and Intermittent Stream Crossings and Linear Feet of Impacts by Corridor and Watershed

Note: Total impacts for corridors are calculated for **Corridor 1** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding the *Corridor 1 Mainline Segments (MD 97 to I-95)*, adding one *Corridor 1 Northwest Branch Option* and one *Corridor 1 I-95 Interchange Option*; or for **Corridor 2** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding one *Corridor 2 Mainline Segments (MD 97 to I-95)*, one of each of the desired *Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options*, and adding one *Corridor 2 I-95 Interchange Option*.

¹The Muddy Branch watershed is not included in the impacts table because there are no wetland or waterway impacts in the Muddy Branch watershed

Northwest Branch Watershed

Impacts from Corridor 1, 10,351 to 11,548 linear feet from 17 to 18 stream crossings, would occur in the Batchellors Forest Tributary, Longmead Tributary, Middle Mainstem Glenmont, and Rolling Stone Tributary subwatersheds. The majority of the impacts would occur in the Batchellors Forest Tributary subwatershed, while the least impacts would occur in the Longmead Tributary subwatershed. In addition to the baseline alignment, two options (each with an additional suboption) exist for the Corridor 1 alignment within the Northwest Branch watershed: Northwest Option A (*Appendix A, Plates 17-19*) (with interchange at Layhill Road) (2,534 linear feet of impact) or (without interchange at Layhill Road) (2,534 linear feet of impact) and Northwest Option B (*Appendix A, Plates 20-22*) (with interchange at Layhill Road) (3,731 linear feet of impact) or (without interchange at Layhill Road) (3,731 linear feet of impact). Options A and B, which would not impact the Batchellors Forest Tributary subwatershed, would result in no differences in the impacts to the Longmead Tributary subwatershed, and would result in only a minimal difference in the impacts to the Rolling Stone Tributary subwatershed. However, Option B would result in approximately 1,197 linear feet of additional impact in the Middle Mainstem Glenmont and Rolling Stone subwatersheds over Option A.

Impacts from Corridor 2, 2,622 to 5,752 linear feet from 12 to 15 stream crossings, would occur in the Batchellors Forest Tributary East, the Batchellors Forest Tributary, the Bryants Nursery Tributary, and the Upper Mainstem subwatersheds. The majority of the impacts would occur in the Batchellors Forest Tributary subwatershed, and the least impacts would occur in the Batchellors Forest East Tributary subwatershed. In addition to the baseline alignment (*Appendix A, Plates 48, 49*), two options exist for the Corridor 2 (*Appendix A, Plates 39-45*) alignment within the Batchellors Forest Tributary subwatershed: Norbeck Option A (4,482 linear feet of impact) and Norbeck Option B with Willow Grove access over ICC (1,529 linear feet of impact) or with Willow Grove access at Mt. Everest Lane (1,918 linear feet of impact). Four options (*Appendix A, Plates 54-69*) exist within the Bryants Nursery Tributary: Spencerville Option A, Spencerville Option B (with relocated Good Hope Road or with ICC over Good Hope Road), Spencerville Option C, and Spencerville Option D. The impacts associated with these four options vary between 161 and 290 linear feet. This variation is not only due to the options themselves but due to the various alignment configurations in the eastern portion of the Spencerville options required to connect with either of the two Burtonsville options. For instance, the eastern end of the Spencerville Option A is different depending on whether it turns south to connect with Burtonsville Option A or whether it turns north to connect with Burtonsville Option B.

Batchellors Forest Tributary subwatershed has the most potential to be affected by the ICC alignments. Therefore, impacts in this subwatershed, which was found to be experiencing erosion and lateral migration (SHA 2004), may cause the most additional erosion in the Northwest Branch watershed, though SWM, sediment and erosion control, and other avoidance and minimization measures are expected to greatly reduce this impact.

Paint Branch Watershed

Impacts in the Paint Branch watershed from Corridor 1 (*Appendix A, Plates 23-25*) resulting from seven stream crossings would be 1,478 linear feet. These impacts would affect four small streams in the Lower Good Hope Tributary and Upper Paint Branch Mainstem subwatersheds. Slightly more of the impacts would occur in the Lower Good Hope Tributary subwatershed than in the Mainstem subwatershed. An additional three stream crossings will occur on bridge structures over the Good Hope Tributary, the Gum Springs Tributary, and the Paint Branch Mainstem.

Corridor 2 (*Appendix A, Plates 78, 79, 81*) impacts would range between zero and 1,144 linear feet resulting from zero to three stream crossings, depending upon which of the Spencerville and Burtonsville options are selected. The Corridor 2 impacts would occur in the Upper Left Fork and Right Fork subwatersheds. Impacts only occur in the Right Fork subwatershed with the selection of Burtonsville Option X. The majority of the impacts would occur as a result of the combination of the Spencerville Option C and Burtonsville Option A alignments (*Appendix A, Plates 54-57, 64, 65*). No direct impacts to streams in the Paint Branch watershed would occur with the selection of Spencerville Options C or B with Burtonsville Option B alignments (*Appendix A, Plates 68, 69*). The Corridor 2 Burtonsville Option A includes a bridge over the Right Fork Paint Branch, resulting in no direct stream impacts to this subwatershed.

According to the Countywide Stream Protection Strategy (CSPS) (MCDEP 1998 and 2003), the Lower Good Hope Tributary subwatershed is experiencing channel widening and sedimentation and has poor bank stability, while the Upper Left Fork subwatershed has moderate to severe bank erosion and incised channels due to a lack of stormwater control. Any additional impacts to these subwatersheds may accelerate already existing channel erosion and stability problems, though these potential impacts would be greatly reduced through proposed SWM, erosion and sediment control, and other minimization measures.

Little Paint Branch Watershed

Corridor 1 (*Appendix A, Plates 26-30*) would result in the majority of the potential stream impacts in the Little Paint Branch watershed (7,286 linear feet, resulting from 11 stream crossings). The Upper Little Paint Branch, Greencastle Tributary and Tanglewood Tributary subwatersheds would be affected. The majority of the impacts would occur in the Tanglewood Tributary subwatershed, and the least would occur in the Upper Little Paint Branch subwatershed. One bridge is proposed over the confluence of Greencastle tributary subwatershed and the Little Paint Branch Mainstem.

Corridor 2 would result in three stream crossings and either 670 or 690 linear feet of impact depending upon whether Fairland Option B or A (*Appendix A, Plates 78-83*), respectively, was selected. The majority of the Corridor 2 impacts (407 linear feet) would occur in the Silverwood Tributary subwatershed, and the remaining impacts would occur in the Upper Little Paint Branch subwatershed.

According to the CSPS, the Tanglewood Tributary subwatershed has Fair stream conditions, unstable banks, and sediment deposition caused by high-density development and

imperviousness (MCDEP 1998 and 2003). Current data also show that the streams have enlarged, which indicates erosion. Additional impacts to this subwatershed may accelerate already existing channel erosion and stability problems. The Silverwood Tributary, which would incur the greatest impacts under Corridor 2, also suffers from erosion but remains in Good overall condition due to numerous baseflow seeps. While Corridor 2 impacts in this subwatershed and the Upper Little Paint Branch subwatershed could contribute to existing erosion problems, the quantity of impacts is relatively small in comparison to impacts from Corridor 1 in other Little Paint Branch subwatersheds. Potential impacts for both corridors would be greatly reduced through SWM, sediment and erosion control, and other avoidance and minimization measures.

Indian Creek Watershed

The majority of the impacts in the Indian Creek watershed are to small headwater streams that have been previously altered by construction of I-95 or historic mining practices. Corridor 1 (*Appendix A, Plates 30-38*) would have impacts ranging between 5,298 to 9,976 linear feet from seven to ten stream crossings and Corridor 2 (*Appendix A, Plates 33-38*) would have impacts ranging between 5,827 and 10,843 linear feet from nine to twelve stream crossings. The I-95 option to terminate the ICC at I-95 would result in the least perennial and intermittent stream impacts to Indian Creek for both Corridor 1 and 2 (5298 and 4960 linear feet, respectively), while the I-95 option to terminate the ICC at Route 1 would result in the most impacts to this watershed for both Corridors (9976 linear feet).

In Corridor 1, impacts would occur in the Middle Mainstem above I-95, Ammendale Tributary, Middle Mainstem, and Upper Mainstem subwatersheds. If I-95 Interchange Option A (terminate ICC at US 1) were selected, the majority of the impacts would occur in the Ammendale Tributary subwatershed, and the minority of the impacts would occur in the Mainstem above I-95 subwatershed. If the I-95 Interchange Option B (terminate ICC at I-95) were selected the majority of the impacts would occur in the Upper Mainstem subwatershed, and the minority of the impacts would occur in the Ammendale Tributary subwatershed.

Corridor 2 impacts would occur in the Middle Mainstem above I-95, Ammendale Tributary, Middle Mainstem and Upper Mainstem subwatersheds. If I-95 Interchange Option A (terminate ICC at US1) were selected, the majority of the impacts would occur in the Ammendale Tributary subwatershed, and the minority of the impacts would occur in the Mainstem above I-95 subwatershed. If the I-95 Interchange Option B (terminate ICC at I-95) were selected the majority of the impacts would occur in the Upper Mainstem subwatershed, and the minority of the impacts would occur in the Ammendale Tributary subwatershed. In Corridor 2 (*Appendix A, Plates 78-86*), Fairland Option A would result in the same impacts to Indian Creek as Fairland Option B.

The existing condition of the Indian Creek watershed is severely disturbed due to past and active mining operations. Therefore, any additional impacts to the watershed may cause further channel erosion, instream sedimentation, and downstream deposition, though SWM, erosion and sediment control, and other measures would be expected to reduce this impact.

Rocky Gorge Watershed

No impacts would occur in the Rocky Gorge watershed as a result of Corridor 1. However, Corridor 2 would result in impacts to the Kruhm Road Tributary, Foxes Branch, Oursler Road Tributary, Ednor Road Tributary and Dustin Road Tributary subwatersheds: between 6,806 and 11,331 linear feet resulting from nine to 16 stream crossings. One bridge proposed over Oursler Road tributary has reduced stream impacts to this subwatershed. The fewest Corridor 2 impacts to this watershed would occur with any combination that includes Burtonsville A. The greatest impact would result from the combination of Spencerville Option D and Burtonsville Option B alignment (*Appendix A, Plates 69-73, 78, 81*) with the majority of these impacts occurring in the Kruhm Road Tributary subwatershed. According to the CSPA and current data, this subwatershed is currently experiencing high sediment loads (MCDEP, 1998 and 2003) and some channel incision. Additional impacts to this subwatershed may cause further channel instability and erosion, through SWM, erosion and sediment control, and other measures would be expected to reduce this impact.

Upper Patuxent Watershed

The Upper Patuxent watershed would be affected equally by Corridor 1 and Corridor 2 (*Appendix A, Plates 31-37, 85, 86*) with, impacts of 910 linear feet resulting from four stream crossings. The Bear Branch and Walker Branch portions of this watershed in which the impacts would occur are severely disturbed as a result of previous and active sand and gravel mining operations in the watersheds and are experiencing severe aggradation and some bank erosion. Additional impacts would be expected to cause further channel erosion and in-stream sedimentation though these impacts would be minimized through SWM and other measures.

Indirect Impacts

In addition to direct impacts, the Build Alternatives also have the potential to indirectly affect stream channels. All of the Build Alternatives would result in an increase in impervious surfaces and associated stormwater runoff within the study area. *Table IV-55* summarizes the additional area of impervious surface that would result from each build alternative. These impacts have increased overall in comparison to those presented in the DEIS due to a greater level of engineering detail available for use in the calculations, such as specific shoulder widths and configurations. As illustrated in the table, Corridor 1 would result in between 340.5 and 391.9 acres of additional impervious surface, while Corridor 2, would result in 361.2 to 408.9 acres. The combination of options that would result in the most impervious surface under Corridor 1 would include Rock Creek Option C (with Old Mill Run Grade Separation) and Northwest Branch Option A (with Interchange at Layhill Road), while the combination with the least additional impervious surface would include Rock Creek Option A and Northwest Branch Option B (without Interchange at Layhill Road).

Table IV-55
Summary of New Impervious Cover Associated with the ICC by Corridor and Watershed in Acres

Corridor	Watershed									
	Muddy Branch	Upper Rock Creek	North Branch Rock Creek	Northwest Branch	Paint Branch	Little Paint Branch	Indian Creek	Rocky Gorge	Upper Patuxent	Total
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
No-Action Alternative	0	0	0	0	0	0	0	0	0	0
Corridor 1 and 2 West of MD 97 Mainline Segments	0.1	32.6	39.9	-	-	-	-	-	-	72.6
Corridor 1 and 2 Rock Creek Options (select one)										
Rock Creek A	-	26.6	-	-	-	-	-	-	-	26.6
Rock Creek C- Olde Mill Run Grade Separation	-	31.8	-	-	-	-	-	-	-	31.8
Rock Creek C- Olde Mill Run Cul-de-Sac	-	31.3	-	-	-	-	-	-	-	31.3
Corridor 1 Mainline Segments (MD 97 to I-95)	-	-	-	59.4	39.2	55.7	-	-	-	154.3
Corridor 1 Northwest Branch Options (select one)										
With Northwest Branch A- with Interchange at Layhill Road	-	-	-	35.2	-	-	-	-	-	35.2
With Northwest Branch A- without Interchange at Layhill Road	-	-	-	28.2	-	-	-	-	-	28.2
With Northwest Branch B- with Interchange at Layhill Road	-	-	-	31.8	-	-	-	-	-	31.8
With Northwest Branch B- without Interchange at Layhill Road	-	-	-	25.5	-	-	-	-	-	25.5
Corridor 1 I-95 Interchange Options (select one)										
I-95 Interchange Option A (terminate ICC at US 1)	-	-	-	-	-	-	83.7	-	14.0	97.7
I-95 Interchange Option B (terminate ICC at I-95)	-	-	-	-	-	-	47.4	-	13.8	61.2
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)										
Corridor 2- with Interchange at Layhill Road	-	-	-	33.0	-	-	48.9	32.7	-	114.6
Corridor 2- without Interchange at Layhill Road	-	-	-	27.2	-	-	48.9	32.7	-	108.8
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment – Norbeck, Spencerville/Burtonsville, and Fairland)										

Table IV-55

Summary of New Impervious Cover Associated with the ICC by Corridor and Watershed in Acres

Corridor	Watershed									
	Muddy Branch	Upper Rock Creek	North Branch Rock Creek	Northwest Branch	Paint Branch	Little Paint Branch	Indian Creek	Rocky Gorge	Upper Patuxent	Total
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
Norbeck A	-	-	-	39.8	-	-	-	-	-	39.8
Norbeck B- with Willow Grove Access Over ICC	-	-	-	40.2	-	-	-	-	-	40.2
Norbeck B- with Willow Grove Access at Mt. Everest Lane	-	-	-	40.2	-	-	-	-	-	40.2
Spencerville A- with Burtonsville A	-	-	-	6.3	28.9	-	-	-	-	35.2
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	-	-	-	6.2	14.3	-	-	20.2	-	40.7
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	-	-	-	6.2	14.5	-	-	20.2	-	40.9
Spencerville A- with Burtonsville X	-	-	-	6.3	29.4	-	-	-	-	35.7
Spencerville B- with Burtonsville A	-	-	-	6.2	28.9	-	-	-	-	35.1
Spencerville B- with Burtonsville B	-	-	-	7.0	13.8	-	-	20.2	-	41.0
Spencerville B- with Burtonsville X	-	-	-	6.2	29.3	-	-	-	-	35.5
Spencerville C- with Burtonsville A	-	-	-	6.2	35.6	-	-	-	-	41.8
Spencerville C- with Burtonsville B	-	-	-	7.0	12.8	-	-	20.0	-	39.8
Spencerville D- with Burtonsville B	-	-	-	6.9	0.4	-	-	30.9	-	38.2
Fairland A	-	-	-	-	-	12.9	5.7	22.0	-	40.6
Fairland B	-	-	-	-	-	10.1	4.1	23.0	5.1	42.3
Corridor 2 I-95 Interchange Options (select one)										
I-95 Interchange Option A (terminate ICC at US 1)	-	-	-	-	-	-	51.3	-	14.3	65.6
I-95 Interchange Option B (terminate ICC at I-95)	-	-	-	-	-	-	23.6	-	14.1	37.7
Corridor 1 Range of Impacts for each Watershed	0.1	59.2-64.4	39.9	84.9-94.6	39.2	55.7	47.4-83.7	-	14.1-14.3	
Corridor 1 Range of Impacts										340.5-391.9

Table IV-55

Summary of New Impervious Cover Associated with the ICC by Corridor and Watershed in Acres

Corridor	Watershed									Total
	Muddy Branch	Upper Rock Creek	North Branch Rock Creek	Northwest Branch	Paint Branch	Little Paint Branch	Indian Creek	Rocky Gorge	Upper Patuxent	
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	
Corridor 2 Range of Impacts for Each Watershed	0.1	59.2-64.4	39.9	73.2-80.2	0.4-35.6	10.1-12.9	76.6-105.9	54.7-86.6	14.1-14.3	
Corridor 2 Range of Impacts										361.2-408.9

Note: Total impacts for corridors are calculated for **Corridor 1** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding the *Corridor 1 Mainline Segments (MD 97 to I-95)*, adding one *Corridor 1 Northwest Branch Option* and one *Corridor 1 I-95 Interchange Option*; or for **Corridor 2** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding one *Corridor 2 Mainline Segments (MD 97 to I-95)*, one of each of the desired *Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options*, and adding one *Corridor 2 I-95 Interchange Option*.

The combination of options under Corridor 2 that would result in the highest amount of impervious surfaces overall (408.9 acres) is Corridor 2 with Rock Creek Option C (with Old Mill Run Grade Separation), an Interchange at Layhill Road, Norbeck Option B (with either Willow Grove Option), Spencerville Option C, Burtonsville Option A, and Fairland Option B. The Corridor 2 combination with the least impervious impact (361.2 acres) is also the combination with the least overall stream impact, and includes Rock Creek Option A, Norbeck Option A, Spencerville Option B, Burtonsville Option A, and Fairland Option A.

The watersheds that would incur the greatest increases in imperviousness from both of the ICC corridors are Northwest Branch and Upper Rock Creek or Indian Creek. The magnitude of impact to these watersheds varies slightly depending on which options are chosen, though overall the magnitude of the impact is highest in Northwest Branch for Corridor 1 and in Indian Creek for Corridor 2. On Corridor 1, the next greatest impact would occur in the Upper Rock Creek watershed, followed by Little Paint Branch. In Corridor 2, the next greatest impacts after Indian Creek and Northwest Branch would occur in Upper Rock Creek or potentially in Rocky Gorge if the northern-most options in the Spencerville and Burtonsville areas are selected. For more detailed information on impacts in subwatersheds, refer to the table in *Appendix L*.

The conversion of open space and forested areas to impervious areas have the potential to cause increased surface runoff volumes, peak stormflows, and bankfull discharges, as well as decreased baseflows and introduction sediment and other pollutants into waterways (CWP, 2003). Additional impervious surfaces related to the ICC could permanently change runoff characteristics, infiltration potential, and stream characteristics in the subwatersheds crossed by the highway. It is important to note that the amount of runoff from existing land uses is highly variable, and conversions of these different land uses to pavement may result in differences in the magnitude of runoff impacts. For instance, residential lawns typically create higher runoff volumes than forested land per unit area and a greater change in stream conditions would be expected from the conversion of forest than from the conversion of residential land uses to roadway. Despite this variability, assessment of new additional impervious surfaces provides a useful tool for analysis of the relative potential for indirect impacts to surface waters from various alternatives, as numerous studies from across the Country have shown watershed imperviousness to be predictive of watershed health (CWP, 2003).

Additional impervious surfaces increase surface runoff volumes and velocities because they decrease the basin infiltration capacity. Because basins with higher imperviousness deliver more runoff to streams, the magnitude and frequency of peak storm discharges are increased. Another result of increased impervious cover is a decrease in the amount of surface water that is allowed to infiltrate to groundwater; therefore, stream baseflow also is reduced. Both reduced baseflow and instream sedimentation can lead to an increase in water temperatures, which can negatively affect water quality and aquatic habitat.

Headwater streams can be particularly susceptible to these impacts as moderate increases in impervious acreage in a small watershed can greatly increase the overall percentage of watershed imperviousness, whereas the same acreage of new impervious surfaces in a large watershed would only slightly increase the overall percent imperviousness. In addition, impervious increases in small headwater streams can affect the stream's ability to perform functions recognized in several recent studies as critical to maintaining watershed health. These functions

include nutrient reduction, flood desynchronization, and ecosystem support for larger receiving streams (Meyer, et al., 2003).

Permits Required

Direct impacts to stream channels would require a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers (USACE) and a waterway construction permit from MDE for direct impacts to streams and floodplains. A Federal Clean Water Act Section 401 water quality certification would be required from MDE for all Section 404 discharges to ensure compliance with Maryland's water quality standards. Under the State's federally mandated anti-degradation policy (COMAR 26.08.02.04), the designated use class for each stream must be protected and maintained. This will be accomplished through best management practices (BMP's) throughout the corridor as well as compliance with required NPDES permits for stormwater discharges. These measures are discussed in more detail in *Indirect Impact Avoidance and Minimization* below. Additionally, a Maryland waterway construction permit must be obtained from MDE for direct impacts in streams and floodplains. Both direct and indirect impacts have been minimized where possible during the preliminary engineering phase, and minimization options will continue to be explored during more detailed phases of design. Summaries of the avoidance and minimization of direct and indirect impacts to streams in the study area and the mitigation for unavoidable direct impacts are provided below.

Direct Impact Avoidance, Minimization, and Mitigation

Avoidance and Minimization

Roadway designs have incorporated the following avoidance and minimization measures in order to reduce direct impacts to stream channels:

- Spanning streams and floodplains with bridges instead of culverts where practicable
- Using bridge spans much greater in length than required hydraulically to reduce fill and avoid and minimize impacts to stream channels, wetlands and floodplains
- Locating bridges to avoid placement of piers in stream channels and minimize impacts to wetlands
- Using culverts that consider the natural stable size and channel materials of streams (for example, those that are buried to provide a natural channel bottom and a smooth bed transition from upstream to downstream, and those that are designed to have the same width, depth, and slope as the stable channel's bankfull width, depth, and slope)
- Realigning the roadway so that it does not cross as many stream channels or crosses as perpendicular to the streams as feasible
- Relocating stream channels that flow parallel to the roadway to areas outside the limits of cut and fill, whenever possible, to maintain habitat rather than placing them entirely within closed culvert systems beneath the roadway embankment

- Reducing intrusion on the landscape by decreasing the width of roadway section
- Using 2:1 side slopes instead of gentler slopes as appropriate
- Using retaining walls instead of slopes where practicable
- Minimizing grading to incorporate natural topography

Reduction of construction related impacts is a high priority for the Lead Agencies, as erosion from exposed soils and other temporary conditions can lead to instream sedimentation that can have more long-term negative impacts on streams. While it is not possible to completely avoid the potential for impacts, temporary construction impacts to stream channels will be greatly minimized through:

- Using equipment fitted with low-pressure tires or tracks in sensitive areas
- Locating construction roads to avoid streams and wetlands wherever possible
- Using timber matting, geotextiles, and temporary bridge structures for construction access roads through wetlands and streams when complete avoidance is not possible
- Stringent use and maintenance of state of the art sediment and erosion control measures that in many cases exceed MDE regulations
- Implementing redundant sediment and erosion control measures in the most sensitive watersheds to mitigate for potential failures during large runoff events
- Providing an Independent Environmental Monitor (IEM), with no affiliation with the design, permitting or construction aspects of the project to review the interim and final design plans and monitor construction to ensure proper sediment control compliance, adherence to limits of disturbance and permit conditions and timely resolution of issues (more information on environmental inspectors is provided in *Section IV.A.7*). The IEM would be a full-time, on-site extension of regulatory agencies and would communicate issues concurrently to the sponsoring agencies so that all parties are informed and involved in the solution process.

The Lead Agencies have coordinated extensively with regulatory and natural resource agency staff to solicit comments and build consensus on avoidance and minimization of impacts to stream resources. Agency comments have been analyzed from engineering and cost/benefit standpoints and incorporated into the on-going engineering and refinement of the proposed corridors wherever practicable.

Compensatory Mitigation

Compensatory mitigation of unavoidable direct impacts to streams in the study area is required by the USACE and the MDE. Mitigation measures for waterway impacts have been evaluated on a project-specific basis and consider the size, stream order, and location of the stream within its watershed to determine appropriate stream mitigation. Mitigation sites have been evaluated in accordance with State and Federal regulations and guidance, which typically require water quality improvements that can include, but are not limited to, stream restoration, stormwater retrofits, fish blockage removal, and aquatic habitat and riparian zone enhancements. As presented in **Table IV-54**, between 32,667 and 39,158 linear feet of perennial and intermittent streams would be directly impacted by Corridor 1, and between 24,525 and 37,584 linear feet would be directly impacted by Corridor 2. Mitigation for these impacts to perennial and intermittent streams would be required.

Mitigation of stream impacts is being provided in the form of stream restoration and fish blockage removal projects. In addition, a number of water quality projects are being proposed in the mitigation package to offset water quality impacts and meet requirements of the MDE 401 Water Quality Certification. All mitigation projects have been reviewed and accepted by the regulatory agencies for their ability to meet requirements set out in state and federal law. The final mitigation package was developed through intensive direction and guidance from the resource agencies on which sites would be most beneficial and best offset project impacts. The compensatory mitigation package is included in **Chapter IV.F.7.f Waters of the U.S. Including Wetlands - Mitigation**.

Indirect Impact Avoidance, Minimization, and Mitigation

Wherever possible, preliminary roadway designs have incorporated the following avoidance and minimization measures in order to reduce indirect impacts to stream channels:

- Reconfiguring the layout of culverts, bridge piers and abutments so that they are in line with the existing alignment of the streams
- Staging and stockpiling construction materials outside of floodplains

In addition to the avoidance and minimization measures listed above, the Lead Agencies will implement SWM Best Management Practices (BMPs) in accordance with MDE guidelines as the primary avoidance and minimization measure to reduce the indirect impacts of increased imperviousness. SWM is an evolving technique, and much has been learned since the 1980s when SWM requirements were first implemented. While early SWM was relatively effective in controlling large runoff events, it was often not designed to treat for water quality and to protect natural channel characteristics. Over the past two decades, SWM has improved greatly with the latest MDE design criteria mandating water quality treatment, groundwater recharge, and channel protection (MDE, 2000). These new criteria are specifically designed to counteract the negative effects of runoff from impervious surfaces on stream systems (MDE, 2000). Effective SWM can greatly diminish the negative effects of increased imperviousness by: reducing losses in groundwater recharge and associated stream baseflow, reducing stormwater peaks, durations, and frequencies of erosive flows, reducing chemical contaminants in runoff, and reducing runoff

temperature extremes that might otherwise result from a build alternative. It should be noted, however, that SWM cannot completely prevent potential impacts to water resources. There is a growing body of research about the effectiveness of BMPs in removing various pollutants, including a National BMP Database developed by the American Society of Civil Engineers (ASCE) as well as university and private research. There are limitations to BMP effectiveness in reducing or removing pollutants from stormwater that are both intuitive and elusive. Limitations affecting water quality include:

- **Imperfect BMP Efficiency** - there is evidence that there are irreducible concentrations of pollutants that leave SWM BMPs with current technology (Schueler, T.R, 2000). The irreducible concentration of a particular pollutant varies for different BMPs with a number of variables to consider, including the actual storm event monitored (rainfall amount, intensity and duration), treatment volume, BMP employed, etc.
- **Seasonal Variations in Climate** - strategies for SWM should certainly be regional, as they are in Maryland, to limit the variation in climate that is served by a given set of regulations and policies. However, even in a relatively small State like Maryland there can be a wide variation in climate that affects the functioning of BMPs. For example, if by regulation a sand filter must be designed to treat one inch of rainfall runoff from the contributing area in a 24 hour period, two inch storm may occur during the same period. The excess runoff can cause overflow or bypass of the sand filter, and, as a result the gross efficiency of the sand filter is compromised for that storm event. Additionally, in areas subject to freeze and thaw, such as Maryland, BMP efficiency is typically diminished during frozen conditions. Research suggests that BMPs do function during the winter, albeit to a more limited extent (Oberts, G.L. et. al, 1989).
- **BMP Maintenance** - theoretically when a SWM BMP is “new” it is operating at peak efficiency. With time, and if the BMP is working properly, it will require maintenance. The maintenance is required to trim vegetation, repair structures as needed, etc. During the period from “new” to “maintenance required” there is an intuitive decline in effectiveness of the BMP at removing intended pollutants. The decline in effectiveness is generally attributable to loss of storage volume to settled pollutants that can be restored with maintenance. BMP maintenance can also affect the functioning of water quantity control BMPs including dry ponds. If storms occur that cause debris to enter quantity control ponds, the debris may clog small diameter channel protection orifices, causing more frequent overtopping of spillways designed to provide depth relief in ponds.
- **Storm Capture** - As mentioned above, SWM requirements typically dictate what rainfall event or runoff volume must be provided within a BMP to adequately address water quality treatment. The rainfall event or treatment volume is typically based on a statistical analysis of the region’s rainfall and a reasonableness factor. In Maryland there is a 90 percent capture rule that essentially requires treatment by BMP for at least 90 percent of all storm events in Maryland, and that equates statistically to about 1 inch of rainfall. When storms occur that exceed the capture requirement, a decline in water quality treatment efficiency can be expected. Conversely, storms of less than 1 inch may,

depending on the BMP employed, provide higher efficiency because of increased residence time afforded to gravity settling of particulate pollutants.

- **Hydrograph Timing** - The timing of discharge hydrographs can affect the design of SWM quantity control ponds, potentially diminishing their effectiveness at providing channel protection. For example, subsequent storms that do not fit the pattern of rainfall and runoff used during design may cause excessive runoff volume and lead to overtopping of spillways designed for infrequent storm use. The result of premature overtopping may be that excess flows are discharged from a quantity control pond to a receiving stream that may not be of sufficient capacity or stability to handle the excess flows.

Ideally, SWM should involve simple, well-designed facilities that require low maintenance and incorporate infiltration, since lack of maintenance can limit the long-term effectiveness of any SWM facility. Despite some limitations, SWM BMPs use the latest technologies and generally function well in reducing water quality and quantity impacts in receiving streams.

The Lead Agencies are committed to protecting water resources from ICC related impacts with a variety of innovative SWM techniques, in compliance with the latest MDE criteria. Advanced technologies that in many cases exceed MDE minimum requirements will be used to mitigate specific anticipated impacts and address the unique needs of the individual receiving stream systems. For example, new road alternatives in Montgomery County Special Protection Areas (SPA) would use a combination filtration/infiltration system. By using filtration as a pre-treatment method before infiltration, infiltration facility maintenance requirements can be reduced and facility life can be maximized. Additionally, SHA has included underground SWM placed beneath the ICC in some areas to minimize impacts to parkland, which will also avoid associated natural resource impacts in those areas (see *Table IV-56* for general areas where this has been included).

The Lead Agency's efforts to protect water resources will include the following:

- SWM control for quality as well as quantity
- Use of grass channels instead of curb and gutter systems for stormwater conveyance
- Location of SWM outside of sensitive areas wherever possible
- Protection of all infiltration areas during construction
- Facility designs based on field infiltration tests at design depths (not sieve analyses)
- Routing roadway runoff away from sensitive areas
- Implementing thorough erosion and sediment control plans

In addition to these more standard measures, the Lead Agencies are also dedicated to exceeding the minimum regulatory requirement for providing water quality control for a 1-inch rainfall event; an MDE requirement that is meant to capture and provide water quality treatment for 90

percent of annual runoff volume. Instead, the Lead Agencies have committed to provide water quality control for a 1.5-inch rainfall event throughout the project corridors to capture more than 95 percent of annual storm events to better protect or improve the existing stream conditions.

The following SWM design parameters, which go beyond current minimum standards, have been considered and agreed upon to reduce overall impacts to water resources:

- Exceed applicable regulations and specifications for water quality treatment by treating 1.5 inches of rainfall throughout the project corridors under study
- Meet Montgomery County Department of Environmental Protection (MCDEP) SPA Stormwater Criteria and review process within designated SPAs
- Incorporate a combination of filtration, and infiltration within SPAs and filtration elsewhere to address water quality
- Control and treat both road and bridge deck runoff in designated SPAs
- Design SWM facilities within Rocky Gorge watershed with spill containment capabilities/controls and integrate these controls into emergency response plans to protect the drinking water supply
- Design facilities within Use III and IV watersheds to be temperature sensitive and promote infiltration to maximize groundwater recharge to protect brown trout and other temperature sensitive species
- Application of SWM features for the ICC depends upon the location of the roadway in the landscape, local topography, local soils (infiltration potential), local watershed Use designation, special requirements such as Special Protection Area or Patuxent Reservoir drainage, impacts to parkland, and other factors. How SWM would be addressed for the ICC is summarized in *Table IV-56*, based on the level of detail available during the current phase of project design.

To ensure that SWM facilities constructed as part of the ICC function as designed long-term, these facilities will be under the jurisdiction of MDE's Federal National Pollutant Discharge Elimination System (NPDES) Phase II General Permit for State and Federal Agencies when issued. The NPDES permit outlines minimum inspection and maintenance frequency requirements, routine inspection of facilities, and maintenance prioritization based on inspection results. Through all these measures, it is the Lead Agency's goal to exceed SWM requirements set forth by MDE, to ensure the long-term effectiveness of these measures, and, by doing so, overcome past shortcomings of SWM in protecting water resources. More detailed information on SWM design approaches, treatment effectiveness, temperature effects, and maintenance of baseflow is located in the NETR (SHA, 2004).

Table IV-56
Stormwater Techniques Summary

Corridor	Limits	SPA	Stream Use Designation	Watershed	SWM / Parkland conflict	Topography	Possible SWM Type	Comments
1 & 2	from I-370 to Redland Rd.	No	IV	Rock Creek	No	Gentle	1, 4, 6, 9	Interchange loops, some r/w bump-outs
1 & 2 Option A	From Redland Road to Muncester Mill Road	No	IV	Rock Creek	Some	Rolling	1, 2, 4, 9, 10	Slopes make grass channels infeasible
1 & 2 Option C	From Redland Road to Muncester Mill Road	No	IV	Rock Creek	Some	Gentle	1, 2, 4, 6	Carry drainage across Rock Creek bridge. Tunnel presents challenges
1 & 2	Muncester Mill Road to Georgia Avenue	Yes	III	Rock Creek	Some	Mixed	3, 5, 6, 9	Linear SWM in SPA
1	Georgia Avenue to Layhill Road	No	IV	Northwest Branch	No	Gentle	1, 4, 6	
1	Layhill Road to West of Nolley Road	No	IV	Northwest Branch	No	Rolling	1, 2, 4, 6, 9	NW Branch Park
1	W. of Nolley Road to NH Avenue	No	IV	Northwest Branch	No	Gentle	1, 2, 4, 6	
1	NH Avenue to W. of Columbia Pike (US 29)	Yes	III	Paint Branch	Some	Mixed	3, 5, 6, 9	Linear SWM in SPA
1	W. of Columbia Pike (US 29) to MC / PGC line	No	I	Little Paint Branch	No	Mixed	1, 4, 7	Use Auto Park pond with modification
1	MC / PGC line to W. of I-95	No	I	Little Paint Branch	No	Gentle	1, 4, 8	
1 & 2	W. of I-95 to Baltimore Avenue (US 1) incl. work on I-95 from MD 198 to MD 212	No	I	Indian Creek	No	Gentle	1, 4, 8	
2	Georgia Ave to NH Ave Norbeck A or B	No	IV	Northwest Branch	No	Mixed	1, 4, 6	
2	NH Ave to E. of MD 198 at Alburt Lane on Spencerville A, B or C to Burtonsville A	Yes	III	Paint Branch	No	Gentle	3, 5, 9	Linear SWM in SPA
2	NH Ave to E. of MD 198 at Oak Hill Road on Spencerville A, B	Yes	III	Paint Branch	No	Gentle	3, 5, 9	Linear SWM in SPA

Table IV-56
Stormwater Techniques Summary

Corridor	Limits	SPA	Stream Use Designation	Watershed	SWM / Parkland conflict	Topography	Possible SWM Type	Comments
	or C to Burtonsville B							
2	NH Ave to W. of Old Columbia Pike (US 29) on Spencerville D to Burtonsville B	No	IV	Patuxent River	No	Gentle	1, 4, 6, 11	

¹¹ Diversion of drainage between NH Ave and Good Hope crossing to NW Branch, , and convertdrainage across Good Hope bridge for discharge in Paint Branch watershed.

Notes:

Appropriate sections of the 2000 Maryland Stormwater Design Manual, (MDM, 2000) are referenced for the SWM criteria listed below.

Water Quality Control

- 1 – Water Quality Volume (WQv) (Section 2.1) addressed through Grass Channel Credits (Section 5.5), substituting 1.5" rainfall for WQ storm.
- 2 – WQv (Section 2.1) addressed through underground sand filtration (Section 3.4) and substituting 1.5" rainfall for WQ storm, to decrease ROW needs in parkland subject to section 4(f) impacts or address rolling terrain.
- 3 – WQv (Section 2.1) addressed through linear sand filters in median and roadside ditches and substituting 1.5" rainfall for WQ storm.

Groundwater Recharge

- 4 – Groundwater Recharge Volume (Rev) (Section 2.2) addressed through percent area method by sheet flow of runoff through roadside areas and use of grassed channels for drainage instead of pipes.
- 5 – Rev (Section 2.2) addressed through percent area method by sheet flow of runoff through roadside areas in addition to storage volume beneath linear sand filters and bottomless sump inlets.

Water Quantity Control

- 6 – Channel Protection Volume (Cpv), or quantity control, addressed through use of 12-hour extended detention of the 1-year storm in dry pond (Section 2.3). No Overbank Flood Control Volume (Qp) (Section 2.4) or Extreme Flood Volume (Qf) (Section 2.5) required in Montgomery County.
- 7 – Cpv addressed through use of 24-hour extended detention of the 1-year storm in pond (Section 2.3). No Qp (Section 2.4) or Qf (Section 2.5) required in Montgomery County.
- 8 – Cpv addressed through use of 24-hour extended detention of the 1-year storm in pond (Section 2.3). Qp (Section 2.4) is required in Prince Georges County. No Qf (Section 2.5) required in Prince Georges County.
- 9 – Cpv addressed through use of underground pipes providing 12-hour extended detention of the 1-year storm (Section 2.3) to decrease thermal impacts in SPA's and ROW needs in parkland subject to section 4(f) impacts. No Qp or Qf requirements in Montgomery County.
- 10 – Waiver from requirements to be requested due to discharge proximity to Lake Needwood.
- 11 – Additional reservoir protection provided through supplemental 10,000 gallons of spill containment storage and shut-off / isolation valves.

b. Water Quality

Impacts

The No-Action Alternative would have no ICC project related impact on the chemical water quality of the study area watersheds.

Both Build Alternatives have the potential to affect the water quality in the study area. These impacts can be categorized as direct and indirect.

Direct Impacts

Impacts during project construction could include physical disturbances or alterations, accidental spills, and sediments releases. These impacts affect aquatic life downstream of the study area and have the potential to contaminate public drinking water supplies with Corridor 2. Direct stream channel impacts associated with each corridor are compared and quantified in *Chapter IV.F.5.a*. The potential negative water quality results of these impacts are discussed below. Discharges of stormwater from the construction of the project will be subject to the requirements of an NPDES stormwater construction permit, which will regulate the Lead Agency's activities so as to avoid and minimize the potential effects discussed below.

During construction, large areas of exposed soil can be severely eroded by wind and rain when the vegetation and naturally occurring soil stabilizers are removed. Erosion of these exposed soils can significantly increase the sediment load to receiving waters (Barrett, 1995). These increased sediment loads can destroy or damage fish spawning areas and macroinvertebrate habitat. An accidental sediment release in a stream can clog the respiratory organs of fish, macroinvertebrates and the other members of their food web (Barrett, 1995). Additional suspended sediment loads have also been shown to cause stream warming by reflecting radiant energy (CWP, 2003). Many metal contaminants, bound to the small particles, are transported during accidental releases of sediment.

The initial response to increased sedimentation due to construction has been found to be a reduction in numbers and species of fish and macroinvertebrates (Barrett, 1995). This reduction in fish numbers in areas of siltation was generally repopulated within 12 months of construction activity cessation. Studies have shown conflicting conclusions about the effectiveness of erosion control methods to reduce the negative effects of sediment release. These erosion prevention methods have been shown to be less effective at mitigating the effects of the early construction stages and more effective at reducing long term stress to the local aquatic biota (Barrett, 1995).

An additional impact associated with the initial construction phase of highway building is the removal of trees and possibly other riparian buffer vegetation. The removal of riparian vegetation greatly reduces the buffering of nutrients and other materials and allows unfiltered water to enter a stream channel directly (Trombulak, 2000). Tree removal during the construction process can reduce the amount of shade provided to a stream and thereby raise the water temperature of that stream. The effect of the temperature change will depend on stream size, existing temperature regime, the volume and temperature of stream baseflow, and the degree of shading. Temperature modeling based on preliminary alternatives in 1997 was conducted using data collected for that study (SHA, 1997). Several parameters including estimated new impervious areas, watershed runoff coefficients, the number and size of potential stream crossings, and the projected low flow stream data were used to create this model. Though actual numerical changes cannot be used the following trends can be extrapolated:

- In the Rock Creek watershed, the largest temperature increase resulting from Corridors 1 and 2 would be in the Mill Creek Tributary
- Water quality in the Paint Branch would be most affected by Corridor 1

- Water quality in the streams leading to Rocky Gorge Reservoir would be most affected by Corridor 2

Impacts, associated with the use of the road after construction, are mainly based on the potential for contamination of surface waters by run-off from new impervious roadway surfaces. These runoff constituents can be grouped as heavy metals, salt, organic molecules, and nutrients (Trombulak, 2000). *Table IV-57* contains a list of common highway runoff constituents and their sources.

Table IV-57

Common Highway Runoff Constituents and Their Primary Sources

Constituent	Primary Sources
Particulates	Pavement wear, vehicles, atmosphere, maintenance
Nitrogen, Phosphorous	Atmosphere, roadside fertilizer application
Lead	Leaded gasoline (auto exhaust), tire wear (lead oxide filler material), lubricating oil and grease, bearing wear
Zinc	Tire wear (filler material), motor oil (stabilizing additive), grease
Iron	Auto body rust, steel highway structures (guardrails, etc.), moving engine parts
Copper	Metal plating, bearing and bushing wear, moving engine parts, brake lining wear, fungicides and insecticides applied by maintenance operations
Cadmium	Tire wear (filler material), insecticide application
Chromium	Metal plating, moving engine parts, brake lining wear
Nickel	Diesel fuel and gasoline (exhaust), lubricating oil, metal plating, bushing wear, brake lining wear, asphalt paving
Manganese	Moving engine parts
Bromide	Exhaust
Cyanide	Anticake compound (ferric ferrocyanide, Prussian Blue or sodium ferrocyanide, Yellow Prussiate of Soda) used to keep deicing salt granular
Sodium, Calcium Chloride	Deicing salts, grease
Sulfate	Deicing salts
Petroleum	Roadway blends, fuel, deicing salts
Polychlorinated Biphenyls (PCB's)	Spills, leaks or blow-by of motor lubricants, antifreeze and hydraulic fluids, asphalt surface leachate
Pesticides, Pathogenic Bacteria (indicators)	Spraying of highway ROWs, background atmospheric deposition, PCB catalyst in synthetic tires
Rubber	Soil, litter, bird droppings and trucks hauling livestock and stockyard waste
Asbestos	Tire wear
	Clutch and brake lining wear

Source: Kohrger, 1984

Heavy metal concentration in nearby surface waters can be elevated by the increased impervious surfaces and vehicle use. The most common heavy metal contaminants are lead, aluminum, iron, cadmium, copper, manganese, titanium, nickel, and zinc. Most of these contaminants are related to gasoline additives and regular highway maintenance. Other sources of metals include

mobilization by excavation, vehicle wear, and combustion of petroleum products, historical fuel additives, and catalytic-converter emissions.

Generally heavy metals from highways found in streams are not at concentrations high enough to cause acute toxicity (CWP, 2003). The greatest concern associated with metals, even at low concentrations, is the long-term accumulation in bottom sediments and animal tissues. Three of the study area watersheds/subwatersheds would be considered more susceptible to the impact of heavy metal contamination because of the presence of detectable levels of metals currently found in these streams. These are: Mill Creek, containing chromium, copper, and lead; Paint Branch, containing chromium, nickel, and zinc; and Little Paint Branch, containing copper and nickel. Although metals levels in these streams are currently within state and Federal standards, additional potential inputs from highway operations could bring levels closer to mandated thresholds and increase the potential for adverse impacts to the aquatic system.

Major water quality stressors are the deicing salts that are used during the winter for highway safety maintenance. Sodium chloride is the most common deicer but it can also be blended with calcium chloride or magnesium chloride. Urea and ethylene glycol are also sometimes used in deicing. SHA most commonly uses rock salt (sodium chloride), a salt brine, and magnesium chloride. Chlorides from these salts can cause acute and chronic toxicity in fish, macroinvertebrates, and plants after icing and snowstorms. The effect of chlorides in streams is dependent on the amount that is applied and the dilution of the receiving waters. Chlorides are also a concern for drinking water sources, as it interferes with treatment processes and can cause an unpleasant taste at relatively low concentrations (CWP, 2003). Little Paint Branch showed the most elevated levels of chlorides in the study area. Mill Creek, Rock Creek, and Northwest Branch also showed substantial levels of chlorides in the stream. These watersheds would be more highly impacted by additional chlorides entering the streams from the highway.

Another group of pollutants, organic molecules including dioxins and polychlorinated biphenyls (PCBs), have been found to be in higher concentrations along roadways. Sources of these compounds include run-off derived from exhaust, fuel, lubricants, and asphalt (Buckler, 1999). Other pollutants in this group include polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene and xylene (BTEX), and methyl tertiary butyl ether (MTBE) (Buckler, 1999). Vehicle emissions have been shown to be an important source of the BTEX compounds. These organic pollutants are known to accumulate to concentrations that will cause mortality and affect growth and reproduction in aquatic organisms (Lopes et al., 1998).

Nutrients are also found in highway runoff. Most research involving nutrients is directed towards lakes, which experience eutrophication in the presence of excess nutrients. High levels of nitrogen and phosphorous can cause algae blooms that lead to lower dissolved oxygen from the decomposition of the algae. These nutrients are deposited into the aquatic system by atmospheric deposition, fossil fuel combustion by automobiles, and stream bank erosion (CWP, 2003). All watersheds in the study area have been shown to have elevated levels of nutrients. Mill Creek, Rock Creek, and Rocky Gorge show the highest concentrations of nitrates and phosphorous. These streams are very susceptible to negative impacts from increased nutrient loading because of existing concentrations as well as their location upstream of lakes and reservoirs that could experience eutrophication. In the Rock Creek and North Branch Rock

Creek watersheds, Lake Needwood and Lake Frank are of special concern because of their location directly downstream of the corridor.

Sediments are also a primary concern with an increase in impervious areas. Even relatively moderate sediment loading to an otherwise healthy stream can reduce the variety and abundance of aquatic life (Waters, 1995). The indirect sediment impacts are the same as those discussed in the Direct Impacts section above and in *Chapter IV.F.5.a*.

New impervious cover anticipated under each of the corridors and associated options are presented in *Table IV-55* and discussed in the watershed narratives below. Estimated changes in percent imperviousness are also presented and are based on existing impervious percentages provided in the *Countywide Stream Protection Strategy (CSPS)* (MCDEP, 1998) for streams in Montgomery County and on impervious information generated in GISHydro (GISHydro2000, 2004) for streams in Prince George's County. While slightly more up to date, the information generated in GISHydro is less accurate than that in the CSPS since it was generated from land use categories rather than an analysis of actual impervious ground cover. Because both of these data sources are some years old and more recent detailed data were not readily available, it should be noted that estimated total impervious percentages may not include more recent development and are therefore presented to provide a relative understanding of the degree of impervious change rather than an exact account of imperviousness. In the Paint Branch SPA, MNCPPC provided more up to date existing impervious data from 2001, so these percentages would be expected to be more accurate projections of imperviousness with the ICC. The watershed area used for calculation of impervious percentages included the combined area of all subwatersheds either upstream of or impacted by either Corridor of the ICC. For example, calculations for the overall impervious percentage for Rock Creek with the ICC included the entirety of all subwatersheds upstream of and including Lake Needwood. Impervious impacts anticipated in individual subwatersheds, are provided in *Appendix L*. Watersheds and subwatershed boundaries are illustrated in *Figures II-13*. The impervious impact numbers presented below have been updated since the DEIS and reflect the more detailed level of preliminary engineering available. Overall the ranges of additional impervious surfaces presented for all corridors and options are higher as more accurate information on the paved portion of the highway typical section, such as specific shoulder configurations, are now reflected in the new impact calculations.

Muddy Branch Watershed

Both Corridors 1 and 2 (*Appendix A, Plate 1*) would impact Muddy Branch equally. An additional 0.1 acres of impervious surfaces would be created within the watershed (*Figure II-13*). This is the least impacted watershed within the study area and should have the lowest chemical water quality impacts.

Upper Rock Creek Watershed

Corridors 1 and 2 would have the same impacts on the Upper Rock Creek watershed (*Figure II-13*). Two options exist for this corridor segment within this watershed, Rock Creek Option A (*Appendix A, Plates 3-5*) and Rock Creek Option C (with Old Mill Run Grade Separation or Cul-de-Sac) (*Appendix A, Plates 6-11*). Impervious cover would increase by 26.6 acres with

Option A, 31.8 acres with Option C (with Old Mill Run Grade Separation), and 31.3 acres with Option C (with Old Mill Run Cul-de-Sac). Options A and C impact the Rock Creek, Lake Needwood, Mill Creek, and South Mill Creek subwatersheds (see *Appendix L* for impacts by subwatershed). Based on existing imperviousness data, the ICC and any of its options would increase imperviousness in the portion of the Rock Creek watershed upstream of and including Lake Needwood by less than one percent, resulting in a total estimated imperviousness of approximately 12.9 percent. As discussed previously, these subwatersheds currently have elevated levels of nutrients making them more susceptible to the increased pollutant loads generally associated with impervious cover. Additional nutrients are of particular concern in Lake Needwood as they could hasten eutrophication of the lake. Monitoring in the Rock Creek mainstem subwatershed has shown summer water temperatures regularly above the 68°F standard. Increased impervious areas within this subwatershed may increase this pre-existing temperature stress. A higher amount of impervious cover is associated with Option C (with Old Mill Run Grade Separation); therefore, greater amounts of impacts to chemical water quality could be expected with this option.

North Branch Rock Creek Watershed

Impervious surfaces would increase by 39.9 acres with both Corridor 1 and 39.9 acres for Corridor 2, as they are on the same alignment through this watershed (*Appendix A, Plates 12-14*). This additional impervious area constitutes an overall increase in watershed imperviousness in the North Branch watershed upstream of the ICC of less than one percent, resulting in a total imperviousness of 10.9 percent. These impacts would occur in the Lower North Branch B, Brooke Manor, and Manor Run subwatersheds (*Figure II-13*). The increased impervious cover associated with both Corridors 1 and 2 may exacerbate existing nutrient enrichment and raise water temperatures within the North Branch, and Lake Frank, which is downstream.

Northwest Branch Watershed

Overall Corridor 2 would result in fewer acres of new impervious cover than Corridor 1, though both Corridors would increase the overall imperviousness of the watershed upstream of the ICC by less than one percent regardless of which options are chosen. In Corridor 1 (*Appendix A, Plates 15-16 and 25*), the greatest increase (80.2 acres) in impervious surfaces would result from the mainline combined with Northwest Option A (with Interchange at Layhill Road) (*Appendix A, Plates 21-24*) while the least increase would be 73.2 acres of new impervious areas resulting from the selection of the mainline combined with Northwest Option B (without Interchange at Layhill Road) (*Appendix A, Plates 17-20*). These impacts would occur in the Batchellors Forest Tributary, the Bel Pre Creek Tributary, the Longmead Tributary, the Middle Mainstem Glenmont, and the Rolling Stone Tributary subwatersheds (*Figure II-13*). The Middle Mainstem Glenmont subwatershed would experience the greatest increase in impervious areas of these subwatersheds, at 31.4 to 37.4 acres, with slightly higher acreages within the Northwest Option A (with Interchange at Layhill Road). The new impervious acreage in the Middle Mainstem Glenmont subwatershed from Corridor 1 constitutes an increase of approximately 1.7 percent, raising the total imperviousness of this subwatershed to approximately 14 percent. The Batchellors Forest Tributary would experience the second highest acreage of subwatershed

impacts, increasing overall imperviousness of the subwatershed to approximately 8 percent, an addition of approximately one percent.

As discussed previously, both the Batchellor's Forest Tributary and the Middle Mainstem Glenmont have been shown to have highly elevated levels of nitrates, phosphorous, solids, and chlorides. These increases in impervious area have the potential to increase the chemical water quality impairment within these subwatersheds. Monitoring has shown that the Batchellors Forest Tributary provides well-buffered stream water temperatures that may be disturbed by a large increase in impervious areas.

New impervious areas for Corridor 2 would range from 73.2 acres to 80.2 acres. The least impacts would occur when the mainline (*Appendix A, Plates 48-51*), Norbeck Option A (*Appendix A, Plates 41 - 43*), Spencerville Option B (*Appendix A, Plates 54 and 55*), Burtonsville Option A (*Appendix A, Plates 69-71*), and Fairland Option A are combined. The greatest impacts would occur when the mainline, Norbeck Option B (*Appendix A, Plates 44 - 47*), Spencerville Option C (*Appendix A, Plates 56 and 64*), Burtonsville Option B (*Appendix A, Plates 72 - 74*), and Fairland Option B are combined. The mainline used with all options would impact the Batchellors Forest Tributary, the Batchellors Forest East Tributary, the Bryants Nursery Tributary, and the Upper Mainstem of the Paint Branch subwatersheds. The greatest impacts for this alignment, 43.4 acres, occur in the Batchellors Forest Tributary. This impact would constitute an increase in subwatershed imperviousness of approximately two percent, with a new total imperviousness of nine percent. Norbeck Options A and B both impact the Batchellors Forest Tributary. Norbeck Option B (with either Willow Grove suboption) has slightly higher impacts than Option A, at 40.2 acres and 39.8 acres, respectively. The Bryants Nursery Tributary is also impacted by all of the Spencerville Options, with the Corridor 2 combination of Spencerville Option B or C with Burtonsville B having slightly higher impacts than the other option combinations. These higher impacts would constitute an approximate increase of 2 percent imperviousness, resulting in an overall imperviousness of approximately nine percent in the Bryant's Nursery subwatershed based on existing imperviousness data provided in the CSPA (MCDEP, 1998). Spencerville Option A, B, or C combined with Burtonsville A, B (with ICC over Good Hope or Relocated Good Hope Road), or X provides the least amount of impacts, slightly less than the other options.

Paint Branch Watershed

New impervious areas resulting from Corridor 1 (*Appendix A, Plates 25-28*) within Paint Branch would total 39.2 acres. This constitutes an increase in impervious area of less than one percent in the Paint Branch SPA. Based on existing imperviousness as of 2001, new impervious area in the Paint Branch SPA with Corridor 1 would total 13.3 percent. Estimates of increases in subwatershed impervious percentages from the ICC are provided in *Table IV-64 in Chapter IV.F.6.a, Aquatic Biota*. Subwatersheds impacted by this corridor would include the Gum Springs Tributary, the Lower Gum Springs Tributary, the Lower Good Hope Tributary, the Hollywood Branch Tributary, and the Paint Branch Upper Mainstem subwatersheds (*Figure II-13*). The greatest amounts of impervious cover, 18.5 acres, would occur in the Lower Good Hope Tributary. The Upper Mainstem would experience the second highest increase, with the addition of 12.8 acres. Together, the Gum Springs and Lower Gum Springs Tributaries would experience an increase of 6.2 acres. As discussed previously, summer water temperature within

these subwatersheds is at the upper limit of what is considered sustainable for the resident brown trout population. Addition of impervious areas within these subwatersheds has the potential to raise water temperatures to a level not suitable for the trout population, though avoidance and minimization measures will greatly reduce this. The Good Hope Tributary and Gum Springs Tributary subwatersheds currently have the coolest water temperatures within the area impacted by Corridor 1. The Upper Mainstem subwatershed already experiences summer water temperatures consistently above 68°F and additional impervious areas may add to the existing problem.

Corridor 2 has a wide range of possible impacts for the Paint Branch, from a low of 0.4 acre of new impervious cover to 35.6 acres, though the percent increase in overall SPA imperviousness is less than one percent for all options. Total new imperviousness would range from approximately 12.6 to 13.3 percent. Impacts associated with the four Spencerville Options (*Appendix A, Plates 52-67*) occur in the Upper Left Fork subwatershed. Only Burtonsville Option A (*Appendix A, Plates 52-57, 69*) would have impacts within Paint Branch and these would occur in the Upper Left Fork as well as the Right Fork subwatersheds. The least impacts would occur with the combination of Spencerville Option D and Burtonsville Option B (*Appendix A, Plate 66*). This combination would add minor amounts of impervious areas to the Upper Left Fork subwatershed, an area that is consistently showing summer water temperatures above 68°F.

The most potential impacts in Corridor 2 are associated with Spencerville Option C and Burtonsville Option A (*Appendix A, Plates 56-57*). These impacts would occur in the Upper Left Fork, Lower Left Fork, and Right Fork subwatersheds. The Right Fork subwatershed also consistently shows temperatures above 68°F, making it and the Upper and Lower Left Fork subwatersheds susceptible to temperature increases associated with new impervious cover.

Little Paint Branch Watershed

Corridor 1 (*Appendix A, Plates 28-32, 35*) would have the most potential new impervious cover in Little Paint Branch, at 55.7 acres, an increase of slightly less than one percent to overall watershed imperviousness for a total new imperviousness of approximately 27.6 percent. These impacts would occur in the Greencastle Tributary, the Tanglewood Tributary, and the Upper Little Paint Branch subwatersheds (*Figure II-13*). Most of these new impervious surfaces, 33.8 acres, would occur in the Tanglewood Tributary subwatershed. The new ICC related impervious surfaces would constitute an approximate five percent increase in imperviousness in this subwatershed, raising the overall percentage to approximately 28 percent. The Tanglewood Tributary subwatershed has elevated nutrient, solids, chlorides, and fecal coliform levels. The Greencastle Tributary subwatershed has the second highest impacts in Corridor 1 and also experiences elevated nutrient, solids, and chloride stresses. These existing conditions make these subwatersheds very susceptible to the increases in pollutant loads generally associated with increased impervious surfaces. Temperatures within Little Paint Branch are currently well below the standard for Use I waters and should not experience temperature increases above the use class standard.

The Fairland Option A (*Appendix A, Plates 77-78*) and Fairland Option B (*Appendix A, Plates 80-81*) within Corridor 2 would have new impervious surfaces totaling 12.9 acres and 10.1 acres, respectively. Either of these options would result in an increase of less than half of one percent in the Little Paint Branch watershed for a total watershed imperviousness of around 27 percent. These impervious areas would occur in the McKnew Park Tributary, Silverwood Tributary and Upper Little Paint Branch subwatersheds. These subwatersheds have some existing nutrient, solids, and chloride enrichments, possibly making them susceptible to new pollutant loadings.

Indian Creek Watershed

New impervious surfaces within Indian Creek would be less in Corridor 1 than in Corridor 2. Because most of the new impervious cover is attributed to the I-95 Interchange area, which is common to both corridors, impacts between the two corridors are relatively similar. The new impervious coverage for Corridor 1, with the I-95 Interchange Option A (terminate ICC at US 1), (*Appendix A, Plates 32 – 34, 36-37 and 40*) would total 83.7 acres and occur in the Mainstem above I-95, the Ammendale Tributary, the Middle Mainstem, and the Upper Mainstem subwatersheds (*Figure II-13*). This new impervious area would increase the overall imperviousness of the portion of the Indian Creek watershed assessed by approximately 1.4 percent, resulting in a total of approximately 25 percent. The greatest amount of new impervious areas, 32.4 acres, would occur within the Mainstem above I-95 and would increase imperviousness in the subwatershed by approximately four percent based on information derived from GISHydro2000 (GISHydro2000, 2004). This would bring the new imperviousness of this subwatershed to around 15 percent. The Ammendale Tributary subwatershed would also experience substantial increases totaling 30.7 acres (an increase of approximately 2.5 percent in the subwatershed for a new impervious percentage of 45). Impervious surfaces would increase by 47.4 acres with the selection of I-95 Interchange Option B (terminate ICC at I-95), which relates to an impervious increase of less than one percent for Indian Creek (total new imperviousness of 24 percent). As discussed previously, comprehensive data about the individual subwatersheds in Indian Creek are not available. The watershed as a whole, experiences water chemistry limitations due to the current and historic mining within the area. Increased inputs of pollutants due to increased impervious surfaces would add to the water chemistry issues already affecting this watershed.

As previously mentioned, Corridor 2 (*Appendix A, Plates 40, 78 – 79 and 82-85*) would have greater total impervious surface increases than Corridor 1. The greatest increases in Corridor 2 would be 105.9 acres (increasing imperviousness by approximately 1.7 percent for a total of 25.4 percent in the watershed) and the least would be 76.6 acres (an increase of about 1.3 percent for a total of 25 percent in the watershed). The Fairland Option A (*Appendix A, Plates 78-79*) and Fairland Option B (*Appendix A, Plates 81-82*) segments would add 5.7 acres and 4.1 acres of impervious cover to Indian Creek, respectively.

Rocky Gorge Watershed

Corridor 1 would not add new impervious cover to the Rocky Gorge watershed. Impervious cover increases would range from 54.7 acres to 86.6 acres for Corridor 2 and occur in the Dustin Road Tributary, the Kruhm Road Tributary, the Foxes Branch Tributary, the Oursler Road Tributary, and the Ednor Road Tributary subwatersheds (*Figure II-13*). These levels of new impervious surfaces would increase the portion of the Rocky Gorge reservoir watershed impacted by the ICC by a maximum of 2.1 percent for a total imperviousness in this portion of

the watershed of approximately 11.6 percent. The most impervious surface increases would be associated with the combination of Spencerville Option D and Burtonsville Option B (*Appendix A, Plates 66-68*). The least increase would be associated with the combination of Spencerville Options A, B, or C and Burtonsville Option A or X (*Appendix A, Plates 52, 54, 56-57*). All of these subwatersheds have elevated levels of nutrients, solids, and chlorides that may be increased by additional impervious surfaces. The potential increases in pollutant loads in these watersheds are more sensitive, due to their location upstream of a public drinking water reservoir.

Upper Patuxent River Watershed

Corridor 1 would have less total new impervious cover in the Upper Patuxent watershed than Corridor 2, depending on which options are selected. These new impervious areas would range from 14.1 acres to 14.3 acres in Corridor 1 and result in an increase in the combined subwatersheds impacted by the ICC of approximately one percent. This would bring the overall imperviousness of these combined subwatersheds to approximately 41 percent. The Fairland Option B (*Appendix A, Plates 80-81*) alignment associated with Corridor 2 would increase the impacts shared with Corridor 1, making the total 19.4 acres. The I-95 Interchange Option A (terminate ICC at US 1) would have higher overall impacts with both Corridor 1 and Corridor 2. All new impervious cover impacts in Corridor 2 would occur in Bear Branch and Walker Branch (*Figure II-13*) and would increase overall imperviousness of these two watersheds combined by slightly more than one percent. Within the Upper Patuxent watershed, Bear Branch currently has the most water quality impacts. The addition of impervious surfaces has the potential to degrade this subwatershed, though increases and associated impacts are not expected to be extensive.

To better understand the magnitude of the potential impacts from the ICC's impervious surfaces, SHA developed a spreadsheet-based nonpoint source (NPS) pollutant load model in 2005 to estimate and compare annual pollutant loads for a variety of NPS pollutants for pre- and post-ICC land use conditions. A spreadsheet model was chosen over a dynamic simulation model due to its simplicity, defensibility, limited scope of study, and ultimate purpose. The model developed uses principles well-established in NPS modeling, including development of pollutant loads from urban and rural land uses on an annual load basis. The analyses performed focus on the corridor of land anticipated to be the ICC right of way (rather than the narrower limits of disturbance) under a build alternative and summarize the NPS pollutant loads for each of the major watersheds crossed by the build alternatives, e.g. Rock Creek, Anacostia River, and Patuxent River. Analyses were performed using representative alignments under study for Corridor 1 and Corridor 2. Post-construction conditions were modeled assuming all runoff from the ICC right-of-way would be treated with stormwater BMPs, which have a range of pollutant removal efficiencies, depending on the pollutant and type of BMP. The removal efficiencies used were derived from information in the National Pollutant Removal Performance Database – 2nd Edition (Winer, 2000). The pollutant removal rates used are assumed to be conservatively low because they do not account for the Lead Agencies commitment to exceed MDE's minimum stormwater management requirements or removal of pollutants associated with providing quantity control (Channel Protection Volume (Cpv)). In addition, benefits from Environmental Stewardship projects intended to remove pollutants from existing development are also not included in the modeling results. The results of this modeling are summarized in *Tables IV-58 through IV-61* and discussed below.

Table IV-58
Modeled Pollutant Loads to Rock Creek from the ICC Corridor

Pollutant	Annual Pollutant Load (lbs./year)								
	Corridor-1			Corridor-2a ¹			Corridor-2b ²		
	Existing	Future	Change	Existing	Future	Change	Existing	Future	Change
Fecal Coliform	18,056	18,004	-52	19,223	20,138	914	19,256	20,166	910
Total Suspended Solids (TSS)	59,537	25,089	-34,448	63,358	28,061	-35,297	63,412	28,101	-35,312
Total Nitrogen (TN)	1,612	1,358	-254	1,740	1,519	-221	1,742	1,521	-221
Total Phosphours (TP)	217	162	-55	232	181	-51	232	182	-51
Total Copper	5	45	40	5	50	45	5	50	45
Total Zinc	30	255	225	31	286	254	31	286	255

Source: SHA, *ICC Pollutant Load Study*, July 2005 (Revised November 2005)

Note: Modeling was conducted for representative alignments of Corridor 1 and Corridor 2 rather than all options and configurations. The model includes pollutant loads before and after construction of the proposed roadway is complete and does not include estimates of pollutant loads during construction.

¹C-2a includes the Corridor 2 alignment with Spencerville A, Burtonsville A and Fairland A options.

²C-2b includes the Corridor 2 alignment with Spencerville D, Burtonsville B and Fairland B options.

³Fecal coliform expressed in billion colonies/year. All other parameters are in lbs/ year.

Table IV-59
Modeled Pollutant Loads to the Anacostia River from the ICC Corridor

Pollutant	Annual Pollutant Load (lbs./year)								
	Corridor-1			Corridor-2a ¹			Corridor-2b ²		
	Existing	Future	Change	Existing	Future	Change	Existing	Future	Change
Fecal Coliform	31,524	35,781	4,257	27,764	34,801	7,036	32,536	38,320	5,784
Total Suspended Solids (TSS)	110,276	49,860	-60,416	114,901	48,495	-66,406	126,867	53,399	-73,467
Total Nitrogen (TN)	3,166	2,699	-467	3,086	2,625	-462	3,405	2,891	-515
Total Phosphours (TP)	407	322	-85	406	313	-93	451	345	-106
Total Copper	21	89	68	22	86	64	22	95	73
Total Zinc	125	507	383	118	494	375	121	543	422

Source: SHA, *ICC Pollutant Load Study*, July 2005 (Revised November 2005)

Note: Modeling was conducted for representative alignments of Corridor 1 and Corridor 2 rather than all options and configurations. The model includes pollutant loads before and after construction of the proposed roadway is complete and does not include estimates of pollutant loads during construction.

¹C-2a includes the Corridor 2 alignment with Spencerville A, Burtonsville A and Fairland A options.

²C-2b includes the Corridor 2 alignment with Spencerville D, Burtonsville B and Fairland B options.

³Fecal coliform expressed in billion colonies/year. All other parameters are in lbs/year.

¹C-2a includes the Corridor 2 alignment with Spencerville A, Burtonsville A and Fairland A options.

²C-2b includes the Corridor 2 alignment with Spencerville D, Burtonsville B and Fairland B options.

³Fecal coliform expressed in _ billion colonies/year _. All other parameters are in lbs/acre.

Table IV-60

Modeled Pollutant Loads to the Rocky Gorge from the ICC Corridor

Pollutant	Annual Pollutant Load (lbs./year)								
	Corridor-1			Corridor-2a ¹			Corridor-2b ²		
	Existing	Future	Change	Existing	Future	Change	Existing	Future	Change
Fecal Coliform	0	0	0	11,252	11,675	423	8,404	8,175	-229
Total Suspended Solids (TSS)	0	0	0	52,162	16,269	-35,894	37,848	11,391	-26,457
Total Nitrogen (TN)	0	0	0	1,306	881	-426	998	617	-381
Total Phosphorus (TP)	0	0	0	166	105	-61	123	74	-49
Total Copper	0	0	0	3	29	26	3	20	17
Total Zinc	0	0	0	13	166	152	12	116	104

Source: SHA, *ICC Pollutant Load Study*, July 2005 (Revised November 2005)

Note: Modeling was conducted for representative alignments of Corridor 1 and Corridor 2 rather than all options and configurations. The model includes pollutant loads before and after construction of the proposed roadway is complete and does not include estimates of pollutant loads during construction.

¹C-2a includes the Corridor 2 alignment with Spencerville A, Burtonsville A and Fairland A options.

²C-2b includes the Corridor 2 alignment with Spencerville D, Burtonsville B and Fairland B options.

³Fecal coliform expressed in billion colonies/year. All other parameters are in lbs/year.

Table IV-61
Modeled Pollutant Loads to the Upper Patuxent River from the ICC Corridor

Pollutant	Annual Pollutant Load (lbs./year)								
	Corridor-1			Corridor-2a ¹			Corridor-2b ²		
	Existing	Future	Change	Existing	Future	Change	Existing	Future	Change
Fecal Coliform ³	7,726	6,994	-732	8,344	7,641	-703	7,727	6,998	-729
Total Suspended Solids (TSS)	66,422	9,746	-56,801	67,448	10,647	-56,801	66,428	9,752	-56,676
Total Nitrogen (TN)	1,629	528	-1,085	1,661	576	-1,085	1,629	528	-1,102
Total Phosphorus (TP)	182	63	-119	188	69	-119	182	63	-119
Total Copper	22	17	-3	22	19	-3	22	17	-5
Total Zinc	129	99	-22	130	103	-22	129	99	-30

Source: SHA, *ICC Pollutant Load Study*, July 2005 (Revised November 2005)

Note: Modeling was conducted for representative alignments of Corridor 1 and Corridor 2 rather than all options and configurations. The model includes pollutant loads before and after construction of the proposed roadway is complete and does not include estimates of pollutant loads during construction.

¹C-2a includes the Corridor 2 alignment with Spencerville A, Burtonsville A and Fairland A options.

²C-2b includes the Corridor 2 alignment with Spencerville D, Burtonsville B and Fairland B options. ³Fecal coliform expressed in billion colonies/year. All other parameters are in lbs./year.

Overall, the addition of the ICC affects pollutant loads to all of the modeled watersheds in a similar manner for Corridors 1 and 2, with the exception of the Rocky Gorge watershed and a somewhat different pattern in the Upper Patuxent watershed. In all watersheds, the conversion of existing land uses to highway in both Corridor 1 and Corridor 2 resulted in a reduction in lbs./year of total suspended solids (TSS), total nitrogen (TN), and total phosphorous (TP) over the current condition. In general, Corridor 2 showed the greatest degree of reduction in these pollutants, though which of the Corridor 2 scenarios lowers loads the most varies depending on the degree to which that scenario crosses the modeled watershed. In contrast to TSS, TN and TP, total zinc and total copper were seen to increase consistently with Corridors 1 and 2 for all watersheds but the Upper Patuxent, with Corridor 2 once again showing the greatest increases. In the Upper Patuxent watershed, all of the pollutants modeled, including copper and zinc, showed a reduction in lbs./year after the ICC is constructed.

Intuitively, if a highway runoff pollutant load event mean concentration, after treatment in a BMP, is less than that of the predevelopment land use within the right of way strip, then the load associated with that pollutant would decrease with conversion of the existing land use to highway land use. For example, fecal coliform loads from highway land use are less than that from any other existing urbanized land use in the right of way strip; therefore, highway conversion of urbanized land use in that strip causes a reduction in fecal coliform loads. Highway conversion of forested land use has the opposite effect on fecal coliform loads.

Similarly, zinc and copper are higher for highways than other land uses in the right-of-way, resulting in an increase in loads of these constituents with the ICC in all watersheds but the Upper Patuxent. In the Upper Patuxent, zinc and copper are reduced by the ICC because the majority of the existing land use in the right of way is highway without BMP treatment of runoff. Construction of the ICC and associated BMPs will allow for treatment and removal of existing pollutant loads such that the zinc and copper in the runoff from the ICC after treatment would be less than exists in current runoff. In summary, while the modeling did show both increases and decreases of specific pollutant loads in various watersheds, the overall finding was that pollutant loads from the roadway corridor would not substantially change existing water quality conditions in the major watersheds crossed by the ICC.

The ICC, including state of the art stormwater management that exceeds MDE requirements, is expected to reduce pollutant loads for a number of pollutants that are known to adversely affect receiving stream water quality, including TSS, TP, and TN. Each of the pollutants studied are foes of receiving stream water quality and ultimately of the Chesapeake Bay. Some pollutants, including soluble forms of metals, e.g. copper, lead and zinc, are known or expected to increase with highway conversion of land use from almost any existing land use. While total metals are typically reduced through BMPs as metals bound to sediment are trapped in the facility, soluble metals are not typically removed efficiently through conventional BMPs. However, the soluble portion of total metals in runoff is relatively low. How soluble metal concentrations in ICC stormwater runoff will be affected by the BMPs planned for the ICC and whether or not soluble metals in BMP effluent will exceed federal drinking water standards is difficult if not impossible to predict with reasonable certainty.

Avoidance, Minimization, and Mitigation

Considerable efforts to avoid and minimize negative effects on water quality have been undertaken since the development of the preliminary alternatives. The north-south orientation of most of the study area streams makes complete avoidance impossible. Direct impacts to streams have been reduced by alignment shifts and the replacement of culverts with bridges where practicable. Specific changes made at major stream crossing are discussed in detail in **Chapter IV.F.6.b Avoidance, Minimization and Mitigation**.

Erosion and sediment control during construction as well as SWM techniques to treat runoff over the long-term are the most important minimization efforts in relation to chemical water quality. These techniques would help to reduce the effects of direct and indirect impacts, including preventing further chemical impairment of waterways listed as requiring TMDLs. SWM techniques would be implemented in accordance with the MDE requirements (MDE, 2000) for both quantity and quality of stormwater and in some cases special “enhancements” would be used to provide additional water quality benefits. The techniques that would be used for the ICC would be grassed swales, infiltration and filtration practices, ponds, underground storage, and other BMPs. As discussed in **Chapter IV.F.6.b Avoidance, Minimization and Mitigation**, effective treatment is provided by filtration of sheet flow in vegetated areas as well as check dams that provide filtration, infiltration, and nutrient uptake. Metals and organic chemicals are removed through adsorption to the roots of vegetation as the water filters through the soil.

In the Rocky Gorge watershed, retention and detention SWM facilities would be equipped with spill controls to protect the public drinking water supply. These controls would include excess storage, emergency shutoff valves and public spill control response plans. In other watersheds, a combination of filtration/infiltration would be used wherever feasible. In temperature sensitive watersheds such as Paint Branch and Upper Rock Creek, SWM facilities would be designed to infiltrate a portion of the heated runoff and allow for underground cooling. For more information on sediment and erosion control, SWM and other avoidance and minimization techniques for surface water resources refer to the discussion in *Chapter IV.F.6.b*.

c. Reservoirs

Impacts

The No-Action Alternative would have no ICC project related impact on reservoir water quality.

Corridor 1 would not have a direct impact on the Rocky Gorge Reservoir, as it does not cross the Reservoir or its tributaries. Corridor 2 would cross several tributaries to Rocky Gorge Reservoir and could potentially have a range of impacts to water quality. As characterized in *Chapter II.E.5.c (Affected Environment)* the Rocky Gorge Reservoir already suffers from a number of water quality impairments. The direct and indirect impacts to streams and the watershed from the ICC could further impair water quality in the reservoir. Direct impacts to streams in the Rocky Gorge watershed are discussed in *Chapter IV.F.7.a* and could include between 6,806 and 11,331 linear feet of stream channel alteration, depending on which options are selected within Corridor 2. The greatest impact to reservoir tributaries would be from any Corridor 2 configuration that includes Burtonsville Option B (*Appendix A, Plates 58-68*) due to this option's proximity to the reservoir (approximately 1,000 feet at its closest).

Under Corridor 2, some degree of reservoir capacity could potentially be lost over the life of the Reservoir due to sediment-laden stormwater entering the Rocky Gorge Reservoir tributaries both during and after road construction. Stormwater management on the ICC, while not 100-percent effective, will greatly reduce the impacts of stormwater, which when not treated, can cause streambed and streambank erosion as well as transport and deposition of sediment into the reservoir. Over the long-term, sediment deposited in the reservoir from the surrounding watershed, as well as the ICC, would reduce its water storage capacity. Increased suspended solids from runoff can raise the turbidity levels, which can increase physical and chemical treatment requirements. In addition, increased water turbidity is often indicative of elevated bacteria concentrations (MDE, 2004). As presented in the Avoidance and Minimization discussion immediately following the discussion of impacts, stormwater impacts will be minimized to the greatest extent possible through the use of SWM practices. Though impacts from sedimentation to the reservoir from the ICC remain a major concern for WSSC, the reservoir operator, the basic pollutant load modeling that was performed by SHA (discussed below) does not indicate that major sedimentation would be expected from the ICC. However, the potential for increased runoff and some associated sedimentation impacts cannot be completely avoided.

For existing state roads within one mile of the reservoir, SHA has modified herbicide application procedures and would follow these same guidelines for the ICC. Vegetation control through use of herbicides would be limited to application in localized areas with Roundup®, which is used in sensitive areas, as it has no residual effects. No broadcast spraying of herbicides would be conducted in areas near the reservoir.

Throughout the design process, the Lead Agencies would work with WSSC, MDE, and other stakeholders to continue to minimize potential impacts to the reservoir from Corridor 2.

d. Scenic and Wild Rivers

Impacts

The No-Action Alternative would have no ICC project related impact on State-listed scenic and wild rivers within the study area. There are no Federal wild and scenic rivers in the study area.

Both of the Build Alternatives have the potential to impact tributaries of the Montgomery County portion of the Potomac River and the Anacostia and Patuxent Rivers; all parts of which are designated as State-listed scenic and wild rivers. No stream channel impacts are anticipated in the Muddy Creek watershed, which drains to the scenic portion of the Potomac. Corridor 1 would impact between 24,413 and 30,288 linear feet of stream channel in the Anacostia watershed drainage and 910 linear feet in the Patuxent watershed drainage. In addition, six new bridge crossings over Anacostia tributaries are also proposed under Corridor 1.

Corridor 2 would impact from 9,119 to 18,429 linear feet of stream channel in the Anacostia watershed and 910 linear feet in the Patuxent watershed. Three new bridge crossings of Anacostia tributaries and one new bridge over a Patuxent tributary are proposed under Corridor 2. More information on direct impacts from crossings of these tributaries is presented in **Chapter IV.F.5.a.**

Prior to the implementation of either of the Build Alternatives, project plans would be provided to the DNR for review in compliance with the Maryland Scenic and Wild Rivers Act. DNR will evaluate whether project related changes to the streams and related land resources affect the overall character of the designated rivers in such a way as to jeopardize the scenic value of the resource. Coordination with DNR over potential impacts to Indian Creek, Little Paint Branch, Paint Branch, Northwest Branch, unnamed Patuxent River tributaries, Bear Branch, and Walker Branch is ongoing during all phases of the project.

Avoidance, Minimization, and Mitigation

Direct impacts to tributaries of the Montgomery County portion of the Potomac River and the Anacostia and Patuxent Rivers associated with ICC corridors have been avoided and minimized wherever possible during preliminary design. Avoidance and minimization measures have included replacing culverts with bridges, lengthening bridges to reduce impacts to the stream and floodplain, and minimizing the roadway section wherever feasible. Coordination with DNR and efforts to reduce impacts further would continue throughout future project design phases.

6. Aquatic Biota

a. Impacts

The No-Action Alternative would have no ICC project related impact on the aquatic biota of the study area watersheds.

Both Build Alternatives, Corridor 1 and Corridor 2, have the potential to affect aquatic biota in the study area. Two primary types of impacts could occur if either of the Corridors is selected: direct impacts and indirect impacts, as discussed below.

Due to the unique habitat and water quality requirements of the brown trout in Paint Branch, specific project related changes that could affect this population are discussed in a separate section following discussion of the direct and indirect impacts to other aquatic biota in the study area.

Direct Impacts

In accordance with the Clean Water Act, direct impacts to stream channels require a Section 404 permit from the USACE. In addition, a Section 401 water quality certification from MDE is the means by which the State of Maryland communicates its finding that anticipated discharges from the project will comply with federally-mandated water quality standards. A waterway construction permit from MDE will also be required for work in streams and floodplains. As discussed in detail in *Chapter IV.F.5 Surface Water Resources*, and shown in *Table IV-54*, the implementation of Corridor 1 would result in direct impacts to between 32,667 and 39,158 linear feet of stream channel depending on which options are selected, while Corridor 2 would impact between 24,525 and 37,584 linear feet.

In recent years, culvert bottoms or inverts are most often installed below the base invert of the stream channel to allow for replacement of a natural stream bottom within the culvert, minimizing long-term impacts to aquatic habitat. During construction, the stream channel is excavated and any organisms living within the stream channel would be displaced or crushed by construction equipment. The primary impact from this activity would be to benthic organisms, such as macroinvertebrates, that are relatively stationary. However, fish mortality is also a possibility as they can be trapped in pools during dewatering of the channel. Although a natural stream bottom would be reestablished within the culvert, the habitat within the culvert is unlikely to support the same fish or macroinvertebrate community present before construction, as the same habitat niches are unlikely to exist. Culverts are relatively straight and typically do not allow for the development of the varied habitat of an unrestrained channel, where deep pools or meanders, overhanging roots, and a variety of flow patterns in riffles allows for a wider variety of habitat niches. In the majority of the impacted streams, the area of channel disturbance is relatively small in comparison to the remaining habitat available, making the overall habitat and mortality impact a small one. However, the smaller the stream, the greater the relative impact to aquatic biota. A greater relative impact in smaller streams can also occur as much of the nutrient processing and ecosystem support that maintain the health of aquatic resources in larger streams occurs in these headwater areas (Meyer, et al., 2003).

The potential direct impacts discussed in this section represent considerable avoidance and minimization efforts. While complete avoidance of stream channel impacts is not possible due to the perpendicular orientation of many of the streams across the corridors and the limited opportunities for alignment shifts in a developed landscape, impacts have been minimized substantially from those represented in preliminary alternatives. Avoidance and minimization of stream impacts employed to date, as well as future efforts to reduce impacts further, are discussed in more detail in *Chapter IV.F.7 Waters of the U.S. Including Wetlands*.

Indirect Impacts

Although the direct and indirect impacts from stream crossings have the potential to cause negative impacts to aquatic biota, perhaps the greatest potential negative effects are related to the change in land-cover associated with either of the Build Alternatives. Both Corridors 1 and 2 would require clearing of forested land in stream valleys that currently provide vital shading of streams, important food and habitat sources from organic detritus and coarse woody debris and anchoring of stream banks and floodplains. Some of this clearing would be a temporary impact related to construction of the road. In these cases, disturbed areas would be revegetated and eventually would provide shade to the stream again. Other temporary impacts to aquatic biota related to construction would include the potential for unintentional sediment discharges that degrade aquatic habitat and impair aquatic communities as described in *Chapter IV.F.5.b Water Quality*.

While indirect impacts cannot be specifically quantified, a qualitative assessment of the magnitude of potential indirect impacts can be made through a quantification of direct land use changes from construction of the roadway. The most substantial and long-term change from either of the corridors would be an increase in impervious surfaces within the study area. A recent report by the Center for Watershed Protection (CWP) summarized the numerous scientific studies that have identified and attempted to quantify the effects of impervious surfaces on aquatic systems (CWP, 2003). Based on data gathered over many years and from many regions across the Country, it is clear that the conversion of open-space and forested areas to impervious surfaces required for construction of the ICC has the potential to have a wide range of impacts on study area streams and their inhabitants. While individual streams have different capacities to buffer the effects of impervious cover, "the scientific literature generally shows that aquatic insect and freshwater fish diversity declines" in watersheds at 10 to 15 percent impervious cover, with sensitive elements of the communities being affected at around even lower impervious levels (CWP, 2003). The changes wrought by impervious cover can affect many aspects of the aquatic system.

Two primary categories of impacts can occur from increases in impervious surfaces that affect aquatic biota: flow related/physical impacts and chemical impacts. The impacts in both of these categories, which are discussed in more detail in Chapter IV.F.5, can in turn, dramatically impact aquatic communities. Table IV-62, which is adapted from the CWP report, summarizes some of the numerous potential changes to streams linked to impervious surfaces and how they can affect the aquatic community.

Table IV-62

Summary of Potential Impacts to Aquatic Biota from Increased Impervious Cover

Stream Change	Effects on Aquatic Biota
Flow Related/Physical Impacts	
Increased flow volumes/Channel forming storms	Alterations in habitat complexity Changes in availability of food organisms Reduced prey diversity Secur related mortality Long-term depletion of large woody debris Accelerated streambank erosion
Decreased base flows	Crowding and increased competition for foraging sites Increased vulnerability to predation Increased fine sediment deposition
Increased sediment transport	Reduced survival of eggs and fry; loss of spawning habitat due to deposition Reduced macroinvertebrate reproduction from siltation of pools
Loss of pools and riffles	Shift in balance of species due to habitat change Loss of deep water cover and feeding areas
Changes in substrate composition	Reduced survival of eggs Loss of inter-gravel fry refugia Reduced aquatic insect production
Loss of large woody debris	Loss of cover from predators and high flows Reduced sediment and organic matter storage Reduced pool formation and organic substrate for macroinvertebrates Loss of spawning habitat for adults Inability to reach over-wintering sites Loss of Summer rearing habitat Increased vulnerability to predation
Creation of fish blockages	
Chemical Impacts	
Increase in temperature	Changes in migration patterns Increased metabolic activity, increased disease and parasite susceptibility Increased mortality of sensitive fish Reduced survival of eggs and fry
Reduction in water quality	Acute and chronic toxicity to juveniles and adult fish Loss of sensitive species Increased physiological stress
Increased turbidity	Reduced survival of eggs Reduced plant productivity Physiological stress on aquatic organisms
Algae blooms	Oxygen depletion due to algal blooms Increased eutrophication rate of standing waters

Source: Center for Watershed Protection (CWP) 2003

Often impacts from imperviousness are most apparent in the macroinvertebrate community. Macroinvertebrates are relatively immobile and are quickly affected by habitat impacts such as bank erosion, sedimentation, and channel bed instability. They are unable to move from unstable stream sections and seek refuge in more stable habitat during high flows. For this reason, and also because they represent a large portion of the base of the stream food chain, declines or changes in macroinvertebrate abundance and diversity are often an early signal of watershed impacts. Research has shown that a sharp drop in aquatic insect communities occurs around the 10 to 15 percent impervious threshold, but a number of studies have shown notable changes in the community at much lower thresholds of six to ten percent (CWP, 2003).

While fish are more mobile than macroinvertebrates and can sometimes avoid short-term water quality or flow impacts, long-term changes in flow regime and habitat from imperviousness has been documented across the Country. Sensitive fish such as brown trout, sculpin, and other

species that require clean and stable stream substrates for feeding and spawning are typically lost around the 10 percent imperviousness threshold, while broader overall declines in the community are documented in the 10 to 15 percent imperviousness range (CWP, 2003).

The majority of the impacts to aquatic habitat are already evident to varying degrees in the study area watersheds. In general, the watersheds with high percentages of impervious surfaces had more impaired aquatic communities. Additional impervious surfaces from implementation of the ICC could add to existing impairment, though the degree of impact cannot be specifically quantified. The impact in many areas may be minimal due to the relative size of additional imperviousness to the size of the watershed, or the quantity of existing imperviousness. However, in some watersheds where impervious cover is near the 10 to 15 percent threshold, additional impervious area from the ICC could be the change in a long series of incremental changes that leads to considerable declines in the quality of aquatic habitat and communities.

Table IV-55 summarizes the additional area of impervious surface in each watershed that would result from each corridor and estimates of resulting watershed impervious percentages are provided in **Chapter IV.F.5.C (Surface Water Quality)**. Impervious impacts are provided at the more detailed subwatershed level in **Appendix L**. Corridor 2 with Rock Creek Option C (with Old Mill Run Grade Separation), Norbeck Option B, Spencerville Option C, Burtonsville Option A, and Fairland Option B, and termination at US Option 1 would result in the highest amount of new impervious surface (408.9 acres), while Corridor 1, with Rock Creek Option A, Northwest Branch B without Interchange at Layhill Road, and termination at I-95 would result in the least (340.5 acres).

Muddy Branch Watershed

Both Corridor 1 and 2 (**Appendix A, Plate 1**) would impact Muddy Branch watershed equally. An additional 0.1 acre of impervious surfaces would be created within the watershed. This watershed has the least increased impervious surfaces within the study area and should have the most minimal aquatic biota impacts. The existing aquatic community has experienced serious degradation from the high amounts of impervious surfaces already within the watershed. The fish and macroinvertebrate communities are considered Poor but the aquatic habitat is still in the Good/Fair range. While the increase from the ICC is small, an increase in the impervious surfaces contribute to flashy flows and contribute to the continued degradation of the aquatic habitat.

Upper Rock Creek Watershed

Corridor 1 and 2 would have the same impacts on the Upper Rock Creek watershed from 42.0 to 59.2 to 64.4 acres depending on the Upper Rock Creek Option (**Appendix A, Plates 3-11**) selected. The quality of aquatic biota in these subwatersheds varies greatly. The Mill Creek subwatershed has a high percentage of existing impervious cover, resulting in Poor macroinvertebrate and fish communities. Increased impervious area may result in further pollutant loads and an even more impacted benthic community. Within the Upper Mainstem, high quality aquatic biota has been preserved through lower density development and good SWM practices. An increase in impervious cover may reduce the high quality of these communities without adequate stormwater protection. A higher amount of impervious cover is

associated with Option C, therefore, resulting in greater amounts of impacts to aquatic biota quality with this option.

North Branch Rock Creek Watershed

Corridor 1 (*Appendix A, Plates 12 -14*) and Corridor 2 would both increase impervious area within North Branch Rock Creek watershed by 39.9 acres. These impacts would occur in the Lower North Branch B, Brooke Manor, and Manor Run subwatersheds. Within Corridor 2, the Norbeck A and Norbeck B (*Appendix A, Plates 41 and 44*) options result in the same amount of impacts to the Brooke Manor and Manor Run subwatersheds. The Manor Run subwatershed has some of the most impaired biological communities within the North Branch, which correlates with its higher percent of impervious coverage. The increase in impervious areas may further impact the aquatic biota within Manor Run. Impacts from either corridor in the North Branch Rock Creek watershed could negatively affect the State-threatened comely shiner, which was recorded in the watershed in 1995. Measures stipulated by DNR to minimize the potential impact to the species are discussed below and in *Chapter IV.F.10, Rare Threatened and Endangered Species*.

Northwest Branch Watershed

Within this watershed, Corridor 1 (*Appendix A, Plates 15 - 25*) would result in more new acreage of impervious cover, from 84.9 to 94.6 acres, than Corridor 2. With the exception of Batchellor's Forest Tributary, all of the subwatersheds within the Northwest Branch watershed are above the 10 percent impervious threshold and have variable aquatic resource conditions. The additional impervious cover in the Batchellor's Forest Tributary, which is reported at seven percent impervious in the CSPS (MCDEP,1998), may initiate more widespread degradation of aquatic conditions in the subwatershed. Impacts from Corridor 1 in the Northwest Branch watershed could negatively affect the State-threatened comely shiner, which was recorded in close proximity to Corridor 1 in 2001. Measures to minimize the potential impact to the species have been included in the project and are discussed below and in *Chapter IV.F.10*.

New impervious areas for Corridor 2 (*Appendix A, Plates 41 – 52, 54, 56, 58, 60, 62, 64 and 66*) would range from 73.2 acres to 80.2 acres. The Bryants Nursery Tributary has approximately seven percent impervious cover and has relatively high quality aquatic resources. Additional impervious cover will push this level closer to the 10 percent impervious threshold (approximately nine percent)and may initiate degradation within the subwatershed. Impacts to downstream water quality from Corridor 2 in the Northwest Branch watershed could negatively affect the State-threatened comely shiner, though potential impacts would be expected to be less than those for Corridor 1 as Corridor 2 is considerably upstream of known populations.

Paint Branch Watershed

New impervious areas provided by Corridor 1 (*Appendix A, Plates 25-28*) within Paint Branch would total 39.2 acres. The aquatic resources within Paint Branch are considered the best quality within the study area. High quality macroinvertebrate communities are found throughout the watershed with the best being found in the Good Hope Tributary. Impacts to the brown trout community are discussed in detail below.

Corridor 2 would have a wide range of possible impervious impacts for the Paint Branch, from 0.4-acre to 35.6 acres.

Paint Branch Trout

Selection of a Build Alternative for the ICC has the potential to negatively affect the Paint Branch brown trout population. Paint Branch's wild trout-supporting capacity is governed primarily by groundwater, its baseflow-sustaining seepage into the channel, and the resultant cooling of warm season temperatures. The groundwater-baseflow-thermal system of the stream forms the most limiting factor for trout. In addition, the incremental development in the watershed that has contributed to habitat impacts such as channel widening, loss of spawning habitat, and temperature increases has highlighted the role that watershed land use plays in the maintenance of the population. The recent decline in the trout population has only served to demonstrate the narrow threshold of conditions that had provided for the relative stability of the trout in the last two decades, and directly illustrate how crucial protecting the Paint Branch watershed's thermally buffered baseflow system is to the sustainability of the brown trout.

Direct Impacts

Direct impacts from the ICC that could affect the brown trout are primarily related to stream crossings. As shown in **Table IV-54**, Corridor 1 would impact 1,478 linear feet of stream channel in Paint Branch, while Corridor 2 would impact between zero and 1,144 linear feet, depending on which Spencerville and Burtonsville Options are chosen.

Impacts along Corridor 1 are related to culverts over small first order tributaries to Good Hope Tributary, and the Upper Mainstem. These smaller streams where impacts are likely to occur on Corridor 1 are not known to provide key trout habitat, although they are important in the overall water quality and biology of the Paint Branch system that support the trout. The main channels of Good Hope Tributary, Gum Springs Tributary, and the Upper Paint Branch Mainstem would be bridged, thus avoiding the direct affects to the stream channel that a culvert would cause. Stream channel impacts in Corridor 2 would be associated with crossings of headwater tributaries to the Upper Left Fork on Spencerville Options A, B and C. The greatest potential impact to the Left Fork would occur with the combination Spencerville C and Burtonsville A. Two of the options, Burtonsville Options A and X, would also cross the Right Fork tributary, but a bridge has been proposed for this crossing, thus avoiding direct stream channel impacts. All impacts to Paint Branch stream channels on Corridor 2 occur outside of the highest quality trout habitat areas.

Indirect Impacts

While direct impacts to trout habitat are relatively small due to the bridging of the major stream channels, indirect impacts have the greatest potential to negatively affect the trout. Both ICC Corridors 1 and 2 would require the introduction of new impervious surfaces into the Paint Branch watershed. As discussed in **Chapter IV.F.5**, numerous studies have linked the relative presence of impervious surfaces to watershed degradation and in particular to the decline of sensitive species such as trout. Increasing watershed imperviousness, unless mitigated, could adversely affect Paint Branch's trout producing capacity, primarily by decreasing groundwater recharge, decreasing baseflow, and increasing warm season temperatures of the stream. This

would hamper trout via thermal stress and by exposure to predators that shallowness causes. The thermal change would also further disadvantage trout in competitive relationships with the many other fish inhabiting the stream. Increasing land imperviousness could also lead to additional channel erosion and sedimentation from larger and more frequent peak stream flows that would further degrade trout habitat. The negative impact of these factors has already been seen in the resource in recent years due to the combination of successive droughts and increasing watershed imperviousness that has led to the low point in the population, documented in 2003 by MCDEP and MDNR. The additional area of impervious surfaces that would be added to the watershed of Upper Paint Branch and its tributaries from each of the corridors is summarized in *Table IV-63*. As shown in the table, Corridor 1 would introduce approximately 39.2 acres of new pavement into the Paint Branch watershed, with the greatest amount of impervious area added to the Good Hope subwatershed followed by the Mainstem. Under Corridor 2, only the Right Fork and Left Fork tributaries would be affected, with impacts ranging from 0.4-acre of new impervious area in the Left Fork and zero acres in the Right Fork, to 23.3 acres and 12.3 acres in the Left and Right Forks, respectively.

As discussed previously, many of the Paint Branch tributaries are already at or above the 10 percent impervious threshold, beyond which substantial degradation of aquatic systems could be expected. *Table IV-64* summarizes existing imperviousness in the Paint Branch SPA and presents projected imperviousness resulting from the ICC Corridors in each of the tributary subwatersheds.

As illustrated in *Table IV-64*, Corridor 1 has the greater potential to negatively affect the critical spawning and nursery habitat of the Gum Springs, and to a lesser degree, Good Hope tributaries. In both of these tributaries, the existing imperviousness may already have negatively affected the trout, as the recent declines appear to indicate that current watershed conditions compound the effects of catastrophic events such as the climactic extremes of the last few years to such an extent that the long-term viability of the population is uncertain. The additional imperviousness proposed under Corridor 1 could add to the existing stressors in the system as follows: potential thermal impacts, reduction of groundwater baseflows that help maintain the cold-water fishery, increased peak stormflows, and additional sediments during construction that would further degrade limited suitable spawning habitat. However, these potential effects would be greatly mitigated by the SWM and other techniques discussed in *Chapter IV.F.5.a* that have been specifically designed to reduce these impacts. While new impervious areas under Corridor 2 also have the potential to measurably raise the impervious percentages in Paint Branch tributary subwatersheds and impact the quality of the resource, potential impacts to the trout population are substantially less than those possible under Corridor 1. The Left Fork tributary, one of the two subwatersheds impacted by Corridor 2, appears to provide very little suitable habitat for trout, as MCDEP monitoring since 1994 only documented trout in the Left Fork in the first two years of sampling. The Right Fork tributary provides more habitat than the Left Fork; however, monitoring has indicated that it is far less productive a habitat than Good Hope tributary. In addition, the majority of the viable trout habitat in the Right Fork is well downstream of the potential Corridor 2 impact areas, while Corridor 1 is in close proximity to the areas of greatest trout production and habitat quality.

Table IV-63
Acres of New Impervious Cover in the Paint Branch Special Protection Area

Alignment Section ¹	Paint Branch Watersheds					
	Good Hope	Gum Springs	Left Fork	Right Fork	Mainstem	Total
No-Actions	-	-	-	-	-	-
Corridor 1						
Mainline	18.5	6.2	-	-	12.8	39.2
Corridor 2 Options						
Spencerville Option A- with Burtonsville Option A	-	-	16.6	12.3	-	28.9
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	-	-	14.3	-	-	14.3
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	-	-	14.5	-	-	14.5
Spencerville A- with Burtonsville X	-	-	18.5	10.9	-	29.4
Spencerville B- with Burtonsville A	-	-	16.7	12.2	-	28.9
Spencerville B- with Burtonsville B	-	-	13.8	-	-	13.8
Spencerville B- with Burtonsville X	-	-	18.4	10.9	-	29.3
Spencerville C- with Burtonsville A	-	-	23.3	12.3	-	35.6
Spencerville C- with Burtonsville B	-	-	12.8	-	-	12.8
Spencerville D- with Burtonsville B	-	-	0.4	-	-	0.4

¹ Only those alignment sections that cross the Paint Branch watershed are included in this table.

Little Paint Branch Watershed

Corridor 1 (*Appendix A, Plates 28-32, 35*) would have the greatest potential for new impervious cover in Little Paint Branch watershed, at 55.7 acres. The quality of the aquatic resources within these subwatersheds varies between "Poor" and "Good" and all are above the 10 percent impervious cover threshold level. Additional impervious cover may further degrade the existing aquatic biota.

Corridor 2 would have new impervious surfaces 10.1 acres and 12.9 acres within Fairland Option A and Fairland Option B (*Appendix A, Plates 77-78 and 80-81*), respectively. Currently, the McKnew Park Tributary has less than 10 percent impervious cover but the aquatic resources within it are rated as "Poor". This suggests other land use parameters may be negatively affecting the biotic communities and may be further stressed by the addition of more impervious areas. Indirect impacts from both Corridors in the Little Paint Branch watershed could negatively affect the State-threatened comely shiner, though recorded populations are outside of direct impacts areas.

Table IV-64
Percent Impervious Cover resulting from the ICC Corridors in the Paint Branch SPA

Paint Branch Watersheds						
Alignment Section ¹	Good Hope	Gum Springs	Left Fork	Right Fork	Mainstem	Total within SPA
Existing Imperviousness ²	10.4	15.6	13.1	11.56	12.9	12.6
No-Action	10.4	15.6	13.1	11.56	12.9	12.6
Corridor 1						
Baseline Alignment	12.3	16.5	-	-	14.8	13.3
Corridor 2 Options						
Spencerville A- with Burtonsville A	-	-	14.3	12.7	-	13.2
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	-	-	14.1	-	-	12.9
Spencerville A – with Burtonsville D (ICC over Good Hope Road)	-	-	14.2	-	-	12.9
Spencerville A – with Burtonsville X	-	-	14.4	12.6	-	13.2
Spencerville B – with Burtonsville A	-	-	14.3	12.8	-	13.2
Spencerville B with Burtonsville B	-	-	14.1	-	-	12.8
Spencerville B – with Burtonsville X	-	-	14.5	12.6	-	13.2
Spencerville C – with Burtonsville A	-	-	14.8	12.8	-	13.3
Spencerville C with Burtonsville B	-	-	14.1	-	-	12.8
Spencerville D with Burtonsville B	-	-	13.2	-	-	12.6

¹ Only those alignment sections that cross the Paint Branch watershed are included in this table.

² Existing imperviousness is based on MNCPPC calculations for development as of 2001.

Indian Creek Watershed

New impervious surfaces within Indian Creek would range from 47.4 acres to 83.7 acres depending on which I-95 Interchange Option is selected. (*Appendix A, Plates 32-34, 36-37 and 40*) The greatest impacts are attributed to I-95 Interchange Option A (terminate ICC at US 1).

Aquatic resources within most of Indian Creek are considered “Poor” and are substantially impacted by the historic and current mining. The addition of impervious surfaces may further degrade this already impacted community.

Corridor 2 (*Appendix A, Plates 40, 78-79 and 82-85*) would have greater total impervious surface, from 76.6 to 105.9 acres, than Corridor 1. These impacts would occur in the Mainstem above the I-95 subwatershed that is impacted by mining and has “Poor” aquatic resources.

Rocky Gorge Watershed

No new impervious surfaces, associated with Corridor 1, would be located within the Rocky Gorge watershed.

Impervious surface increases would range from 54.7 acres to 86.6 acres for Corridor 2 (*Appendix A, Plates 52, 54, 56-57, 66-77, and 80*). Although the fish communities are considered “Poor” due to the small stream sizes, the subwatersheds within the Rocky Gorge watershed contain relatively high quality macroinvertebrate communities. All of the subwatersheds within the Rocky Gorge watershed currently have less than 10 percent impervious cover. Additional impervious cover may seriously impact these small, steep watersheds and cause degradation of the aquatic community.

Upper Patuxent River Watershed

Corridor 1 (*Appendix A, Plates 37-39*) and Corridor 2 (*Appendix A, Plates 80-81*) would both have new impervious areas ranging from 14.1 to 14.3 acres. The aquatic resources within Bear Branch and Walker Branch are generally considered “Poor” and may experience further stress associated with these impacts.

b. Avoidance, Minimization, and Mitigation

While the effects of imperviousness on aquatic habitat and biota cannot be completely avoided by the project, the Lead Agencies have undertaken extensive efforts to avoid and minimize these potential affects. These measures are discussed below.

Direct Impact

Some degree of impact to aquatic biota within the study area is unavoidable if a Build Alternative is selected. However, considerable effort to avoid and minimize potential direct impacts has taken place throughout the planning process to date, and will continue as the project moves forward to more detailed stages of design. The Lead Agencies have worked closely with regulatory agencies and resource managers to identify sensitive aquatic resources and determine potential minimization techniques. Agency recommendations have been evaluated on both an engineering and cost effectiveness basis and implemented wherever possible. Efforts to avoid and minimize direct impacts to stream channels have included alignment shifts, replacement of culverts with bridges where practicable, and reductions in overall roadway section width at stream crossings where safety considerations allow. Specific changes made at each major stream crossing are discussed in more detail in *Chapter IV.F.7 Waters of the U.S. Including Wetlands*.

In areas where culverts are planned, buried culverts will be used in accordance with MDE requirements wherever feasible to maintain natural stream substrate within the culvert. Culverts will be designed with the specific geomorphic characteristics of the stream in mind to avoid downstream scour and to control ongoing degradation that can create fish blockages. The Lead Agencies have worked closely with local and state resource managers to identify culvert crossings where fish passage is of particular concern and where additional measures beyond those required by MDE may need to be investigated when culverts are designed. Bridge lengths

have been expanded at many crossings to avoid future conflicts with natural stream channel migration within floodplains, which will reduce erosion and the subsequent requirements for future habitat disturbances to protect bridge abutments.

All in-stream work for culverts and bridges will be carried out in compliance with MDE requirements related to State-mandated stream closure periods for the designated use class of the stream, which is administered by MDE. In-stream work is prohibited in Use I streams from March 1 through June 15, Use III streams from October 1 through April 30, and Use IV streams from March 1 through May 31, for the protection of aquatic species. A special closure period has been recommended by DNR as the agency responsible for protection of the state-threatened comely shiner. The closure period has been recommended for North Branch Rock Creek, Northwest Branch and Little Paint Branch from April 15 through July 31. Other measures recommended by DNR to protect the species, which include the use of “best management practices” (BMPs) for erosion control, on-site environmental inspectors to ensure erosion and sediment control compliance, and improvements to existing water quality and stream channel degradation in these watersheds through mitigation and environmental stewardship, are already included in project plans.

During in-stream construction, the Lead Agencies have successfully provided fish relocation from dewatered work areas on other projects, considerably reducing construction related fish mortality. On this project, SHA will employ these and other methods to continue to reduce impacts to aquatic biota wherever possible in all stages of the project. Unavoidable direct impacts to stream channels will be mitigated in accordance with State and Federal regulations through projects aimed at improving water quality. Mitigation for stream channel impacts is discussed in detail in *Chapter IV.F.5 Surface Water Resources*.

Indirect Impacts

Indirect impacts will also be minimized substantially through strict adherence to, and in some areas surpassing mandated sediment and erosion control and SWM requirements. Sediment and erosion control will be implemented in compliance with MDE regulations, with redundancy of controls in sensitive areas, to eliminate potential control failures that could deliver sediment-laden runoff to streams. During construction of stream crossings, an environmental inspector will be on-site to ensure proper sediment control compliance. Use of such inspectors has greatly reduced unintentional sediment discharges and other construction related impacts on recent SHA projects.

SWM will be developed in compliance with all applicable MDE regulations, guidance, and 2000 *Maryland Stormwater Design Manual* (MDE, 2000). As discussed in *Chapter IV.F.5 Surface Water Resources*, the Lead Agencies have initiated a watershed approach to SWM design for the ICC, taking specific watershed characteristics or sensitive resources into account when setting management priorities. In addition, the Lead Agencies have committed to exceed minimum regulatory requirements and provide water quality control for the 1.5-inch rainfall event rather than the 1.0-inch storm, which is required. While the success of mitigating biological effects from impervious surfaces with stormwater treatment has not been studied comprehensively, some studies show a partial mitigating effect on biological degradation (CWP, 2003). However,

most of the studies have been conducted on older stormwater SWM techniques that were designed only to maximize pollutant removal and not necessarily incorporate downstream channel protection (CWP, 2003). The newer techniques to be used on the ICC will control for channel protection, water quality and baseflow maintenance, all of which should help to minimize the negative effects of new roadway surfaces on aquatic biota. These techniques should help minimize the additional stress to each of the project area watersheds, which are already listed by MDE as biologically impaired. Over the long-term, all SWM facilities will be monitored and maintained in accordance with NPDES permits to ensure that each facility continues to provide the intended level of quantity and/or quality control.

Paint Branch Trout

Efforts to avoid and minimize impacts to the brown trout population in Paint Branch have been ongoing throughout the planning process for the ICC. The Lead Agencies are committed to protecting the high quality of the Paint Branch resource. The Lead Agencies have coordinated extensively with regulatory agencies as well as scientists and resource managers through the establishment of a Brown Trout Work Group to review project elements and determine appropriate minimization of impacts to the trout resource. Issues brought before the group for review and comment have included the proposed SWM approach in the SPA; avoidance and minimization recommendations such as bridge locations and sediment and erosion control measures; compensatory mitigation and environmental stewardship projects in the Paint Branch; and studies to augment cool baseflows in the Good Hope Tributary. The results of this coordination and recommendations on avoidance and minimization are reflected in the project design presented in the FEIS.

Within Corridor 1, the bridges over Good Hope Tributary and the Paint Branch Mainstem were lengthened by 96-feet and 132-feet respectively early in design to reduce impacts within the floodplain. In addition, the road profile approaching the Good Hope tributary from the west has been raised approximately 2.5-feet to redirect any stormwater flows from this portion of the roadway out of the subwatershed in order to prevent any highway runoff from entering the Good Hope Tributary. This will preclude increases in temperature, pollutants, sediment, and storm discharges in Good Hope Tributary. Stormwater flows will be captured, treated, and routed to either the Northwest Branch watershed or the Paint Branch mainstem. The "first flush" of runoff from the Montgomery County Maintenance Depot will also be treated and discharged to the Northwest Branch watershed for the same reason. Further protection is provided by a stormwater piping conveyance system that will be designed into the bridges to prevent runoff from the bridges from entering streams, and the road profile was raised between Gum Springs and Paint Branch to allow for one continuous bridge between the two streams to preclude the need for additional fill. Within Corridor 2, a bridge over the Right Fork of Paint Branch has replaced the culvert shown in the preliminary design.

During construction, temporary impacts from sediment will be minimized through the use of stringent sediment and erosion control measures in accordance with state (MDE) requirements, on-site environmental inspector, and adherence to the Use III stream closure period from October 1 through April 30. In sensitive areas such as SPAs and the Rocky Gorge watershed, and in addition to the approach to erosion and sediment control mentioned above, the Lead Agencies have committed to employing redundant erosion and sediment control measures for an added

measure of resource protection. Clearing of forested areas will be avoided and minimized to the greatest extent possible to avoid stream warming and destabilization of soils.

Long-term impacts of imperviousness, including temperature increases, loss of baseflow, habitat degradation and chemical contaminants will be minimized to the greatest extent possible through innovative SWM. As described in *Chapter IV.F.5 Surface Water Resources* and summarized below, a linear SWM approach has been specifically designed for use in SPAs.

The linear approach applied in SPAs aims to avoid many of the aquatic resource impacts typically associated with highway development. Sediments and attached pollutants will be removed from runoff as stormwater passes by sheet flow through vegetation and then into continuous, linear bioretention or sand filtration systems. These systems will be placed in the median and roadside ditches and will be small but numerous to limit the individual drainage area treated at an individual facility.

After filtration, flows would be routed into a pipe system and, where needed, into underground storage chambers that would attenuate flows in accordance with water quantity control requirements. These systems are also anticipated to provide vital heat dissipation to avoid potential temperature impacts at the pipe discharge point. Infiltration will be provided within the bottom of the linear filtration systems and wherever geotechnically feasible through deep sump inlets and manholes that allow for water contact with permeable native soils to diminish impacts to local base flows. As with all MdTA and SHA SWM facilities, the components of the linear system would be monitored and maintained in compliance with NPDES permit requirements to ensure long-term function of all aspects of the system.

In addition to these measures, the regulatory agencies requested that the Lead Agencies study ways to potentially augment the cool-water baseflows that sustain the trout population in the Good Hope Tributary. The Lead Agencies conducted a preliminary study on the feasibility of augmenting baseflow during the summer months with groundwater from a drilled well. Based on a fracture trace analysis and an environmental records search, it was determined that the available groundwater in the area is limited, and pumping of groundwater in the Good Hope to augment streamflow would most likely diminish the amount of groundwater naturally discharging to the stream. Due to these potential negative consequences, the Lead Agencies and the regulatory agencies agreed that no further study of this option was warranted. However, the Lead Agencies continue to investigate other potential methods to augment cool baseflow including storage and cooling of stormwater for release during summer months, with a potential potable water back-up when stormwater quantities are not adequate. Challenges that are being investigated related to these options include storing the amount of water needed and removal of chlorine from a back-up potable water supply. The Lead Agencies will continue to coordinate with the agencies, including the Brown Trout Work Group regarding the need for and feasibility of these options as studies continue.

7. Waters of the U.S. Including Wetlands

This section addresses surface water features, including wetlands that are regulated under CWA Section 404 and associated MDE requirements. The impacts and requirements discussed in this

Section are distinct from the surface water issues addressed in Section 5, which addresses CWA Section 402 and related MDE NPDES permitting and SWM issues.

A Section 404 permit from the USACE is required for the discharge of dredged or fill material into Waters of the U.S., including wetlands (federally-regulated waters). The project will also require a Section 401 Water Quality Certification from MDE. In addition, MDE requires a Nontidal Wetlands and Waterways permit for any proposed impacts to nontidal wetlands, including the 25-foot buffer, and for any proposed discharge of fill in the 100-year floodplain.

a. Direct Impacts

The No-Action Alternative would have no ICC project-related impact on Waters of the U.S., including wetlands, within the study area.

The direct impacts to wetlands and waterways that would occur from the various Build Alternatives and their options within Corridors 1 and 2 are listed in *Table IV-65*. This table also presents total impacts by wetland class, waterway type, and watershed for the various corridors, options, and sub-options. To save space in the table, scrub-shrub wetlands are included with forested wetlands because the two classes are treated similarly with respect to mitigation requirements.

Build Alternatives for the ICC would directly impact Waters of the U.S. including wetlands from cutting and filling for the roadway and the placement of bridge abutments. Other project-related activities such as SWM, sediment and erosion control, bike trails, and maintenance facilities could directly impact wetlands and waterways. Direct impacts could also occur from temporary construction-related activities and the conversion of wetlands from one vegetative cover class to another from potential shading effects of bridges. Conversion effects such as these are not regulated by the USACE, but are regulated by the MDE. Temporary construction and conversion impacts were not addressed in the 2004 DEIS, but are now fully covered in this FEIS.

Corridor 1 and its options traverse the Muddy Branch, Upper Rock Creek, North Branch Rock Creek, Northwest Branch, Paint Branch, Little Paint Branch, Indian Creek, and Upper Patuxent watersheds. Based on the options presented in *Table IV-65*, permanent impacts associated with Corridor 1 and its options would range from 29.81 to 31.82 acres of palustrine emergent (PEM) wetlands; 15.32 to 16.22 acres of palustrine forested (PFO) wetlands; and 32,667 to 39,158 linear feet of perennial and intermittent streams. In addition, ephemeral stream impacts would range from 9,715 to 10,296 linear feet and open water pond impacts would range from 5.54 to 9.09 acres.

Corridor 2 and its options would pass through the Muddy Branch, Upper Rock Creek, North Branch Rock Creek, Northwest Branch, Paint Branch, Little Paint Branch, Indian Creek, Rocky Gorge, and Upper Patuxent watersheds. Based on the options presented in *Table IV-65*, the range of impacts associated with Corridor 2 and its options would vary from 32.26 to 38.20 acres of PEM wetlands; 14.14 to 17.86 acres of PFO systems; and 24,525 to 37,584 linear feet of perennial and intermittent streams (*Table IV-65*). In addition, ephemeral stream impacts would range from 10,409 to 11,160 linear feet and open water pond impacts would range from 4.20 to 9.22 acres.

The impacts to wetlands and waterways for each of the corridor alignments are higher in the present study than estimated in the 1997 DEIS. These differences result primarily from the fact that the wetlands associated with the sand and gravel mining activities in the Indian Creek watershed west of I-95 (Wetland 8CA and 10E) were not included in the impact calculation in 1997. These wash pond wetlands, created incidental to the mining operations, were exempt from wetland jurisdiction during the 1997 study because the areas were still actively being mined. However, the current guidance from the USACE and MDE require many of these areas to be counted as jurisdictional wetlands. Many of these wetlands are currently dominated by a monotypic stand of *Phragmites* (common reed) and have a low functional capacity. Based on the various corridor options, the high and low impact ranges of these wash pond wetlands are 27.45 to 28.08 acres for Corridor 1 and 29.26 to 30.02 acres for Corridor 2, which constitutes 58 to 14 percent of the total range of potential impacts to wetlands for Corridor 1 and 55 to 62 percent of the total range of wetland impacts for Corridor 2. Other differences in wetland and waterway impacts between the 1997 DEIS and the 2005 FEIS result from differences in the level of engineering design detail between the two studies. The 2005 FEIS addresses impacts associated with SWM, sediment and erosion control, bridge pier placement, bike paths, maintenance facilities, and temporary construction. This level of detail was not available at the time of the 1997 DEIS. There were also differences in the way that the wetlands and waterways were delineated and depicted on mapping between the 1997 DEIS and the 2005 FEIS. In 1997, the wetland boundaries were estimated in the field and hand drawn onto project mapping. During the current study, wetland limits were more accurately located in the field using Global Positioning System (GPS) survey techniques, and the surveyed wetland boundaries were incorporated onto project base mapping using computer graphics applications. This approach allows for a more accurate depiction of wetland and waterway impacts.

There were also differences in wetland and waterway impacts between the DEIS and the present FEIS. Overall, the FEIS impacts are less than those presented for the DEIS. The primary reason for the reduction is that impacts in the DEIS were calculated based on the limits of right of way, while impacts presented in this document are based on a conservative estimate of limits of disturbance. Additional reductions in impacts have also been realized through avoidance and minimization measures implemented since the DEIS. For more information on specific reductions to individual wetlands and waterways, see the avoidance and minimization table presented in *Appendix M*.

Muddy Branch Watershed

The common alignments of Corridor 1 and 2 would have no impact on wetlands or waterways within the Muddy Branch watershed of the Potomac basin (*Appendix A, Plate 1*).

Table IV-65
Wetland (Ac.) and Waterway (Lf.) Impacts By Corridor and Watershed

Corridor	Watershed ¹																										
	Upper Rock Creek			North Branch Rock Creek			Northwest Branch			Paint Branch			Little Paint Branch			Indian Creek			Rocky Gorge			Upper Patuxent			Total		
	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters
No-Action Alternative	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corridor 1 and 2 West of MD 97 Mainline Segments	0.19	3.30	4,396 ^S 793 ^R 0 ^P	0.23	1.14	1,645 ^S 448 ^R 0 ^P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.42	4.44	6,041 ^S 1,241 ^R 0 ^P
Corridor 1 and 2 Rock Creek Options (select one)																											
Rock Creek A	0.51	0.16	1,303 ^S 458 ^R 0.09 ^P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.51	0.16	1,303 ^S 458 ^R 0.09 ^P
Rock Creek C- Olde Mill Run Grade Separation	0.34	0.06	1,919 ^S 412 ^R 0.09 ^P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.34	0.06	1,919 ^S 412 ^R 0.09 ^P
Rock Creek C- Olde Mill Run Cul-de-Sac	0.34	0.06	1,639 ^S 219 ^R 0.09 ^P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.34	0.06	1,639 ^S 219 ^R 0.09 ^P
Corridor 1 Mainline Segments (MD 97 to I-95)	-	-	-	0.03	0.23	0 ^S 485 ^R 0.02 ^P	0.2	2.7	7,817 ^S 0 ^R 1.39 ^P	0.2	1.2	1,478 ^S 87 ^R 0.26 ^P	0.0	3.5	7,286 ^S 1,003 ^R 0 ^P	-	-	-	-	-	-	-	-	-	0.54	7.78	16581 ^S 1,575 ^R 1.67 ^P
Corridor 1 Northwest Branch Options (select one)																											
Northwest Branch A- with Interchange at Layhill Road	-	-	-	-	-	-	0	0.9	2,534 ^S 0 ^R 1.33 ^P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0.96	2,534 ^S 0 ^R 1.33 ^P
Northwest Branch A- without Interchange at Layhill Road	-	-	-	-	-	-	0	0.9	2,534 ^S 0 ^R 1.33 ^P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0.95	2,534 ^S 0 ^R 1.33 ^P
Northwest Branch B- with	-	-	-	-	-	-	0	1.2	3731 ^S 0 ^R 0.75 ^P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	1.26	3,731 ^S 0 ^R 0.75 ^P

Table IV-65
Wetland (Ac.) and Waterway (Lf.) Impacts By Corridor and Watershed

Corridor	Watershed ¹																											
	Upper Rock Creek			North Branch Rock Creek			Northwest Branch			Paint Branch			Little Paint Branch			Indian Creek			Rocky Gorge			Upper Patuxent			Total			
	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	
																												PEM
Interchange at Layhill Road																												
Northwest Branch B-without Interchange at Layhill Road	-	-	-	-	-	-	0	1.26	3731 ^S 0 ^R 0.75 ^P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	1.26	3,731 ^S 0 ^R 0.75 ^P
Corridor 1 I-95 Interchange Options (select one)																												
I-95 Interchange Option A (terminate ICC at US 1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 ^S 1,829 ^R 0 ^P	30.28	2.57	9,976 ^S 1,690 ^R 5.94 ^P	-	-	-	0.07	0.01	910 ^S 3,161 ^R 0.06 ^P	30.35	2.58	10,886 ^S 6,680 ^R 6.00 ^P	
I-95 Interchange Option B (terminate ICC at I-95)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 ^S 1,829 ^R 0 ^P	28.44	2.08	5,298 ^S 2,032 ^R 2.97 ^P	-	-	-	0.07	0.01	910 ^S 3,161 ^R 0.06 ^P	28.51	2.09	6,208 ^S 7,022 ^R 3.03 ^P	
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)																												
Corridor 2-with Interchange at Layhill Road	-	-	-	-	-	-	0.35	0.99	932 ^S 241 ^R 0.49 ^P	-	-	-	0.11	0	407 ^S 596 ^R 0 ^P	0.4	0.26	154 ^S 243 ^R 0.08 ^P	0.10	0.38	3,819 ^S 333 ^R 0 ^P	-	-	-	0.96	1.63	5,312 ^S 1,413 ^R 0.57 ^P	
Corridor 2-without Interchange at Layhill Road	-	-	-	-	-	-	0	0.99	980 ^S 241 ^R 0.48 ^P	-	-	-	0.11	0	407 ^S 596 ^R 0 ^P	0.4	0.26	154 ^S 243 ^R 0.08 ^P	0.10	0.38	3,819 ^S 333 ^R 0 ^P	-	-	-	0.61	1.63	5,360 ^S 1,413 ^R 0.56 ^P	
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)																												
Norbeck A	-	-	-	0.03	0.23	0 ^S	0.1	2.0	4,482 ^S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.22	2.23	4,482 ^S	

Table IV-65
Wetland (Ac.) and Waterway (Lf.) Impacts By Corridor and Watershed

Corridor	Watershed ¹																										
	Upper Rock Creek			North Branch Rock Creek			Northwest Branch			Paint Branch			Little Paint Branch			Indian Creek			Rocky Gorge			Upper Patuxent			Total		
	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters
						485 ^R 0.02 ^P	9		0 ^R 0.17 ^P																	Total Wetland	
																										2.45	485 ^R 0.19 ^P
Norbeck B- with Willow Grove Access Over ICC	-	-	-	0.03	0.23	0 ^S 485 ^R 0.02 ^P	1.2 9	0.5 9	1,529 ^S 0 ^R 1.82 ^P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.32	0.82	1,529 ^S 485 ^R 1.84 ^P
																										2.14	1.84 ^P
Norbeck B- with Willow Grove Access at Mt. Everest Lane	-	-	-	0.03	0.23	0 ^S 485 ^R 0.02 ^P	1.2 9	0.4 7	1,918 ^S 0 ^R 1.82 ^P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.32	0.70	1,918 ^S 485 ^R 1.84 ^P
																										2.02	1.84 ^P
Spencerville A- with Burtonsville A	-	-	-	-	-	-	0	0.6 6	206 ^S 0 ^R 0.02 ^P	0	1.2 1	301 ^S 0 ^R 0.38 ^P	-	-	-	-	-	-	0.38	1.30	2,987 ^S 371 ^R 0 ^P	-	-	-	0.38	3.17	3,494 ^S 371 ^R 0.40 ^P
																										3.55	0.40 ^P
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	-	-	-	-	-	-	0	0.6 6	187 ^S 0 ^R 0.02 ^P	0	0.6 4	395 ^S 0 ^R 0.18 ^P	-	-	-	-	-	-	1.95	2.67	7,318 ^S 537 ^R 0 ^P	-	-	-	1.95	3.97	7,900 ^S 537 ^R 0.2 ^P
																										5.92	0.2 ^P
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	-	-	-	-	-	-	0	0.6 6	191 ^S 0 ^R 0.02 ^P	0	0.4 7	337 ^S 0 ^R 0.16 ^P	-	-	-	-	-	-	1.95	2.67	7,318 ^S 537 ^R 0 ^P	-	-	-	1.95	3.80	7,846 ^S 537 ^R 0.18 ^P
																										5.75	0.18 ^P
Spencerville A- with Burtonsville X	-	-	-	-	-	-	0	0.6 6	206 ^S 0 ^R 0.02 ^P	0	0.9 4	597 ^S 0 ^R 0.38 ^P	-	-	-	-	-	-	0.38	1.31	3,003 ^S 371 ^R 0 ^P	-	-	-	0.38	2.91	3,806 ^S 371 ^R 0.40 ^P
																										3.29	0.40 ^P
Spencerville B- with Burtonsville A	-	-	-	-	-	-	0	0.6 6	206 ^S 0 ^R 0.02 ^P	0	1.1 2	636 ^S 0 ^R 0.14 ^P	-	-	-	-	-	-	0.38	1.30	2,987 ^S 371 ^R 0 ^P	-	-	-	0.38	3.08	3,829 ^S 371 ^R 0.16 ^P
																										3.46	0.16 ^P
Spencerville B- with Burtonsville B	-	-	-	-	-	-	0	0.5 0	161 ^S 0 ^R 0.02 ^P	0	0	241 ^S 0 ^R 0.01 ^P	-	-	-	-	-	-	1.95	2.67	7,318 ^S 537 ^R 0 ^P	-	-	-	1.95	3.17	7,720 ^S 537 ^R 0.03 ^P
																										5.12	0.03 ^P
Spencerville B- with	-	-	-	-	-	-	0	0.6 6	206 ^S 0 ^R	0	1.0 1	928 ^S 0 ^R	-	-	-	-	-	-	0.38	1.31	3,003 ^S 371 ^R	-	-	-	0.38	2.98	4,137 ^S

Table IV-65
Wetland (Ac.) and Waterway (Lf.) Impacts By Corridor and Watershed

Corridor	Watershed ¹																													
	Upper Rock Creek			North Branch Rock Creek			Northwest Branch			Paint Branch			Little Paint Branch			Indian Creek			Rocky Gorge			Upper Patuxent			Total					
	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters
Burtonsville X									0.02 ^P			0.13 ^P																	3.36	0.15 ^P
Spencerville C- with Burtonsville A	-	-	-	-	-	-	0	0.6 ⁷	206 ^S 0 ^R 0.02 ^P	0	1.3 ⁴	1,144 ^S 0 ^R 0.07 ^P	-	-	-	-	-	-	0.38	1.30	2,987 ^S 371 ^R 0 ^P	-	-	-	-	-	-	0.38	3.31	4,337 ^S 371 ^R 0.09 ^P
Spencerville C- with Burtonsville B	-	-	-	-	-	-	0	0.5 ⁰	174 ^S 0 ^R 0.02 ^P	0	0	0 ⁰ 0 ⁰ 0 ^P	-	-	-	-	-	-	1.95	2.67	7,318 ^S 537 ^R 0 ^P	-	-	-	-	-	-	1.95	3.17	7,492 ^S 537 ^R 0.02 ^P
Spencerville D- with Burtonsville B	-	-	-	-	-	-	0	0.8 ²	290 ^S 0 ^R 0.02 ^P	0	0	0 ⁰ 0 ⁰ 0 ^P	-	-	-	-	-	-	2.15	3.38	7,512 ^S 537 ^R 0.23 ^P	-	-	-	-	-	-	2.15	4.20	7,802 ^S 537 ^R 0.25 ^P
Fairland A	-	-	-	-	-	-	-	-	-	-	-	-	0.0 ³	2.0 ²	283 ^S 0 ^R 0 ^P	0.21	0.32	713 ^S 0 ^R 0.32 ^P	-	-	-	-	-	-	-	-	-	0.24	2.34	996 ^S 0 ^R 0.32 ^P
Fairland B	-	-	-	-	-	-	-	-	-	-	-	-	0	1.9 ⁰	263 ^S 0 ^R 0 ^P	0.21	0.44	713 ^S 0 ^R 0.31 ^P	-	-	-	0.87	0	-	-	-	1.08	2.34	976 ^S 0 ^R 0.31 ^P	
Corridor 2 I-95 Interchange Options (select one)																														
I-95 Interchange Option A (terminate ICC at US 1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,829 ^R 0 ^P	31.69	2.57	9,976 ^S 1,690 ^R 5.94 ^P	-	-	-	0.07	0.01	910 ^S 3,161 ^R 0.06 ^P	31.76	2.58	10,886 ^S 6,680 ^R 6.00 ^P			
I-95 Interchange Option B (terminate ICC at I-95)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 ^S 1,829 ^R 0 ^P	29.98	2.05	4,960 ^S 2,036 ^R 2.97 ^P	-	-	-	0.07	0.01	910 ^S 3,161 ^R 0.06 ^P	30.05	2.06	5,870 ^S 7,026 ^R 3.03 ^P			
Corridor 1 Range of Impacts for each Watershed	0.53–0.70	3.36–3.74	5,699–6,315 ^S 1,012–1,251 ^R 0.09 ^P	0.26	1.37	1,645 ^S 933 ^R 0.02 ^P	0.2 ²	3.7 ² –4.0 ³	10,351 ^S –11,548 ^S 241 ^R 2.62–3.21 ^P	0.2	1.2 ⁵	1,478 ^S 87 ^R 0.26 ^P	0.0 ⁹	3.5 ³	7,286 ^S 2,832 ^R 0 ^P	28.44–30.28	2.08–2.57	5,298–9,976 ^S 1,690–2,032 2.97–5.94 ^P	-	-	-	0.07	0.01	910 ^S 3,161 ^R 0.06 ^P						
Corridor 1 Range of Impacts																									29.81–31.82	15.32–16.22	32,667–39,158 ^S 9,715–			

Table IV-65
Wetland (Ac.) and Waterway (Lf.) Impacts By Corridor and Watershed

Corridor	Watershed ¹																											
	Upper Rock Creek			North Branch Rock Creek			Northwest Branch			Paint Branch			Little Paint Branch			Indian Creek			Rocky Gorge			Upper Patuxent			Total			
	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	PEM	PFO ²	Waters	
																												PEM
														</														

Note: Total impacts for corridors are calculated for **Corridor 1** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding the *Corridor 1 Mainline Segments (MD 97 to I-95)*, adding one *Corridor 1 Northwest Branch Option* and one *Corridor 1 I-95 Interchange Option*; or for **Corridor 2** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding one *Corridor 2 Mainline Segments (MD 97 to I-95)*, one of each of the desired *Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options*, and adding one *Corridor 2 I-95 Interchange Option*.

Note: Total impacts for each corridor cannot be calculated by adding the ranges from each watershed, because the minimum or maximum impact in each watershed does not necessarily occur within the same combination of options.

Note: Total range of impacts for Corridor 1 and Corridor 2 must be derived by adding the minimum or maximum total wetland number provided for each segment. Total impacts for each corridor cannot be calculated by adding the ranges of PEM and PFO impacts, because the minimum or maximum PEM or PFO impact does not necessarily occur within the same combination of options.

¹The Muddy Branch watershed is not included in the impacts table because there are no wetland or waterway impacts in the Muddy Branch watershed

² This category includes PFO and PSS wetlands combined to save space, as both are regulated similarly and require the same impact replacement ratios (2:1).

^S Perennial and Intermittent Streams (linear feet)

^E Ephemeral Channels (linear feet)

^P Area of POW (open water ponds in acres)

Upper Rock Creek Watershed

Similar to the Potomac basin, the portion of the proposed alignment that passes through the Upper Rock Creek watershed is common to both alignments. Two principal options are being investigated within this watershed, Rock Creek Option A and Rock Creek Option C (*Appendix A, Plates 2-11*). Rock Creek Option A crosses Rock Creek near the confluence of Rock Creek and Mill Creek, while Rock Creek Option C crosses Rock Creek at a narrower location farther upstream. Within Rock Creek Option C, there are two sub-options being investigated, one with a grade separation at Olde Mill Run and one with a cul-de-sac at Olde Mill Run. Impacts within the Upper Rock Creek watershed would range between 0.53 acre and 0.70 acre of PEM wetlands and between 3.36 and 3.74 acres of PFO wetlands, with the sub-options within Rock Creek Option C having the fewest wetland impacts. Approximately 5,699 to 6,315 linear feet of perennial and intermittent streams and 1,012 to 1,251 linear feet of ephemeral streams would be impacted, and 0.09 acre of open water ponds would be affected. For streams, Rock Creek Option A would result in less impact even though Rock Creek Option C crosses Rock Creek at a narrower floodplain location. This results because Rock Creek Option A would bridge both Rock Creek and a tributary to Mill Creek, whereas both sub-options of Rock Creek Option C would bridge only Rock Creek and provide culverts at the remaining crossings.

North Branch Rock Creek Watershed

Impacts to the North Branch Rock Creek watershed are the same for both corridors, although a portion of the Corridor 2 impacts are associated with the Norbeck A and B options at the MD 97 interchange. This also includes impacts from sub-options within Norbeck B, including Norbeck B with Willow Grove access over the ICC and Willow Grove access at Mt. Everest Lane. The two corridors (*Appendix A, Plates 12-14, 41*) would impact approximately 0.26 acre of PEM wetlands and approximately 1.37 acres of PFO wetlands. They would also impact 1,645 linear feet of perennial and intermittent streams, 933 linear feet of ephemeral streams, and 0.02 acre of open water ponds. For Corridor 2, impacts to wetlands and streams would be the same for each option and sub-option.

Northwest Branch Watershed

The construction of either corridor through the Northwest Branch watershed would result in impacts to Waters of the U.S., including wetlands. Corridor 1 (*Appendix A, Plates 15-25*) includes four Northwest Branch option and sub-option combinations including Northwest Branch Option A with and without an interchange at Layhill Road and Northwest Branch Option B with and without an interchange at Layhill Road. The selection of Corridor 1 with Northwest Branch Option A without an interchange at Layhill Road would result in the fewest wetland impacts while the selection of Corridor 1 with Northwest Branch Option B, with or without an interchange at Layhill Road, would result in the highest wetland impacts. These Corridor 1 impacts would total 0.22 acre of PEM and 3.72 acres to 4.03 acres of PFO. Impacts to perennial and intermittent streams would be highest with the selection of Corridor 1 with Northwest Branch Option B (with or without an interchange at Layhill Road) and fewest with the selection of Corridor 1 with Northwest Branch Option A (with or without an interchange at Layhill Road). These stream impacts would range from 10,351 to 11,548 linear feet. Additionally, 241 linear

feet of ephemeral streams and 2.62 to 3.21 acres of open water ponds would be impacted, with the fewest impacts being associated with Corridor 1 with Northwest Branch Option B (with or without an interchange at Layhill Road). Corridor 2 (*Appendix A, Plates 41-52, 54,56,58,60,62,64,66*) includes three options associated with Norbeck Road (Norbeck A, Norbeck B with Willow Grove Road access over the ICC, and Norbeck B with Willow Grove access at Mt. Everest Lane). Corridor 2 also provides various Spencerville and Burtonsville options including Spencerville A with Burtonsville A, Spencerville A with Burtonsville B (Relocated Good Hope Road), Spencerville A with Burtonsville B (ICC over Good Hope Road), Spencerville A to Burtonsville X, Spencerville B with Burtonsville A, Spencerville B with Burtonsville B, Spencerville B with Burtonsville X, Spencerville C with Burtonsville A, Spencerville C with Burtonsville B, and Spencerville D with Burtonsville B. The mainline of Corridor 2 also has two options at Layhill Road, one with an interchange and one without. Corridor 2 wetland impacts would range from 0.19 to 1.64 acres of PEM and 1.96 to 3.81 acres of PFO. Impacts to streams would range from 2,622 to 5,752 linear feet of perennial and intermittent streams and include 241 linear feet of ephemeral streams. Open water pond impacts would range from 0.67 to 2.33 acres. Norbeck B with Willow Grove Road access at Mt. Everest Lane has the lowest wetland impacts of the three Norbeck sub-options, while Spencerville A with Burtonsville X has the lowest wetland impacts for the Spencerville with Burtonsville options. The mainline option without an interchange at Layhill Road would have lower wetland impacts than the option with an interchange. Norbeck B with Willow Grove access over the ICC would have the lowest stream impacts as would the combination of Spencerville A with Burtonsville A. Corridor 2 mainline stream impacts within the Northwest Branch watershed would be less for the option with the Layhill Road interchange.

Paint Branch Watershed

Direct impacts to wetlands and other Waters of the U.S. within the Paint Branch Watershed would occur from the construction of Corridor 1 (*Appendix A, Plates 25-27*). Impacts to PEM wetlands would be approximately 0.2 acre, while impacts to PFO wetlands would total 1.25 acres. In addition, approximately 1,478 linear feet of perennial and intermittent streams and 87 linear feet of ephemeral streams would be affected by the construction of Corridor 1. Open water pond impacts would total approximately 0.26 acre. Depending on the various Spencerville with Burtonsville options associated with Corridor 2 (*Appendix A, Plates 52-66, 69*), impacts to PFO wetlands could be lower or higher than those calculated for Corridor 1. Overall, Corridor 2 impacts to PFO would range from 0 to 1.34 acres. Perennial and intermittent stream and open water pond impacts would be lower in Corridor 2 than Corridor 1, with perennial and intermittent streams ranging from 0 to 1,144 linear feet and open water ponds ranging from 0 to 0.38 acre. No impacts would occur to PEM wetlands in the Paint Branch watershed from the construction of Corridor 2. Corridor 2 options without impacts to Waters of the U.S. include Spencerville C and D with Burtonsville B. Wetland impacts would also be minimized by using the Spencerville A with Burtonsville B sub-options and Spencerville B with Burtonsville B option.

the permitting agencies and coordination is ongoing to make a final determination of remnant wetland impacts. Once a final determination is made, the amount of the indirect impact will be included as a permanent impact in the project permits. Based on coordination to date, remnant wetland impacts are expected to be less than an acre for either of the build alternatives.

Table IV-66
Wetland Conversion from Forested/Scrub-shrub to Emergent

Corridor	Wetland Impact (Acre)
No-Action Alternative	0
Corridor 1 and 2 West of MD 97 Mainline Segments	0.01
Corridor 1 and 2 Rock Creek Options (select one)	
Rock Creek A	0
Rock Creek C- Olde Mill Run Grade Separation	0
Rock Creek C- Olde Mill Run Cul-de-Sac	0
Corridor 1 Mainline Segments (MD 97 to I-95)	0.31
Corridor 1 Northwest Branch Options (select one)	
Northwest Branch A- with Interchange at Layhill Road	0
Northwest Branch A- without Interchange at Layhill Road	0
Northwest Branch B- with Interchange at Layhill Road	0
Northwest Branch B- without Interchange at Layhill Road	0
Corridor 1 I-95 Interchange Options (select one)	
I-95 Interchange Option A (terminate ICC at US 1)	0.33
I-95 Interchange Option B (terminate ICC at I-95)	0.33
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)	
Corridor 2- with Interchange at Layhill Road	0.55
Corridor 2- without Interchange at Layhill Road	0.55
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)	
Norbeck A	0.07
Norbeck B- with ICC over Willow Grove	0.06
Norbeck B- with Willow Grove Access at Mt. Everest Lane	0.19
Spencerville A- with Burtonsville A	0.01
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	0
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	0
Spencerville A- with Burtonsville X	0
Spencerville B- with Burtonsville A	0.01
Spencerville B- with Burtonsville B	0
Spencerville B- with Burtonsville X	0
Spencerville C- with Burtonsville A	0.01
Spencerville C- with Burtonsville B	0
Spencerville D- with Burtonsville B	0
Fairland A	0
Fairland B	0
Corridor 2 I-95 Interchange Options (select one)	
I-95 Interchange Option A (terminate ICC at US 1)	0.33
I-95 Interchange Option B (terminate ICC at I-95)	0.33
Corridor 1 Range of Impacts	0.65
Corridor 2 Range of Impacts	0.95 – 1.09

d. Temporary Impacts

Waters of the U.S., including nontidal wetlands may be temporarily impacted by the construction of a selected corridor. The temporary impacts to Waters of the U.S. are listed in **Table IV-67** below. Temporary impacts will be avoided and/or minimized to the greatest extent possible. Restoration of temporary impact areas to pre-construction elevations is proposed and will be included with the roadway construction documents.

Table IV-67
Temporary Impacts to Waters of the U.S.

Corridor	Stream Perenn./Intermitt. (Linear Feet)	Stream Ephemeral (Linear Feet)	Wetlands (Acres)		Ponds (Acres)
			PEU/PSS	PEM	
No-Action Alternative	0	0	0	0	0
Corridor 1 and 2 West of MD 97 Mainline Segments	156	25	0	0	0
Corridor 1 and 2 Rock Creek Options (select one)					
Rock Creek A	234	22	0.24	0	0
Rock Creek C- Oldie Mill Run Grade Separation	78	0	0	0	0
Rock Creek C- Oldie Mill Run Cul-de-Sac	77	0	0	0	0
Corridor 1 Mainline Segments (MD 97 to I-95)	119	0	0.81	0	0
Corridor 1 Northwest Branch Options (select one)					
Northwest Branch A- with Interchange at Layhill Road	211	0	1.77	0	0
Northwest Branch A- without Interchange at Layhill Road	212	0	1.77	0	0
Northwest Branch B- with Interchange at Layhill Road	0	0	7.36	0	0
Northwest Branch B- without Interchange at Layhill Road	0	0	7.36	0	0
Corridor 1 I-95 Interchange Options (select one)					
I-95 Interchange Option A (terminate ICC at US 1)	164	0	0	0	0
I-95 Interchange Option B (terminate ICC at I-95)	42	0	0	0	0
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)					
Corridor 2- with Interchange at Layhill Road	126	0	0	0.17	0
Corridor 2- without Interchange at Layhill Road	108	0	0	0.17	0.01
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)					
Norbeck A	121	0	0	0	0
Norbeck B- with ICC over Willow Grove	31	0	0	0	0
Norbeck B- with Willow Grove Access at Mt. Everest Lane	31	0	0	0	0
Spencerville A- with Burtonsville A	70	0	0	0	0
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	57	0	0	0	0
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	83	0	0	0	0
Spencerville A- with Burtonsville X	0		0	0	0
Spencerville B- with Burtonsville A	70	0	0	0	0.03
Spencerville B- with Burtonsville B	91	0	0	0	0
Spencerville B- with Burtonsville X	0		0	0	0
Spencerville C- with Burtonsville A	70	0	0	0	0.03
Spencerville C- with Burtonsville B	57	0	0	0	0
Spencerville D- with Burtonsville B	90	0	0	0	0.02
Fairland A	0	0	0	0	0
Fairland B	0	0	0	0	0
Corridor 2 I-95 Interchange Options (select one)					
I-95 Interchange Option A (terminate ICC at US 1)	164	0	0	0	0
I-95 Interchange Option B (terminate ICC at I-95)	42	0	0	0	0
Corridor 1 Range of Impacts	434-925	25-47	2.87-8.70	0	0
Corridor 2 Range of Impacts	484-942	25-47	0-0.24	0.17	0-0.04

The following types of temporary impacts may occur with this project:

- **Cofferdams** - Temporary cofferdams may be needed to construct bridge footings in waters and wetlands
- **Temporary Construction/Access/Staging Areas/Sediment Erosion Control Measures** - In order to construct the project, a temporary construction zone and erosion control measures are required along the cut/fill boundary line. After construction, the temporary construction zone will be restored
- **Bridges** - Vegetation may need to be cleared to access the area to construct the bridge piers and abutments

When constructing a new bridge in a remote area, a contractor will typically establish an access/haul road to provide safe and efficient access to the bridge site for construction equipment, materials and workers. In addition, material storage and work areas, or staging areas, will be prepared to provide adequate working space. Typically, the access road and staging areas are specifically located so that they do not interfere with permanent or temporary construction works. Therefore, the access roads are usually located to one side of the new bridge, specifically avoiding abutment and pier locations, and overhead obstructions. As a result, a temporary construction easement is frequently needed outside of the permanent right-of-way required for the bridge and approach roadways to address the location of the access road and staging areas.

Temporary Impact Restoration Efforts: The restoration plan for the temporary impacts will include the following elements:

- Removal of all construction material from the aquatic resource area
- De-consolidation of compacted soils
- Replacement of topsoil lost to erosion and sediment control measures
- Re-establishment of finished grade prior to construction activities
- Re-seeding with native wetland seed mix in areas that were vegetated with emergent plants prior to construction. The mix will contain native species identified in the wetland area temporarily impacted
- Replacement of native trees and shrubs in areas that were forested prior to construction. The plants will include trees and shrubs that were identified in the wetland area temporarily impacted
- Monitoring to ensure successful restoration will be part of the Environmental Management Program

- Monitoring to ensure successful restoration of temporary impacts will continue for one year following the restoration effort.
- Remediation efforts will be implemented if it is determined necessary after one year of monitoring.
- SHA shall mitigate for the lost resource if remediation does not prove successful one year after the remediation efforts were implemented

Restoration specifications will be included in the Final Roadway plans and contract documents.

e. Avoidance and Minimization

If a Build Alternative is selected, impacts to wetlands and Waters of the U.S. are unavoidable. These impacts will be regulated under any CWA Section 401/404 permit and state nontidal wetlands permit that is issued for the project. The majority of the major stream valleys in the study area, where the greatest number of wetlands and waterways are located, are oriented in a north-south direction making the avoidance of these resources impossible when implementing an east-west roadway. However, considerable effort to avoid and minimize potential direct impacts has taken place throughout the planning process to date, and will continue as the project moves forward to more detailed stages of design. The Lead Agencies have worked closely with regulatory agencies and resource managers to identify sensitive aquatic resources and determine potential minimization techniques.

Agency recommendations have been evaluated on both an engineering and cost effectiveness basis and implemented wherever feasible. From the outset of the current ICC study and as documented within the DEIS, efforts to avoid and minimize direct impacts to stream channels and wetlands in the major stream valleys and elsewhere along the two alignments have been very extensive. The engineering design teams implemented avoidance and minimization techniques that included alignment shifts, replacement of culverts with bridges, where practicable, and reductions in overall roadway section width at stream crossings where safety considerations allow. Alignment shifts took place within the Rock Creek watershed to avoid potential impacts to Mill Creek and its tributaries. New bridges were proposed in place of culverts at twelve stream/wetland crossings along Corridor 1 and seven crossings along Corridor 2. Reductions in roadway section widths were proposed at the major stream/wetland crossings and elsewhere along both alignments. Roadway width reductions not only included reduced sections, but also reduced safety grading, and 2:1 side slopes where feasible. For the FEIS, the Lead Agencies have identified additional avoidance and minimization measures to further reduce wetland and waterway impacts. These measures include new alignment shifts, additional length to proposed bridges, a new bridge over Indian Creek for a Collector-Distributor lane east of I-95, the use of longer wing walls on select bridges and retaining walls elsewhere to minimize the amount of fill within adjacent wetlands, and the shifting of SWM facilities outside of wetlands and waters.

While efforts during the DEIS primarily focused on the major stream crossings, recent efforts have attempted to minimize impacts to wetlands and waterways in all areas of both Corridors 1 and 2. Engineering designs will continue to be refined to address avoidance and minimization of

impacts as the feasibility and effectiveness of using measures such as retaining walls, steeper fill slopes, and reduced roadway sections are evaluated. This process will continue through all phases of design and construction planning. Changes made at each major stream crossing and at other key locations throughout Corridors 1 and 2 are listed in *Table IV-68* and discussed in more detail below. In addition, a table is included in *Appendix M* that summarizes avoidance and minimization efforts since the 1997 DEIS for each wetland/waterway system. Plates that show more substantial avoidance and minimization measures for specific wetland/waterway systems are also included in *Appendix M*. There are no new major stream crossings or wetland impacts in the Muddy Branch watershed, so this watershed was not included in this avoidance and minimization discussion.

Upper Rock Creek Watershed

The project alignment in the Upper Rock Creek watershed is common to both Corridor 1 and Corridor 2. At the I-370 interchange with the ICC (*Appendix A, Plate 2, STA 85+00-125+00*), the ramp configuration was realigned to the east, minimizing wetland and stream impacts within the headwaters of Mill Creek. At the crossing of Mill Creek west of Shady Grove Road (*Appendix A, Plates 3, 6 and 9, STA 151+00*) and the crossing of a tributary to Mill Creek west of Rodland Road (*Appendix A, Plates 3, 6 and 9, STA 174+00*), the feasibility of reducing the culvert lengths and associated fill by increasing the height of the headwalls is being investigated. The crossing of a tributary of Mill Creek southwest of the Winters Run community (*Appendix A, Plate 4, STA 204+00*) was minimized in the DEIS by replacing a proposed culvert with a bridge structure. The corridor was also shifted slightly north and east at this location to avoid grading near the Mill Creek mainstem. The bridge spans at least 35 feet on either side of the tributary stream, avoiding over 300 linear feet of direct impacts to the stream channel and reducing floodplain impacts. In the FEIS, the bridge was lengthened to minimize floodplain impacts. A new temporary impact of 88 linear feet is now proposed for right-of-way for a potential sanitary sewer line relocation.

The proposed bridge over Rock Creek itself was adjusted in the DEIS to further reduce impacts. On Option A (*Appendix A, Plate 4, STA 226+00*), the alignment was adjusted and the bridge length was extended to avoid stream channel impacts to a large meander in Rock Creek and the confluence of Mill Creek. Wetland impacts were not minimized by these changes; however, measures to reduce impacts to wetlands are being investigated. In the FEIS, a wing wall was extended on the northwest side of the bridge to minimize impacts to Wetland 1L/1M. On Option C in the DEIS, on both the Olde Mill Run Grade Separation and the Olde Mill Run Cul-de-Sac options (*Appendix A, Plates 7 and 10, STA 240+00*), the bridge length was extended to reduce the need for fill on steep slopes, avoiding channel impacts and reducing potential water quality impacts. In the FEIS, the bridge was lengthened on the east side to span more of the floodplain. Overall, Rock Creek Option C would have just over 600 linear feet more stream impact than Rock Creek Option A, but would have one fewer stream crossing.

Table IV-68

Summary of Preliminary Stream Crossings, Stream and Wetland Impacts, and Avoidance and Minimization Measures^{1,2}

Station	Corridor	Option	Amount of Reduction from DRIS ²	Avoidance and Minimization Measures
Rock Creek Watershed				
85+00 – 125+00	1&2	Mainline	1,565 lf 0.3 ac	FEIS: Reconfiguration of ICC/I-370 interchange ramps
204+00	1&2	Rock Creek A	N/A ⁴	DEIS: - Added a bridge that spans 35' on each side of stream - Shifted alignment to the north and east to avoid grading near Mill Creek - Avoided culvert impacts of over 300 lf. on Mill Creek FEIS: - Extended the bridge to span over 130' to the west and over 170' to the east of the stream to minimize floodplain impacts. New temporary impact to stream of 88 lf. for ROW for potential sanitary sewer line relocation
236+00	1&2	Rock Creek A	0.19 ac.	DEIS: - Addition of bridge avoids encroachment on east-west meander just north of roadway and the Rock Creek/Mill Creek confluence just south of the roadway FEIS: - Extended wing walls on bridge on northwest side to minimize impacts to Wetland II/1M
240+00	1&2	Rock Creek C (Old Mill Run Grade Separation and Old Mill Run Cul-de-Sac)	N/A	DEIS: - Alignment at crossing shifted to avoid potential stream impacts, but bridge length remains as shown in preliminary design FEIS: - Bridge lengthened 80' on east side to span more of the floodplain
North Branch Rock Creek				
319+00	1&2	Mainline	N/A	DEIS: - Bridge extended westward to avoid a spring and eastward so that grading limits would be at least 35' from the stream; grade raised 10' to avoid blasting on the knoll east of North Branch Rock Creek FEIS: - Bridge was lengthened an additional 50' to further avoid the spring on the west side of the stream
328+00	1&2	Mainline	237 lf.	DEIS: - Addition of a bridge avoids stream impacts of approximately 450 linear feet on tributary to North Branch Rock Creek and reduces wetland impacts - Fill impact was reduced by 0.4 acres, however there is a conversion impact to the wetland from shading effects of the bridge FEIS: - Bridge was shortened and shifted slightly east; the USACE accepted the shift and slightly greater stream and wetland impacts since the primary objective in bridging this location was wildlife passage, not wetland avoidance - Wing wall was extended on the southeastern side of the bridge to reduce wetland impacts in that location
Northwest Branch				
533+00	1	Northwest Branch A w/ or w/o Interchange at Layhill Road	0.3 ac.	DEIS: - Bridge lengthened to avoid impacts to tributary, reduce wetland impact and span the Northwest Branch 3-year floodplain FEIS: - Bridge lengthened another 35' on each side of the stream to avoid wetland impacts

Table IV-68

Summary of Preliminary Stream Crossings, Stream and Wetland Impacts, and Avoidance and Minimization Measures^{1,2}

Station	Corridor	Option	Amount of Reduction from DRIS ²	Avoidance and Minimization Measures
561+00	1	Northwest Branch A w/ or w/o Interchange at Layhill Road	N/A	DEIS: - Lengthened bridge over Northwest Branch and Bonifant Road to reduce floodplain and wetland impacts - Fill impact was reduced FEIS: - Lengthened bridge another 30' north of Bonifant Road to further reduce fill impacts to wetlands
593+00	1	Northwest Branch A w/ or w/o Interchange at Layhill Road	0.3 ac.	DEIS: - Bridge lengthened to span Northwest Branch 10-year floodplain and reduce wetland impacts - Fill impacts were reduced FEIS: - Bridge lengthened 50' at western end to move farther from wetlands and streams - At eastern end, bridge lengthened 55' and wing walls extended to avoid impacts to a tributary stream and to reduce wetland impacts
538+00	1	Northwest Branch B w/ or w/o Interchange at Layhill Road	0.2 ac.	DEIS: - Bridge lengthened to avoid stream impacts and minimize wetland and floodplain impacts due to fill FEIS: - Bridge lengthened another 25' to reduce wetland impacts
558+00	1	Northwest Branch B w/ or w/o Interchange at Layhill Road	N/A	DEIS: - Bridge lengthened to span Bonifant Road and Northwest Branch and avoid wetland impacts FEIS: - Bridge lengthened another 70' north of Bonifant Road to further reduce fill impacts to wetlands - Bridge also lengthened another 30' at the southern end to shift the abutment farther from the stream
577+00	1	Northwest Branch B w/ or w/o Interchange at Layhill Road	N/A	DEIS: - Bridge lengthened to minimize stream, wetland, and floodplain impacts; however, the Northwest Branch would require realignment of over 1,300 linear feet in the vicinity of this bridge FEIS: - Bridge lengthened 90' at the north end to move farther from wetlands and streams - At southern end, bridge extended 60' to avoid wetland impacts
472+00	2	Norbeck A	0.1 ac.	DEIS: - Bridge reduces stream impacts on a tributary to Hatchellors Run FEIS: - Bridge lengthened at eastern end to reduce wetland impact
472+00	2	Norbeck B w/ Willow Grove Access Over ICC	58 lf. 0.1 ac.	DEIS: - Bridge reduces stream impacts on a tributary to Hatchellors Run FEIS: - Bridge lengthened to further reduce impacts to the stream and to wetlands
472+00	2	Norbeck B w/ Willow Grove Access to Mt. Everest Lane	27 lf. 0.2 ac.	DEIS: - Bridge reduces stream impacts on a tributary to Hatchellors Run FEIS: - Bridge lengthened to further reduce impacts to the stream and to avoid impacts to wetlands

Table IV-68

Summary of Preliminary Stream Crossings, Stream and Wetland Impacts, and Avoidance and Minimization Measures^{1,2}

Station	Corridor	Option	Amount of Reduction from DEIS ²	Avoidance and Minimization Measures
517+00	2	With Interchange at Layhill Road	170 lf. 1.0 ac.	FEIS: - Bridge over Layhill Road will result in reduced impacts to stream and wetland - Shift in location of SWM pond will avoid SWM impact to wetland
517+00	2	Without Interchange at Layhill Road	0.2 ac.	FEIS: - Bridge over Layhill Road will result in reduced impacts to wetland - Shift in location of SWM pond will avoid SWM impact to wetland
552+00	2	W/ and W/O Interchange at Layhill Road	0.1 ac.	FEIS: SWM pond shifted to avoid impact to wetland
536+00	2	W/ and W/O Interchange at Layhill Road	179 lf. 0.5 ac.	FEIS: Bridges over Norwood Road will result in reduced impacts to wetlands and streams
570+00	2	W/ and W/O Interchange at Layhill Road	37 lf. 0.1 ac.	DEIS: - Bridge over Nursery Run to minimize stream and wetland impacts FEIS: - Bridge width reduced to minimize impacts to stream and wetland - SWM pond shifted east out of wetland - Retaining wall proposed on east side of bridge crossing to further minimize impacts to wetland and stream
Paint Branch				
673+00	1	Mainline	N/A	DEIS: - Replaced crossing with a bridge to minimize wetland impacts FEIS: - Replaced bridge with culvert because the bridge would be so low that no vegetation would grow under the bridge, and this could be a source of sediment to the stream
691+00	1	Mainline	N/A	DEIS: - Reduced stream impacts - Bridge lengthened to avoid stream valley impacts from fill and allow more room for erosion protection during construction - Stormwater diversion pipe to be placed on bridge to minimize thermal impacts to stream
725+00 – 735+00	1	Mainline	217 lf. 0.8 ac. (pond)	FEIS: - Bridge lengthened an additional 30' to reduce floodplain impacts FEIS: - SWM was relocated outside of the stream - An existing SWM pond was avoided
742+00 – 748+00	1	Mainline	327 lf.	DEIS: - Profile lowered to reduce impacts to knoll area between Gum Springs and Paint Branch - Storm drain pipe to convey roadway runoff to the downstream section of the stream FEIS: - Bridge profile was raised and the ends lengthened to span more of the stream and floodplain reducing impacts to Paint Branch and Gum Springs
759+00	2	Bartonville A	N/A	DEIS: - Bridge avoids stream impacts on Right Fork Paint Branch FEIS: - Bridge lengthened 10' on the eastern side

Table IV-68

Summary of Preliminary Stream Crossings, Stream and Wetland Impacts, and Avoidance and Minimization Measures^{1,2}

Station	Corridor	Option	Amount of Reduction from DEIS ³	Avoidance and Minimization Measures
759+00	2	Bartonville X	N/A	DEIS: • Option not proposed FEIS: • Bridge proposed that crosses just south of Bartonville A bridge • Adds 288' of impact to tributary to Right Fork of Paint Branch
Little Paint Branch				
880+00	1	Mainline	63 lf. 0.2 ac.	DEIS: • Preliminary bridge design already included Avoidance & Minimization with grading kept at least 30' to 40' outside of the streambanks and at least 10' of clearance between the top of bank and the underside of the bridge FEIS: • Bridge lengthened 55' on eastern side and bridge width reduced to 185' to reduce impacts to stream and wetlands • Conversion impacts will result from shading effects of the bridge
910+00	2	Fairland B	151 lf.	FEIS: • Shifted SWM pond out of stream channel of the Upper Little Paint Branch.
Indian Creek				
760+00 — 765+00	1&2	I-95 Truncated / Extension to US 1	444 lf. 0.7 ac.	FEIS: • Bridge added to C-D lane along northbound I-95 south of the ICC interchange to cross over Indian Creek and another C-D lane.
768+00 — 788+00	1&2	I-95 Truncated / Extension to US 1	2,797 lf. 7.0 ac.	FEIS: • Alignment of ramp from eastbound ICC to southbound I-95 shifted north and retaining wall proposed along the embankment of I-95 to minimize impacts to wetlands associated with the Aitchison Bog
953+00 — 990+00	1&2	I-95 Extension to US 1	395 lf. 5.2 ac.	FEIS: • Alignment shifted south over 700' to avoid wetlands and a state rare aster plant associated with a forested wetland floodplain and beaver marsh
Rocky Gorge				
762+00	2	Bartonville B	N/A	DEIS: • Bridge over tributary to Rocky Gorge FEIS: • Bridge lengthened to span more of the floodplain
Upper Patuxent River				
937+00	2	Fairland B	0.1 ac.	FEIS: • Shifted SWM pond outside of wetland

¹ Adapted from the March 3, 2004 IAWG Meeting preparation materials dated February 25, 2004 and from numerous meetings and memoranda from the section design engineering teams through April 2005. For specific impact avoidance and reductions for individual wetland/waterway systems, see **Appendix O**.

² Numbers refer to linear feet of perennial/intermittent streams and acreage of wetlands. Impact reductions from DEIS to FEIS are only included in the table where there was a true impact avoidance or minimization as a result of an engineering design modification.

³ No impacts to wetlands or waterways within the Muddy Branch watershed are anticipated.

⁴ N/A denotes negligible change in impacts between DEIS and FEIS or an increase in impact resulting from changes in project design based on more detailed engineering studies.

North Branch Rock Creek Watershed

The project alignment in the North Branch Rock Creek watershed includes segments that are common to both Corridor 1 and Corridor 2 and a small segment at the MD 97 interchange with the ICC that is unique to Corridor 1 and Corridor 2. In the DEIS, the bridge over the North Branch Rock Creek (*Appendix A, Plate 12, STA 319+00*) was extended 50 feet westward to avoid a spring and eastward so that the grading limits would be at least 35 feet away from the stream banks. In addition, the profile was raised approximately ten feet to reduce the potential for blasting on the knoll east of the stream valley. In the FEIS, the bridge was lengthened an additional 50 feet to further avoid impacting the spring on the west side of the stream. The culvert over the Brooke Manor tributary, a tributary to North Branch Rock Creek located just east of the mainstem, (*Appendix A, Plate 12, STA 328+00*) included in the original design was replaced in the DEIS with a 200-foot long bridge structure that allowed for at least 35 feet of lateral clearance from the stream banks and avoided approximately 450 feet of stream channel impacts. The use of a bridge also reduces the need for fill in the adjacent wetland. In the FEIS, this bridge length has been reduced on the recommendation of the USACE (the new bridge length is 125 feet) since the primary objective in bridging this location was wildlife passage, not wetland avoidance. A large meander of Brooke Manor tributary will be removed to provide a more stable crossing. A wing wall was extended on the southeastern side of the bridge to reduce wetland impacts in that location. Burying of any rip-rap required for stabilization beneath the bridge is being investigated to facilitate small mammal and amphibian passage.

Northwest Branch Watershed

Along Corridor 1, the mainstem of Northwest Branch is crossed three times on both Northwest Options A and B due to the broad meander pattern of the stream and the limited undeveloped corridor available for the proposed roadway. On Option A, the northernmost crossing (*Appendix A, Plates 17 and 18, STA 533+00*) is accomplished on a bridge that was lengthened in the DEIS to avoid over 220 feet of stream channel impacts to a tributary stream, reduce the wetland impact, and span the two-year floodplain of Northwest Branch. In the FEIS, the bridge was lengthened an additional 35 feet on each side of the stream to avoid wetland impacts. The second crossing on Option A (*Appendix A, Plate 19, STA 561+00*), south of Bonifant Road, was also lengthened in the DEIS to span Bonifant Road, Northwest Branch, and more of the floodplain, reducing the potential wetland fill required. In the FEIS, this bridge was further lengthened north of Bonifant Road to further reduce wetland fill impacts. The third and southernmost crossing on Option A (*Appendix A, Plate 19, STA 593+00*) was adjusted in the DEIS to span the 10-year floodplain and reduce fill within wetlands. In the FEIS, this bridge was lengthened an additional 50 feet at the western end providing an additional buffer to wetlands and streams. At the eastern end, the bridge was lengthened 55 feet and wing walls extended to avoid impacts to a tributary stream and to reduce wetland impacts.

Along Corridor 1 Option B, the easternmost crossing (*Appendix A, Plates 21 and 22, STA 538+00*) is a bridge that was lengthened in the DEIS to avoid stream impacts and minimize wetland and floodplain impacts due to fill. In the FEIS, this bridge was lengthened another 25 feet to reduce fill impacts to wetlands. The second crossing (*Appendix A, Plate 23, STA 558+00*) is a bridge that was lengthened in the DEIS to span Bonifant Road and Northwest

Branch and avoid wetland impacts. In the FEIS, this bridge was lengthened another 70 feet north of Bonifant Road to further reduce fill impacts to wetlands. The bridge was also lengthened another 30 feet at the southern end to shift the abutment farther from the stream. The third crossing along Option B (*Appendix A, Plates 23 and 24, STA 577+00*) is a bridge that was lengthened in the DEIS to minimize stream, wetland, and floodplain impacts, however, the Northwest Branch would require realignment in the vicinity of this bridge. In the FEIS, the bridge was lengthened 90 feet at the north end to provide additional buffer to wetlands and streams. At the southern end, the bridge was extended 60 feet to avoid wetland impacts. The stream relocation would still be necessary at this crossing resulting in over 1,300 linear feet of stream impact. Also, wetland impact reductions along Northwest Branch Option B are considerably less than for Option A. This results primarily from the portions of wetlands crossed and the orientation of the crossings. On Option B, larger portions of wetlands are crossed at diagonals rather than perpendicularly. Even though bridges have been extended similarly for both options, this crossing orientation on larger wetland systems for Option B bridges results in greater wetland impacts at the bridge abutments than on Option A, which crosses smaller wetlands at more of a perpendicular angle to the wetland.

On Corridor 2, Norbeck Option A (*Appendix A, Plate 42*) crosses three tributaries to the Batchellors Forest tributary. Two of the crossings will be accomplished with culverts (*STA 433+00 and 459+00*) and measures to reduce culvert length and associated fill are being investigated. The culvert over the third tributary (*STA 472+00*) was replaced with a bridge in the DEIS, avoiding over 300 feet of stream channel impact. In the FEIS, the bridge length was reduced at the western end creating greater stream impacts. However, the bridge was lengthened at the eastern end to reduce wetland impacts. Because the proposed bridge height is less than 30 feet, there will be a conversion impact to the forested wetlands. On Corridor 2, Norbeck Option B, with Willow Grove access over the ICC and with Willow Grove access to Mt. Everest Lane (*Appendix A, Plates 45 and 46, STA 469+00*), crosses a tributary to Batchellors Run with a bridge that avoids stream channel impact. In the FEIS, the bridge proposed for the Norbeck Option B with Willow Grove access over the ICC crossing was lengthened to further reduce impacts to the stream and to wetlands. The bridge proposed for the Norbeck B with Willow Grove access to Mt. Everest Lane crossing was lengthened to reduce impacts to the stream and to completely avoid fill impacts to the wetland. Because the proposed bridge height for each sub-option is less than 30 feet, there will be a conversion impact to the forested wetlands.

The mainline of Corridor 2 with and without an interchange at Layhill Road (*Appendix A, Plates 48, 49 and 50*) will cross the Longmead tributary, the Bryants Nursery tributary and the mainstem of Northwest Branch on bridges. In the FEIS, the bridge over Layhill Road (*STA 517+00*) was designed to reduce impacts to the stream and wetlands. A shift in location of a proposed SWM pond will further avoid impact to wetlands at this interchange. The crossing of the mainstem of Northwest Branch (*STA 556+00*) at Norwood Road will be on an extended bridge that will reduce wetland and stream impacts. At *STA 552+00*, a proposed SWM pond was shifted south to avoid an impact to forested wetlands. The crossing of Bryants Nursery tributary (*STA 570+00*) was proposed on an extended bridge in the DEIS to minimize stream and wetland impacts. In the FEIS, the bridge width was reduced to minimize impacts to the stream and wetland. A retaining wall was also proposed on the east side of the bridge crossing to further

minimize impacts to wetland and stream. On the north side of the proposed ICC, a SWM pond was shifted outside of the wetland limits to avoid an impact.

Paint Branch Watershed

On Corridor 1, four bridges were proposed in the DEIS to avoid stream channel impacts on Paint Branch and its tributaries. The crossing of the tributary to the Good Hope Tributary downstream of the Colesville Maintenance Depot (*Appendix A, Plate 25, STA 673+00*) was originally replaced with a bridge to minimize the amount of wetland impacts. However, the bridge would only be a few feet above the elevation of the wetland, resulting in permanent shading impacts to the wetland and likely creating an added source of sediment to the stream. In the FEIS, a culvert was once again proposed at this crossing raising the impacts to wetlands by 0.4 acre and to perennial and intermittent streams by 444 linear feet. A spring box or other seep maintenance measure and culvert would collect and discharge groundwater to the stream that currently discharges from the wetland. At the crossing (*Appendix A, Plate 26, STA 691+00*) of Good Hope Tributary, Paint Branch's primary trout habitat, the preliminary bridge was lengthened in the DEIS to avoid stream valley impacts, reduce fill required on valley slopes, and allow for more room to provide erosion control protection during construction. In addition, the potential for thermal impacts from bridge runoff will be avoided through a conveyance system on the underside of the bridge that will direct stormwater away from the Good Hope Tributary. In the FEIS, the bridge was lengthened an additional 30 feet to reduce floodplain impacts. Gum Springs (*Appendix A, Plate 27, STA 742+00*) will be spanned by a bridge, which will also be designed to pipe stormwater away from primary trout habitat areas. The profile of the bridge was lowered in the DEIS to reduce the amount of fill needed on the knoll between Gum Springs and the Paint Branch mainstem. In the FEIS, the bridge profile was raised and the bridge extended to span both Gum Springs tributary and Paint Branch, reducing impacts to both streams. A SWM facility was shifted south to avoid impacts to an intermittent stream channel.

On Corridor 2, Burtonsville Option A (*Appendix A, Plate 69, STA 759+00*), a culvert over the Right Fork of Paint Branch was replaced in the DEIS with a bridge structure, avoiding over 150 feet of stream channel impacts. In the FEIS, the bridge was lengthened 10 feet on the eastern side. Also in the FEIS, another option, Burtonsville Option X was added. This option extends to the south of Burtonsville Option A, but would cross the Right Fork of Paint Branch on a bridge that would be just south of the Burtonsville Option A bridge crossing. However, this option would add 288 linear feet of culvert impact to a tributary to the Right Fork of Paint Branch west of the Right Fork of Paint Branch crossing. Conversion of forested wetlands to emergent wetlands will result from shading effects of the Burtonsville Option A bridge, however, the Burtonsville Option X bridge crosses below the wetland and would not impact it.

Little Paint Branch Watershed

Little Paint Branch would be spanned on Corridor 1 (*Appendix A, Plate 32, STA 880+00*) with a bridge that allows 30 to 40 feet outside of the stream banks of both the mainstem and a tributary stream. The bridge substantially minimizes the filling of wetlands in the Little Paint Branch floodplain. In the FEIS, the bridge was lengthened 55 feet on eastern side and the bridge width

Rocky Gorge Watershed

A number of culvert crossings and one bridge crossing (*Appendix A, Plate 73, STA 762+00*) of small tributaries to the Rocky Gorge Reservoir occur along the Burtonsville Option B of Corridor 2. Measures to reduce culvert lengths are being investigated on all of the culverts, as the steepness of the terrain would greatly increase required fill and culvert length. In the FEIS, the proposed bridge crossing at *STA 762+00* was lengthened to span more of the floodplain.

Upper Patuxent

Impacts to wetlands and waterways in the Upper Patuxent watershed are primarily related to extensions of existing stream culverts and encroachments on small associated wetlands. Many of the stream channels that would be impacted are located in manipulated drainage ditches along I-95 or its interchanges and cannot be avoided when additional lanes are added to I-95 for movement to and from the ICC. Impacts have been minimized wherever possible by limiting culvert extensions to only that required to support the widening, and stream channels that flow parallel to the roadway will be relocated to accommodate existing stream flow. In addition, along the Fairland Option B of Corridor 2 (*Appendix A, Plate 81, STA 937+00*), wetland impacts have been reduced by shifting a SWM facility outside the limits of the wetland.

f. Mitigation

Section 404 of the Clean Water Act provides regulatory authority to the USACE to issue or deny permits for discharge of dredged or fill material into Waters of the U.S., including wetlands and other special aquatic sites (i.e., mud flats, riffle pool complexes, and vegetated shallows). The MDE regulates any alteration to nontidal wetlands under the Maryland Nontidal Wetland Protection Act, including the alteration of wetland vegetation or draining of wetland hydrology. MDE also has jurisdiction over isolated wetlands, which are not regulated by the USACE.

In accordance with Federal and State regulations, avoidance and minimization measures to reduce impacts to wetlands and other Waters of the U.S. are being implemented for all phases of the project and will continue through final design and construction of the project. This effort includes working closely with resource agencies to refine avoidance and minimization measures.

Appropriate and practicable compensatory mitigation is required for unavoidable adverse impacts to wetlands and other Waters of the US. Compensatory mitigation is being evaluated in accordance with State and Federal regulations and guidance such as Code of Maryland Regulations, Interagency Mitigation Task Force Guidance 1994, USACE Regulatory Guidance Letter 2002-02 and the Mitigation and Monitoring Guidelines Baltimore District Regulatory Program U.S. Army Corps of Engineers 2004. The proposed compensatory mitigation program focuses on the replacement of the affected aquatic resource functions in addition to the acreage affected. In regard to wetland impacts, the mitigation requirements were determined by the ratio of wetland acres replaced to wetland acres lost. Emergent wetlands will be mitigated on a 1:1 replacement basis, while forested and scrub-shrub wetlands will be mitigated on a 2:1 basis. In addition, forested wetlands under bridges with proposed clearances less than 30 feet in height will be converted to emergent wetlands and mitigated on a 1:1 replacement basis. *Table IV-69*

details the maximum amount of wetland acreages that would be affected by the implementation of the project corridors and regulated ratios for the type of wetland proposed for mitigation.

Table IV-69
Wetland Mitigation Requirements

Cowardin Class	Wetland Acres Impacted	Replacement Ratio
Corridor 1		
PEM	29.81-31.82	29.81-31.82 (1:1)
PFO	15.32-16.22	30.64-32.44 (2:1)
PFO conversion to PEM	0.65	0.65 (1:1)
TOTAL	45.78-48.69	61.10-64.91
Corridor 2		
PEM	32.26-38.20	32.26-38.20 (1:1)
PFO	14.14-17.86	28.28-35.72 (2:1)
PFO conversion to PEM	0.95-1.09	0.95-1.09 (1:1)
TOTAL	47.35-57.15	61.49-75.01

*These numbers reflect the upper limits of the calculated acreage for each corridor.

The USACE and MDE typically require mitigation for waterway impacts on a project-specific basis. The agencies target compensatory stream mitigation projects to replace stream functions when feasible. In addition to stream channel improvements, mitigation measures for waterway impacts consider the size, stream order, and location of the stream to determine appropriate stream mitigation. Other mitigation measures such as removal of fish blockages, riparian buffer enhancements, and water quality improvements may be used at the agencies' discretion. **Table IV-54 in Chapter IV.F.7.a** summarizes the perennial and intermittent stream impacts, as well as open water pond impacts, by Corridor for each watershed. According to this table, Corridor 1 options would impact up to 39,158 linear feet of perennial/intermittent stream, up to 10,296 linear feet of ephemeral stream and up to 9.09 acres of open water ponds, while Corridor 2 options would impact up to 37,584 linear feet of perennial/intermittent stream, up to 11,160 linear feet of ephemeral stream and up to 9.22 acres of open water ponds. Palustrine open water (POW) ponds are not regulated or mitigated as wetlands due to their lack of vegetation, therefore, they are accounted for under stream mitigation. Compensatory mitigation is preferred, when practicable, in areas within or adjacent to the project corridors (i.e. on-site compensatory mitigation). If on-site compensatory mitigation is not practicable, off-site mitigation should be undertaken in the same watershed as the affected resource, if possible. The agencies may require in-kind, out-of-kind, or a combination of both for mitigation to achieve functional replacement. In-kind replacement is preferred when it is feasible and the impacted resource is locally important, while out-of-kind mitigation is appropriate when it is more practicable and provides an equal or greater watershed benefit than in-kind compensation (e.g., of greater ecological importance to the region of impact). For wetlands, compensation measures are determined in accordance with the recommendations provided by the MDE and USACE Baltimore District. This guidance uses an ecosystem based approach when determining compensatory mitigation requirements that considers the resource needs of the watersheds where impacts will occur and those of neighboring watersheds.

Wetlands

The mitigation site selection process focuses on locating areas with the highest potential for wetland creation or restoration with emphasis on “in-kind” replacement within the watersheds potentially affected by the project and neighboring watersheds.

A compensatory mitigation package has been designed to fulfill the mitigation requirement, as well as meet the resource protection goals of the natural resource agencies and the Lead Agencies (**Table IV-70, Figure IV-5**). The seven mitigation sites proposed are nontidal wetland creation sites. Of the seven proposed sites, two sites are located in the Northwest Branch watershed, one site is located in the Paint Branch watershed, three sites are located in the Seneca Creek watershed and one site is located in the Monocacy River watershed. These sites will be further evaluated with detailed field investigations. Please refer to the NETR (SHA, 2004) and the sections below for additional details regarding wetland mitigation and the site screening process. In addition, 12 nontidal wetland creation mitigation sites within the Monocacy River watershed in Frederick County have been identified as backup mitigation sites, if for some technical reason one of the preferred mitigation sites is no longer feasible (**Table IV-71**). SHA may also consider other suitable backup wetland creation sites closer to the project area if they can be identified in a timely manner. The regulatory agencies gave preliminary concurrence on the proposed wetland mitigation sites and backup list on April 6, 2005.

Waters of the U.S.

The Waters of the U.S. mitigation site selection process focuses on locating streams with the greatest need for restoration within the watersheds potentially affected by the project. Emphasis is placed on first and second order streams in need of restoration in subwatersheds crossed by or adjacent to those crossed by the proposed corridors. All potential sites considered for compensatory mitigation of Waters of the U.S. have been gathered from input from various Federal, State, and local agencies or have been proposed in previously published documents, such as previous mitigation site searches and watershed studies. Only mitigation projects that have not been built and those that are not currently under design or construction were considered in the site screening process. The stream restoration and water quality projects included in the current compensatory mitigation package (**Table IV-70, Figure IV-5**) could include many of the following types of stream improvements:

- Aquatic habitat enhancement
- Fish passage restoration
- Bank stabilization
- Floodplain reconnection
- Riparian buffer enhancement
- Outfall protection

- Structure scour protection
- Stormwater retrofits
- Small scale BMPs
- Removal of existing culverts and impervious area

In addition to traditional stream restoration projects, fish blockage removal and SWM retrofits originally identified by Federal, State, and local resource agencies are included in the current compensatory mitigation package (*Table IV-70, Figure IV-5*). These types of sites were added in order to provide an ecosystem based approach to compensatory mitigation while addressing the resource needs of the watersheds where ICC-related impacts are proposed to occur. The proposed package for Corridor 1 includes five water quality sites (Paint Branch watershed), six stream restoration sites (one in Northwest Branch watershed, three in Paint Branch watershed and two in Indian Creek watershed), two fish blockage removal sites in the Rock Creek watershed and one fish blockage removal site in the Paint Branch watershed. The proposed package for Corridor 2 includes five water quality sites (Paint Branch watershed), five stream restoration sites (one in Northwest Branch watershed, one in Paint Branch watershed, two in Indian Creek watershed and one in the Patuxent River watershed), two fish blockage removal sites in the Rock Creek watershed and one fish blockage removal site in the Paint Branch watershed. In addition, three water quality sites in the Paint Branch watershed and two stream restoration sites in the Paint Branch watershed have been identified as backup mitigation sites, if for some technical reason one of the preferred mitigation sites is no longer feasible (*Table IV-71*). The regulatory agencies gave preliminary concurrence on the proposed stream mitigation sites and backup list on April 6, 2005.

All stream restoration, fish blockage removal, and SWM retrofit sites will be further evaluated with detailed field investigations. Please refer to the NETR (SHA, 2004) and sections below for additional details regarding stream mitigation and the site screening process.

Agency Coordination

Mitigation planning has been coordinated with the USACE, MDE, and other resource agencies on a continuing basis throughout the current study. The watershed-based approach was used for the mitigation site search and selection process. This process included the integration of the mitigation into watershed plans while using functional assessment and previous resource agency studies to determine watershed needs. A key component of the approach was to identify mitigation sites that would protect and enhance water quality, and improve stream channel stability, fisheries, and wildlife habitat. Resource agency personnel participated in a series of workshops and field meetings between January and April 2005 to review the proposed aquatic resources compensatory mitigation package listed in *Table IV-70*. The Natural Resources Environmental Stewardship projects presented in Chapter VI were reviewed concurrently during these workshops and site visits.

At a meeting on April 6, 2005 the proposed compensatory mitigation package along with backup sites were presented to the agencies. The package proposed at the meeting is provided in **Table IV-71**. Based on this package of proposed mitigation projects, the regulatory agencies gave preliminary concurrence.

Mitigation requirements specified in this plan are based on the maximum level of impacts that may occur within the limit of disturbance proposed for construction. Therefore, the mitigation plan accounts for the maximum amount of mitigation that could be required. Impacts to wetland vegetation due to construction access needs have been deemed temporary in accordance with regulatory guidelines. Mitigation for these temporary impacts (in **Table IV-66**) will be accomplished on-site and in-kind and will be included with the roadway construction documents. Mitigation requirements may be revised through on-going coordination with the regulatory agencies as final engineering plans are prepared during the design phase of this project.

Next Steps for Compensatory Mitigation Package

The regulatory agencies gave preliminary concurrence on the proposed compensatory mitigation package on April 6, 2005. The next step in the process is to conduct a detailed NEPA assessment and technical site assessments, as described in detail below. It is during this phase of the process that sites may be dropped due to potential resource impacts or technical issues. If a site is dropped from consideration, a site from the backup list will be brought forward for the same analysis.

NEPA Clearance

Each mitigation site will be evaluated in accordance with the same requirements as this document for the following resources to confirm that the site will not have an adverse affect on the natural, social and/or cultural environment.

- ROW clearance/acquisition
- Cultural resources investigation
- Hazardous materials investigation
- Wetland delineation
- Rare, Threatened or Endangered species coordination
- Terrestrial and habitat investigation

A narrative for each site and the resource findings will be prepared and submitted to the regulatory agencies for review and approval. If sites are determined not to have any fatal flaws, more detailed baseline studies will be conducted. An overview of these baseline studies is described below.

Table IV-70
Compensatory Mitigation Package

Site ID	Watershed/ County	Potential Restoration Units ¹	Compensatory Mitigation Concept – Aquatic Resources	Number and Type of Parcel (Public or Private)	Corridor
Stream Restoration Sites					
IC-59	Indian Creek/ Prince George's	1,100	IC-59 and IC-62 are located on the mainstem of Indian Creek just upstream and downstream of the Powder Mill Road crossing. The concept for IC-59 and IC-62 includes stream restoration efforts (gabion removal, berm removal, bank stabilization, floodplain creation, fish blockage removal, riparian buffer enhancement, and habitat enhancement).	IC-59 (5-private, 1- public)	1 and 2
IC-62	Indian Creek/ Prince George's	1,900		IC-62 (1-public)	
NW-160	Northwest Branch/ Montgomery	11,000	This site includes the mainstem of Northwest Branch from Bonifant Road downstream to Indian Springs Golf Course. A portion of Rolling Stone tributary that joins Northwest Branch within the project site would also be included. The concept for NWB includes the following stream restoration efforts: floodplain creation to provide energy dissipation of erosive flood flows, reduce erosive shear stresses, reduce channel incision, and increase infiltration and groundwater recharge; bank stabilization to provide energy dissipation of erosive flood flows, reduce erosive shear stresses, and reduce bank erosion and instream sedimentation; enhancing the riparian buffer; installation of woody debris and other types of instream cover and gravel channel material to enhance the benthic and fish habitats and communities.	1-private 1-public	1 and 2
PB-12B	Paint Branch/ Montgomery	4,500	PB-12B is located on Hollywood Branch and flows southeasterly from where the stream goes under Laurie Drive to the confluence with Paint Branch in the Fairview Estates community. The concept for PB-12B includes stream restoration efforts (bank stabilization, floodplain creation, utility conflict resolution, fish blockage removal, and riparian buffer enhancement).	1-public	1
PB-119	Paint Branch/Prince George's	1,000	Site PB-119 is located on the mainstem of Good Hope tributary to Paint Branch. The limits for this site extend from approximately 300 feet upstream to 700 feet downstream of the Good Hope Road crossing of this stream. The concept for PB-119 includes the following stream restoration efforts: floodplain creation to provide energy dissipation of erosive flood flows, reduce erosive shear stresses, reduce channel incision, bank stabilization to provide energy dissipation of erosive flood flows, reduce erosive shear stresses, and reduce bank erosion and instream sedimentation; and installation of woody debris and other types of instream cover and gravel channel material to enhance the benthic and fish habitats and communities.	1-public	1 and 2
PB-8	Paint Branch/ Montgomery	1200	PB-8 is located in the Left Fork subwatershed of the Upper Paint Branch watershed. PB-8 is made up of two reaches. The western reach is located entirely within Upper Paint Branch Park. The concept for PB-8 includes stream restoration efforts (bank stabilization, floodplain creation, riparian buffer enhancement, fish blockage removal, and habitat enhancement).	PB-8 (5-private, 2- public)	1
PR-254	Patuxent/ Montgomery Co.	3500	This is the Lower James Creek tributary to Hawlings River located along Gold Mine Road. Existing conditions in this watershed are affected by agricultural practices and, more recently, conversion to suburban development. Water quality improvement in the Hawlings River is needed because is a significant portion of the Rocky Gorge watershed.	1-public	2

Table IV-70
Compensatory Mitigation Package

Site ID	Watershed/ County	Potential Restoration Units ¹	Compensatory Mitigation Concept – Aquatic Resources	Number and Type of Parcel (Public or Private)	Corridor
Fish Passage Sites					
PB-93A	Paint Branch/Prince George's	500	This is a fish passage site located at an exposed sewer line between US 1 and the College Park Airport. The blockage can be seen from the footbridge located approximately 1,000 feet upstream of the confluence of Paint Branch with Indian Creek. The drop at this site is about 1.5 feet and at lower flows is a complete blockage to upstream fish passage.	1-public	1 and 2
RC-131	Rock Creek/ Montgomery	500	RC-131 is located east of the intersection of Beach Drive and Pinehurst Parkway on the mainstem of Rock Creek within Rock Creek Park. The blockage is an exposed utility crossing that has a vertical drop of approximately one foot causing a depth of flow of approximately two inches at normal flow.	1-public	1 and 2
RC-131A	Rock Creek/ Montgomery	500	RC-131A is located east of Beach Drive in the Candy Cane Park section of Rock Creek Park. This is a partial fish blockage caused by a concrete sewer encasement that is exposed at lower flow conditions. In addition to restoring fish passage over the blockage, other improvements slated for this site include streambank stabilization and riparian buffer improvement to improve stream habitat.	1-public	1 and 2
Wetland Creation Sites					
MR-5	Monocacy River/ Montgomery	19	This site is an active cow pasture located at the intersection of Bethesda Church Road and Clarksburg Road within the floodplain of Bennett Creek.	1-private	1 and 2
SC-2	Seneca Creek/ Montgomery	21	This site is located at the corner of Huntmaster Road and Brink Road within the floodplain of Goshen Branch. This site is also located across from the existing Hawkins wetlands creation site. The created wetlands could be hydrologically connected to the emergent wetlands on site and provide a riparian buffer to the stream.	1-public	1 and 2
NW-128	Northwest Branch/ Montgomery	3	NW-128 is currently a ball field located in Northwest Branch Recreational Park. The site would be excavated 2'-3' to tap into groundwater or divert flows from Northwest Branch into the site. The ball field would be converted to a wetland/floodplain condition by removing the fill from the site.	1-public	1 and 2
PB-1	Paint Branch/ Montgomery	12	PB-1 is located on the south side of Spencerville Road and east of Peach Orchard Road along a tributary to Paint Branch. The site begins as a farm pond located on the south side of the stream. The concept for this site is to create forested wetlands on the south side of the stream by excavating less than five feet to hydrologically connect to the stream and existing groundwater. The north side of the stream could be reforested with a mix of wetland and upland tree species. The pond would be removed as part of this concept to reduce thermal impacts to the stream.	1-private	1 and 2
SC-19	Seneca Creek/ Montgomery	19	This site is located east and west of Woodfield Road at the Great Seneca crossing. This site is situated in the floodplain of Great Seneca Creek and receives both surface water input and bank overflows that could support the hydrology of a created wetland.	1-private	1 and 2

Table IV-70
Compensatory Mitigation Package

Site ID	Watershed/ County	Potential Restoration Units ¹	Compensatory Mitigation Concept – Aquatic Resources	Number and Type of Parcel (Public or Private)	Corridor
SC-21	Seneca Creek/ Montgomery	6	This site is located on the north side of Brink Road at the Great Seneca Creek crossing along the east bank of the stream. The hydrology for the created wetland would be supported by groundwater and the hydric soils that are mapped within the stream valley. Wildcat Branch, a tributary to Great Seneca Creek, is located just upstream of this site and is classified as Class III trout waters.	1-public	1 and 2
NW-69	Northwest Branch/ Montgomery	3	NW-69 is located on the north side of Batchellors Forest Road across from Trotters Glen Golf Course in the headwaters of Batchellors Run. The concept for NW-69 includes the following efforts: grading and planting to create a forested wetland and spraying to eradicate multiflora rose. The concept for this site is to extend the existing wetland along the east side of the stream and plant the site with forested wetland species such as sycamore, spicebush and arrow-wood.	1-private	1 and 2
Water Quality Mitigation Sites					
PB-33	Paint Branch/ Montgomery	80	This site is located in the Great Hope Manor community, adjacent to the Right Fork at Good Hope Road and Good Hope Drive. The concept includes cleaning up debris, adding infiltration trench and /or bioretention cells to the extent possible, retrofit of the existing riser to provide extended detention, expansion of the existing SWM pond next to the community center to provide extended detention and stabilization of an	1-private	1 and 2
PB-43	Paint Branch/ Montgomery	40	Unvegetated outfall channel east of Timberlake Drive and Seibel Drive. The concept includes retrofitting existing outfall channel with grass swale, biofilter, or infiltration trench.	1-private	1 and 2
PB-46A	Paint Branch/ Montgomery	22	Existing dry pond at west end of Perrywood Road. The concept is to convert a dry extended detention pond to attenuate flows without raising temperatures, including planting the riparian buffer and pond. Pond may need to expand into adjacent parkland to capture runoff for entire drainage area.	1-private	1 and 2
PB-114A	Paint Branch/ Montgomery	70	Degraded stream channel at the south end of Eastway Drive in Peachwood Park. The concept includes evaluating alternatives previously developed by MCDEP and MWCOG to plan and construct an off-line extended detention facility to address one of the few remaining uncontrolled drainage areas contributing to Good Hope Tributary.	1-private	1 and 2
PB-49	Paint Branch/ Montgomery	134	Uncontrolled runoff from tributary north of Rainbow Drive, east of Wembrough Street and west of Langside Street. The concept includes constructing a new dry extended detention pond to attenuate flows without raising temperatures and planting the riparian buffer and pond.	1-public	1 and 2

Table IV-71
Backup Compensatory Mitigation Package

Site ID	Watershed/ County	Potential Restoration Units	<u>Backup Compensatory Mitigation Concept – Aquatic Resources</u>
Backup Wetland Creation Sites			
MR-19	Monocacy River/Frederick	25	This site is located on the south side of Daysville Road and east of Water Street Road within the floodplain of Israel Creek.
MR-20	Monocacy River/Frederick	45	North side of Daysville Road, just past Bennie Duncan Road. Active pasture with wetlands along Laurel Branch.
MR-22	Monocacy River/Frederick	10	South side of Woodsboro Road along Israel Creek, east of Woodsboro Pike.
MR-13	Monocacy River/Frederick	37	Active cow pasture on the north side of Glissans Mill Road and west of Kimmel Road along the South Fork of Linganore Creek.
MR-14	Monocacy River/Frederick	36	South side of Glissans Mill Road, just west of Harrisville Road along the South Fork of Linganore Creek.
MR-15	Monocacy River/Frederick	22	Active cow pasture located north and south of Glissans Mill Road and south of Harrisville Road along the South Fork of Linganore Creek.
MR-12	Monocacy River/Frederick	45	South side of Lime Plant Road, along the north side of Bens Branch and the confluence with another tributary.
MR-1	Monocacy River/Frederick	28	North side of Ganley Lane, west of MD 75 (Green Valley Road) along Bush Creek.
MR-16	Monocacy River/Frederick	25	East and west of Woodville Road, just north of the intersection with Emerson Burner Road along the North Fork of Linganore Creek.
MR-17	Monocacy River/Frederick	24	East and west side of Emerson Burner Road at the Linganore Creek stream crossing.
MR-18	Monocacy River/Frederick	40	East and west of Dollyhyde Road along the North Fork of Linganore Creek.
MR-8	Monocacy River/Frederick	21	The floodplain of Bush Creek which is bounded by Ijamsville Road, Prices Distillery Road and the railroad tracks.
Backup Stream Restoration Sites			
PB-108	Paint Branch/Montgomery	2400	PB -108 is made up of two reaches. The first reach flows from Good Hope Drive to the confluence with the first left bank tributary, north of Maydale Drive. The second reach is a tributary to the Left Fork from south of the Craddock Street and Kings House Road intersection
PB-37	Paint Branch/Montgomery	2700	PB-37 is located in the headwaters of the Upper Gum Springs between Good Hope Road and Fireside Drive.
Backup Water Quality Sites			
PB-50	Paint Branch/Montgomery	220	Tributary east of Wembrough Street and north of Rainbow Drive.
PB-40	Paint Branch/Montgomery	83	South of Fireside Drive, west of Harold Road.
PB-48	Paint Branch/Montgomery	20	East of Evensham Place and northwest of Langside Street.
¹ Potential Restoration Units vary depending on the type of restoration proposed and are as follows: Units for stream restoration sites are linear feet of restoration, units for fish passage sites are linear feet of blockage removal, units for wetland creation sites are acres, and units for water quality mitigation are acres of drainage area treated.			

Stream Baseline Studies

The baseline studies for stream restoration sites will include collection of geomorphic data and analysis activities involved in Levels I, II, III and IV of the Rosgen Stream Classification Methodology. These assessments will also be performed at stable reference reaches that may serve as design analogs. The major assessment activities will include collection of stream survey data to determine existing discharge and channel stability information. Detailed stream cross section and profile surveys, measurement of sediment particles, and channel planform characteristics will be conducted. Existing conditions including the degree of streambank erosion, aquatic habitat and riparian corridor conditions will be thoroughly assessed over a period of approximately one year. All of this data will be summarized in a report and, with a conceptual restoration plan, evaluated to determine if the site should proceed to design. A wetland delineation will be conducted at each site to identify and flag any existing wetlands on site.

Wetland Mitigation Baseline Studies

The baseline studies for the wetland mitigation sites will include the collection and analysis of detailed hydrologic data on potential groundwater and surface water sources, soil profile information and vegetation community data. These assessments will also be performed at an adjacent or nearby reference wetland where available. Hydrologic, soil and vegetative information will be collected for a minimum of one year. This information will be summarized in a report and, with a conceptual wetland creation plan, evaluated to determine if the site should proceed to design.

Fish Passage Baseline Studies

The baseline studies for the fish passage restoration sites will include the geomorphic data collection and analysis activities involved in Levels I and II of the Rosgen Methodology and site specific data for developing stage/discharge relationships. The goal is to collect this type of data over a full range of discharge regimes to determine the hydrologic and hydraulic factors that currently limit fish passage. It is anticipated that these data will be collected over a period of approximately one year. This information will be summarized in a report and a conceptual restoration plan will be evaluated to determine the most practical method for providing fish passage.

Water Quality Sites Baseline Studies

The baseline studies for the water quality sites will document the existing conditions at the proposed SWM retrofit sites. They include collection and analysis activities for total suspended solids (TSS) and site specific engineering data. It is anticipated that it will take approximately one year to collect the necessary data on the existing SWM facilities, summarize it in a report and provide a conceptual restoration plan to evaluate the most practical method for providing improved water quality.

g. Mitigation Post Construction Monitoring/Performance Standards

The post construction monitoring/performance standards for the compensatory mitigation package proposed for the project will be initiated after construction and continue for five years or less depending on the success of the project. At the end of the monitoring period (the growing season each year), a report will be prepared describing the data collected. The report will also include a discussion of changes or trends and an estimate of the total area of the site meeting the technical criteria. Any problem areas will be noted and a recommendation of remedial action, if any, will also be described. The report will document annual precipitation rates and climatic conditions just prior to the field investigations. In addition to the report narrative, the report will include figures and photographs. All reports, data, and mapping will be submitted to the regulatory agencies by December 31st each year. Individual monitoring plans will be developed for each type of proposed project (wetland, stream, fish passage, or water quality) during the design phase of the compensatory mitigation sites.

Stream Restoration Sites

The purpose of the stream monitoring program is to determine the degree of success achieved by the stream restoration project in meeting the permit conditions. The degree of success will be evaluated based on the level to which the goals and objectives, established by the Lead Agencies, are met. Monitoring data, as obtained through an effective program, should provide evidence that the goals of the project are being met, while simultaneously revealing any deficiencies. The stream restoration project will require semi-annual monitoring for a period of five (5) years, including a *minimum* of two (2) significant ($\geq$ bankfull) flow events. If less than two (2) significant flow events occur during the first five (5) years, it is recommended that the monitoring might continue until it is demonstrated that the project is capable of withstanding two (2) significant flow events.

In addition to the semi-annual monitoring, spontaneous monitoring after significant ($\geq$ bankfull) storm events may be performed if determined necessary. Also, fish and benthic macroinvertebrate sampling and identification will be conducted at least once during the five year monitoring period.

Frequency

An as-built survey shall be completed after project construction. Monitoring will be performed on a semi-annual basis for a period of up to five (5) years. Monitoring will occur immediately following the spring high flow season to assess the effects of heightened water levels on the project. Monitoring will also be performed during the low flow period of late summer, which will allow for the inspection of portions of the project that may have been underwater during the spring inspection. Spontaneous monitoring may also be performed following significant storm events ($\geq$ bankfull), to assess the effects of flood flows on the project. Bankfull flow levels for the project reach will be assumed to occur when bankfull is achieved on either a reference reach or at a gage station utilized in the project design. Any deficiencies noted during monitoring activities will be reported for remedial action.

Monitoring data, as obtained through an effective program, should provide evidence that the goals of the project are being met, while simultaneously revealing any deficiencies. The stream restoration project will require semi-annual monitoring for a period of five (5) years, including a *minimum* of two (2) significant ($\geq$ bankfull) flow events. If less than two (2) significant flow events occur during the first five (5) years, it is recommended that the monitoring might continue until it is demonstrated that the project is capable of withstanding two (2) significant flow events.

In addition to the semi-annual monitoring, spontaneous monitoring after significant ($\geq$ bankfull) storm events may be performed if determined necessary. Also, fish and benthic macroinvertebrate sampling and identification will be conducted at least once during the five year monitoring period.

Station Selection

Stream monitoring station selection will take place prior to the completion of the as-built surveys. Any of the original established cross sections that were undisturbed by construction will continue to be utilized. Those cross sections affected by the channel enhancements will be reestablished during the as-built survey. The monitoring stations will then remain constant throughout the monitoring period. Upstream and downstream control stations will be defined at/near the limits of work.

Monitoring efforts will include overall site reconnaissance, as well as visual inspections of all in-stream structures that have been installed. An appropriate number of cross section monitoring stations will be required in addition to the upstream and downstream control sections to adequately measure deposition/scour, lateral and down valley migration, as well as any other possible instabilities. The cross sections should be selected so as to include both pools and riffles, and be located both above and below constructed channel stabilization features. Additional monitoring stations may be defined at any time, at any location determined to be experiencing instability. Permanent monuments will be installed at the cross sections to ensure consistency for the prescribed period and during possible extended periodical monitoring.

Visual Inspection / Photographic Documentation

An overall visual inspection will take place over the entire project site during the normal course of monitoring to assess the general condition of the project. Additionally, visual inspections will take place at every monitoring station and at every in-stream structure to determine any deficiencies. Any changes in form or function, structural stability, scour, vegetation growth, or any other anomalies will be noted. Any deficiencies noted during inspections will be reported for remedial action. Photographs will be taken at every monitoring station and in-stream channel stabilization device.

Geomorphic Stability

Measurements of the geometry, pattern and profile of the reconstructed stream will be conducted to determine how closely the new channel matches historic geometry and stream stability. Cross sectional surveys will be taken at the upstream and downstream control stations, as well as at the

defined cross section monitoring stations located within the project limits. Cross sectional surveys will be performed in both riffles and pools in order to obtain a representative sample. The cross sectional surveys, taken between the permanent monuments, will include a sufficient number of points to determine channel width, depth, thalweg, top of bank and bankfull indicators. Flow velocity measurements will be taken at the cross sections using a calibrated flow meter at a point approximately 40% of the water depth (from the bottom up). Velocity measurements will be taken at numerous measured points across the cross section so that a velocity profile can be assembled.

A longitudinal profile will be developed along the thalweg, which delineates riffles, pools, water surface and where possible, bankfull and terrace features, including structural restoration devices. The functionality of the constructed channel stabilization features will also be assessed. A visual inspection will be conducted assessing developments such as scour, loss of basal toe protection, flow misdirection and any other observed anomalies.

The reconstructed channel grain size distribution will be determined. Pebble counts will be performed at the upstream and downstream control sections as well as at the determined cross sections within the limits of work, including particles from pools, glides, runs and riffles.

Wetlands Creation Sites

All wetland creation sites will be monitored using the latest SHA mitigation monitoring protocols. The protocols involve the following methodology:

Aerial Photography – Low-level aerial photography of the site will be flown in the early spring and late summer or early fall. Aerial photographs will be used to estimate the limits of identifiable vegetation cover types, bare ground, or open water.

Photographs - Photographic documentation will be made from the same designated photographic stations that have been used in previous monitoring years. The project team will compare the photographs each year to assess the vegetated succession of the site.

Vegetation – Field verification of vegetation cover types, estimated from aerial photographs, will be made once during spring and once during fall. Vegetation cover types will be mapped on a copy of the aerial photograph. A minimum of one sample plot per cover type will be assessed using the routine wetland field evaluation method described in the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual. Sample plots will be randomly located within each mapped cover type, and the location surveyed using GPS. Dominant plant species found in each vegetation layer will be recorded in order of dominance along with the size and condition of any woody plant species. Areas of bare ground or open water greater than 0.01 acre in size that do not appear on the aerial photograph will be estimated on the available mapping. Areas dominated by invasive species will also be identified and mapped.

Hydrology – Surface water hydrology will be observed in the field during both spring and fall vegetation monitoring. Surface water studies are proposed a minimum of twice per year to capture the effects of the different levels of discharge on the constructed sites. Areas with

different hydrologic regimes will be mapped and an average water depth measured for each. Where surface water is present, an estimate of water clarity will also be made. Where surface water is not present, a boring will be taken at each vegetation sample plot within the representative cover types to determine the presence or absence and average depth of near-surface groundwater. Groundwater monitoring wells will be installed only on sites where the hydrology of the site appears to be problematic and requires more detailed study or potential remediation.

Soils – Soil borings will be dug at each vegetation sampling plot during the fall site visit of each monitoring year. At a minimum, one to two borings will be taken in each designed wetland type. If more than one cover type exists within a designed wetland type, then at least one boring will be taken within each existing cover type. Additional borings may be performed in areas that appear to be problematic (e.g. too dry), as needed. The pits will be excavated to a minimum depth of fifteen (15) inches. The results of the sampling, including soil profile data and characteristics will be documented.

Wildlife – Evidence of wildlife use of the mitigation sites will be documented during field visits to the sites. Evidence may include visual observations, tracks, scat, nests or dens, etc. Documentation will include the date, time of day, species, and number of individuals present. Any wildlife problems such as deer browsing, mice girdling, or beaver activity will also be documented.

Fish Passage Sites

Removal of fish blockages and construction of fish passages is proposed as stream restoration mitigation for waterway impacts associated with construction of the project. The performance standards outlined in this section are established to set objectives for successful anadromous fish passage restoration. One (1) stream reach (Rock Creek) is proposed for fish passage improvements, with different fish passage techniques likely to be used depending upon the unique circumstances of the stream reach and type of blockage at the sites.

Performance standards to assess the success of a wide range of anadromous fish passage options must necessarily be broad-based. However, the ultimate test of fish passage improvements is the observation of fish movements through the fish passage structure or the documentation of target fish species above the former blockage, regardless of the fish passage technique used. Many factors, other than the presence of fish blockages, are responsible for the migratory distance that anadromous fish will go to spawn. These factors can include the upstream location of where the fish were spawned, water temperature and depth, and the availability of suitable spawning substrates. Anadromous fish that currently migrate to the base of existing fish blockages cannot proceed farther upstream to spawn and consequently must either forego spawning or spawn downstream of the blockage. Therefore, it cannot be presumed that once the blockage is removed that the fish will be compelled to go farther upstream. For this reason, establishing performance standards based on numbers or percentages of fish observed above the fish passage will be inappropriate.

While chemical, biological, and habitat features, not controlled by fish passage design, may affect anadromous fish migration within a stream reach, certain critical physical parameters required for successful fish passage can be controlled. These parameters include water depth and water velocity. In addition, sediment deposition or scour at the structure, presence of debris dams, and other, general conditions of the structure can be readily assessed. Monitoring of specific performance standards for these parameters is proposed for this project. Performance of fish passage structures is proposed at average annual stream flow or normal flow, because this condition generally occurs in the spring, which coincides with the time of greatest anadromous fish migration.

Initial post construction monitoring of fish passage structures will include an as-built survey to ensure that structures comply with design parameters. Monitoring of the fish passage structures should begin during the first spring following successful construction of the fish passage structure, before the start of fish migration, to ensure that structures are performing as designed. One monitoring visit is proposed in February of each monitoring year to assess structure integrity. Physical parameters will be monitored once per month between March 15 and May 15 for five consecutive years following construction. As performance standards are based on conditions at normal flow, conditions assessed at the fish passage sites during specific monitoring days will be compared to the long-term normal flow for that stream reach. Flow data for each monitoring date are available for each stream reach from USGS stream gage stations on those reaches and extrapolations will be made to each fish passage site.

General Conditions

The overall integrity of each fish passage structure will be monitored before the onset of fish migration. Fish passage structures shall comply with design specifications to ensure that proper water depths and water velocities are maintained during fish migration. In addition, if trash racks are present, they should be cleaned of any accumulated debris.

Water Depth

Water depth measurements will be taken at the inlet and outlet of the fish passage structure or throughout the step pool design during the recommended monitoring periods.

Water Velocity

Water velocity will be measured at the inlet and outlet of the fish passage structure or throughout the step pool design during the recommended monitoring periods.

Bottom Scour

To monitor the vertical drop from the fish passage structure to the stream substrate, cross-sectional surveys will be completed. One cross-section immediately above and one immediately below the fish passage structure will be surveyed twice during the monitoring period (once between March 15 and April 15 and once between April 15 and May 15).

Sediment Deposition

To monitor sediment deposition at the inlet and outlet of the fish passage structure, cross-sectional surveys will be completed. One cross-section immediately above and one immediately below the fish passage structure will be surveyed twice during the monitoring period (once between March 15 and April 15 and once between April 15 and May 15).

Water Quality Sites

The Total Suspended Solids (TSS) will be monitored at the outfall from the existing SWM ponds being retrofitted.

Three (3) water samples during high flow periods associated with one (1) storm event per year will be collected. Flow data at the time of sampling will be collected. Data will be collected at least ½ hour apart.

The TSS data will be analyzed to determine if any differences exist in pre and post construction TSS loadings.

8. Vegetation

a. Forest Characterizations

Direct Impacts

The No-Action Alternative would have no ICC project related impact on existing forests in the study area.

Corridor 1 (672.4-747.2 acres impacted) would have a greater impact than Corridor 2 (532.1-650.1 acres). Should the decision be made to truncate the project at I-95, it would result in a reduction of approximately 63 acres of forest impact, depending on the corridor. Depending on the options selected for Corridor 1, approximately seven percent of the impacted acres would be associated with riparian areas and 93 percent with upland habitats. As with Corridor 1, the acreage affected by Corridor 2 and its selected options would be approximately seven percent riparian habitat and 93 percent upland areas. A large percentage of Corridor 1 impacts would be associated with parklands. As detailed in **Table IV-72**, the impacts associated with both corridors would include a predominance of mature forest with stands having an average size class of 11 to 17.9 and 18 to 29.9 inches diameter breast height (dbh). Very few stands that would be impacted fall into the 2 to 5.9 inch dbh range. Tulip poplar, tulip poplar/mixed oak, and tulip poplar/red maple stands comprise approximately half of the forest impacts associated with Corridors 1 and 2. The breakdown of impacts per size class, corridor, and option is provided in **Table IV-72**. The options considered here include options that are representative of all the options being considered. With the exception of the I-95 truncated option, the options have only slight variations from the alignment options presented. The truncated option that would terminate the ICC at I-95 would reduce the length of both corridors by about one mile. This option would result in measurably less impacts. Difference in total impacts due to the

additional option variations will be negligible. Details on the variations in impacts for each corridor from these options including the truncated option are provided in the **Summary**. More detailed impact calculations will be completed upon refinement of these options during the design process.

Table IV-72
Percent of Forest Impacts by Size Class per Corridor

Corridor	Dominant Size Class (Percent Impacted)			
	2 – 5.9" dbh	6 – 10.9" dbh	11 – 17.9" dbh	18 – 29.9" dbh
No-Action Alternative	0%	0%	0%	0%
Corridor 1 Common Segments	4%	22%	44%	30%
Corridor 2 Common Segments	7%	29%	34%	30%
Rock Creek Option A	0%	25%	1%	74%
Rock Creek Option C	0%	10%	52%	38%
Northwest Branch Option A	3%	3 %	11%	83%
Northwest Branch Option B	0%	8%	8%	83%
Corridor 2 Norbeck, Spencerville, Fairland and Burtonsville Option Combinations	0%	3 – 13%	31 – 69%	25 – 57%

Note: For purposes of this table, ranges associated with size class impacts based on percentage are presented. Ranges take into consideration various options that would be required to calculate actual acreage impacts.

Note: Several additional options are being considered within the alignment ROW. With the exception of the I-95 truncated option, the options have only slight variations from the alignment options presented. The truncated option that would terminate the ICC at I-95 would reduce the length of both corridors by about one mile. This option would result in measurably less impacts. Difference in total impacts due to remainder of the additional option variations will be negligible. Details on the variations in impacts for each Corridor from these options including the truncated option are provided in **Table S-2** in the Summary Chapter. Because **Table S-2** includes all of these various options, total ranges in **Table S-2** for each corridor may differ slightly from those presented above. More detailed impact calculations will be completed upon refinement of these options by the engineers during the design process.

Direct impacts include all types of forest cover including forest interior habitat, which is presented in more detail in **Table IV-73**.

Table IV-73
Summary of Forest Impacts

Corridor	Forest Impacts (Acres)
No-Action Alternative	0.0
Corridor 1 and 2 West of MD 97 Mainline Segments	108.2
Corridor 1 and 2 Rock Creek Options (select one)	
Rock Creek A	48.5
Rock Creek C- Olde Mill Run Grade Separation	47.2
Rock Creek C- Olde Mill Run Cul-de-Sac	44.7
Corridor 1 Mainline Segments (MD 97 to I-95)	322.2
Corridor 1 Northwest Branch Options (select one)	
Northwest Branch A- with Interchange at Layhill Road	57.1
Northwest Branch A- without Interchange at Layhill Road	55.9
Northwest Branch B- with Interchange at Layhill Road	49.6
Northwest Branch B- without Interchange at Layhill Road	48.8
Corridor 1 I-95 Interchange Options (select one)	
I-95 Interchange Option A (terminate ICC at US 1)	211.2
I-95 Interchange Option B (terminate ICC at I-95)	148.5
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)	

Table IV-73
Summary of Forest Impacts

Corridor	Forest Impacts (Acres)
Corridor 2- with Interchange at Layhill Road	70.4
Corridor 2- without Interchange at Layhill Road	70.3
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)	
Norbeck A	102.9
Norbeck B- with ICC over Willow Grove	90.0
Norbeck B- with Willow Grove Access at Mt. Everest Lane	90.1
Spencerville A- with Burtonsville A	62.9
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	84.3
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	82.5
Spencerville A- with Burtonsville X	66.4
Spencerville B- with Burtonsville A	60.9
Spencerville B- with Burtonsville B	80.9
Spencerville B- with Burtonsville X	65.1
Spencerville C- with Burtonsville A	60.9
Spencerville C- with Burtonsville B	71.9
Spencerville D- with Burtonsville B	72.1
Fairland A	28.4
Fairland B	13.9
Corridor 2 I-95 Interchange Options (select one)	
I-95 Interchange Option A (terminate ICC at US 1)	207.4
I-95 Interchange Option B (terminate ICC at I-95)	144.1
Corridor 1 Range of Impacts	672.4 – 747.2
Corridor 2 Range of Impacts	532.1 – 650.1

Note: Total impacts for corridors are calculated for **Corridor 1** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding the *Corridor 1 Mainline Segments (MD 97 to I-95)*, adding one *Corridor 1 Northwest Branch Option* and one *Corridor 1 I-95 Interchange Option*; or for **Corridor 2** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding one *Corridor 2 Mainline Segments (MD 97 to I-95)*, one of each of the desired *Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options*, and adding one *Corridor 2 I-95 Interchange Option*.

Indirect Impacts

There is the likelihood of both short and long term indirect effects on forests associated with any Build Alternative. With either corridor, the forest edge created along a newly constructed highway would consist of vegetation that previously grew under forested conditions. However, forest edge conditions are different from those associated with more interior or undisturbed forest. Forest edge communities shift to more shade-intolerant, more xeric vegetation and early successional species (Brown et al, 1990.) Forest edges often experience an increase in the penetration of light and wind. The exposure to more sunlight results in drier soil conditions. These changes in soil conditions can dictate which vegetation can become established or thrive. If the new exposure is to the south and west, hotter and drier conditions along the edge favor invasive or exotic species that can out-compete more native species that were previously protected. The aggressive nature of invasive and exotic species is not limited to just the forest edge. Many species such as Japanese honeysuckle (*Lonicera japonica*) and Japanese stilt grass (*Microstegium vimineum*) can extend into the forest substantially beyond the edge, influencing an otherwise healthy vegetative community. Grassy areas along roadways represent forest habitat discontinuities in forested landscapes and may serve as conduits facilitating the spread of undesirable plants and animals (Seabrook and Dettmann, 1996; Parendes and Jones, 2000).

There are also stresses on the individual trees that are part of the new forest edge located along a recently constructed highway. Many of the trees along the edge that had been growing within the forest interior are exposed to numerous biotic and abiotic stresses. Many of these stresses may not be immediately noticeable but instead can occur over several years. Wind throw is a common problem, especially for shallow rooted species such as tulip poplar. No longer buffered by the adjacent canopy, the exposure to winds for those trees grown in more forested conditions in combination with a change in soil is a leading cause of wind throw. Root damage from the removal of adjacent vegetation can also result in stresses to the newly exposed trees and other vegetation. Changes in soil are not limited to drier soil conditions but may also include changes in the surrounding grade. Additionally, soil moved during grading may also suffocate existing tree root systems. As trees become more stressed, they often become more susceptible to disease and insect infestations. Trees grown in forested conditions that are suddenly exposed to edges degrade over time and many finally die, especially if root systems are disturbed by grading activities. Tulip poplars commonly degrade and die over 8 to 10 years following disturbance, while oaks and hickories commonly degrade and die over 12 and 15 years. Additional light penetrating the forests from the newly exposed edges encourage a host of different plants including non-native invasive plants and birds.

Other indirect effects include the potential exposure to pollution such as gas, oil, and heavy metals that can occasionally spread into the adjacent forest from the highway. Noise pollution, as described in more detail in the Forest Interior Dwelling Species (FIDS) section (**Chapter IV.F.8.b**), has been shown to disturb bird vocalizations during the nesting season.

Forest fragmentation can affect the functions and values provided by each forest area. Depending on the impact, either corridor could result in forest impacts that reduce the ecological viability of the remaining forest. This can be the result of either isolating remaining forest patches or reducing their size. Highways can dissect the continuous habitat stands into smaller patch sizes and higher edge to interior ratios (Jackson et al., 1998). Smaller forest patches may provide less habitat, food sources, or refuge opportunities for certain species. For sensitive species, such as forest interior dwelling birds (**Chapter IV.F.8.b**), forest size is critical. Specifically, how the forest is crossed by a new highway is also a factor in determining whether a loss of ecological functions and values will occur. Forest stands that are bisected by the highway, as opposed to a situation where an outer portion of a stand is impacted, may result in the creation of more edge. Bisecting the forest may result in isolating two or more portions, limiting habitat and opportunities for certain wildlife species.

Indirect impacts could occur throughout the forests associated with both corridors. Larger forests that may be indirectly affected include Rock Creek Park, North Branch Rock Creek Park, Northwest Branch Park, Paint Branch Park, and Little Paint Branch Park. Other forested areas ranging from stands just a few acres in size to those over 50 acres may also experience some of the indirect effects described above. It is anticipated that for all of the parkland forests, current ecological functions would not be completely compromised. Even those forests that would be bisected could still maintain viable forest functions and values. In some cases, especially for smaller forest stands, the potential indirect effects of the project would diminish the functions that the existing forest provides.

Avoidance, Minimization, and Mitigation

Regulatory Guidance

The primary approach to mitigating forest loss will be through compliance with the Maryland Reforestation Law, which requires a one acre for one acre replacement of any forested areas that are cleared during construction. Before replacement is considered, every reasonable effort must be made to minimize the cutting or clearing of trees. Only the minimum number of trees may be cut, and sound design practices must be utilized. When prudent minimization efforts have been considered and one acre or more of forest clearing is still required, replacement of the forests must occur on a one-to-one basis. The constructing agency is required to locate State or publicly owned land of equivalent size to be reforested. The DNR is the agency in charge of the reforestation efforts.

Several provisions apply to the location of the reforested land. Reforestation should first occur within the construction site or the project ROW being used for construction. If this cannot be reasonably accomplished, reforestation should occur on public land located within the county and watershed where the clearing occurred or, finally, within the county or watershed in the state in which the construction activity is located.

If a search for land has been conducted, to the satisfaction of DNR, and no appropriate land has been located, the constructing agency can make a payment into the Reforestation Fund. This fund is used to plant replacement trees on public lands, such as parks or schools. Money deposited in the fund is required to be used within one year or within two growing seasons after completion of the construction project. Any funds not used after this time will be returned to the constructing agency.

For the Build Alternatives, impacts to forest resources would be unavoidable. All of the major stream valley parks are along a north-south axis with each proposed alignment traversing from west to east. Efforts to minimize impacts include considering different options that avoid priority forest and parkland, and constructing retaining walls to reduce slopes where appropriate. To minimize impacts, the proposed ROW is based on 2:1 slopes, where feasible, which are steeper than the Lead Agencies would normally use in low cuts and fills. Additional efforts to reduce impacts, such as moving stormwater management underground in some locations, are also underway.

Consistency with the Green Infrastructure Program

DNR has evaluated forest loss as part of its Green Infrastructure study of hubs (habitat areas) and corridors (connections between habitat areas). DNR has identified existing undeveloped lands within the study area as important to the preservation of the regional Green Infrastructure. In addition, DNR has commented that the proposed ICC may fragment many of the existing hubs including the loss of north-south connectivity between hubs (specifically regional parks such as Rock Creek). Opportunities to offset some of the fragmentation may include identifying and filling existing gaps in green corridors between hubs, reforesting gaps within hubs or along hub edges to increase forest interior conditions, and expanding the boundaries of important hubs.

Reforestation efforts associated with the ICC are complimentary to the Green Infrastructure goals. Many of the reforestation sites are consistent with the Green Infrastructure planning and promote buffer enhancement, forest connectivity (FIDS habitat development), and reforestation near, or adjacent to, existing hubs and corridors. Identified ICC reforestation sites will increase existing forest interior, buffer streams, wetlands and other aquatic habitats, as well as protect other sensitive natural resources and habitats.

Mitigation Site Searches

As detailed above, the Maryland Reforestation Law requires State agencies to make every reasonable effort to avoid or minimize impacts to trees. The ongoing mitigation site selection process focuses on selecting the most appropriate reforestation sites to improve existing habitat conditions on other publicly or State-owned land. It is understood that it would take considerable time to fully realize the maximum benefits of a forest mitigation project. For eastern hardwood forests such as those possibly affected, nearly 40 years could be needed to realize the compensation of mature forests. Furthermore, small acreages of even very successful reforestation will not likely ever provide the full range of benefits of large contiguous forested areas. Despite the inherent challenges associated with forest compensation, the Lead Agencies are preparing to fully comply with the Maryland Reforestation Law and follow best practices in site selection, planting, monitoring, and protection.

Even though the Maryland Reforestation Law directs State agencies to reforest within publicly or State-owned property, some privately owned sites were included in the site selection process. However, these sites would need to be acquired by local governments and become public land prior to any mitigation occurring under the Maryland Reforestation Law.

Numerous sites have been selected for field verification based on the above-mentioned criteria (SHA, 2004). Small isolated sites that provide little forest connectivity or riparian buffer benefit were categorized as having low reforestation potential. Sites that were similarly small but have the potential to provide water quality and/or connectivity benefits were classified as having a moderate reforestation potential. Finally, larger sites that have the potential to significantly benefit the environment through habitat or water quality improvements were classified as having a high reforestation potential. In addition, several sites previously identified in prior ICC studies as good candidates were found during the field reviews to be already reforested and were dropped from further consideration. Mitigation sites will also be compared with restoration needs identified through the Green Infrastructure Assessment to ensure consistency.

Ongoing coordination with governmental agencies will continue throughout the remainder of the NEPA process to ensure that adequate reforestation acreage has been located in accordance with the compensatory mitigation requirements of the Maryland Reforestation Law.

Current sites under consideration or coordination with the landowners are as follows:

Washington Suburban Sanitary Commission

Approximately 200 acres of potential reforestation area has been identified on Washington Suburban Sanitary Commission (WSSC) property. These sites are located within the Rocky Gorge watershed and abut the Triadelphia Reservoir. Approximately 165 acres are located in Montgomery County and 35 acres are in Howard County. Even though the 35 acres located within Howard County are outside of the counties in which the ICC could be constructed, they still meet the Maryland Reforestation Law criteria because they are located within the Rocky Gorge Watershed. Habitat and water quality improvements from reforestation within the WSSC properties would benefit Montgomery, Prince George's, and Howard Counties by enhancing the reservoir buffer, connecting forest tracts, and once established, creating forest interior habitat.

Maryland Department of Natural Resources

Coordination had initially occurred with Seneca Creek State Park staff regarding potential reforestation efforts within the park. Preliminary discussions resulted in the identification of approximately 200 acres of state parkland that could be used for reforestation purposes, 36 acres of which are available immediately. In order to use State park lands, an internal review is required of each park parcel potentially used for reforestation purposes by the DNR's Land Management Unit. The purpose of the review is to ensure that reforestation efforts do not conflict with other potential park uses or commitments. DNR Land Management staff is also considering other state lands within the general proximity to the study area, other than Seneca Creek State Park.

Maryland-National Capital Park and Planning Commission

The ICC study team is working closely with M-NCPPC staff to identify existing parkland properties that may be suitable for reforestation. M-NCPPC park properties or portions thereof located in 100-year floodplains or other sensitive environs are typically limited for active park use or the placement of structures, or for parking and are therefore ideal for reforestation. Numerous sites have been located throughout Montgomery County through the use of GIS and provided by the ICC study team to M-NCPPC for their review. Several M-NCPPC regional park managers are currently reviewing these sites for reforestation purposes. An estimated 75 to 100 acres is tentatively acceptable as reforestation areas.

Casey Property at Hoyles Mill

Additional mitigation for natural resources impacted in Rock Creek Regional Park are anticipated to be provided at the Casey Property at Hoyles Mill, which is located outside of the ICC study area near Poolesville in Montgomery County (*see Figure IV-5*). This site, which would become public parkland, would add an additional 459 acres to the park system adjacent to several existing parks including Seneca Creek State Park, South Germantown Recreational Park, Little Seneca Stream Valley Park and Hoyles Mill Conservation Park. Preservation of this property will add over 340 acres of existing forest and 214 acres of existing FIDS habitat to the

park system. There is approximately 118 acres of open land that may be available for reforestation, which could also help increase the FIDS habitat to approximately 340 acres on site.

Forest Mitigation in Parkland (Section 4(f)) Properties)

The ICC Team has identified 100 to 150 acres of open space that could be reforested within proposed parkland mitigation sites. This reforestation may include stream buffer planting and upland reforestation; both of which would improve habitat and water quality conditions.

Wetland/Stream Compensatory Mitigation and Environmental Stewardship Sites

It is anticipated that as part of the wetland compensation and Environmental Stewardship efforts, additional reforestation acreage opportunities will be identified. Many of the wetland mitigation sites, for example, will have additional land other than the actual wetland area that could be used for reforestation. The ICC study team has identified approximately 75 acres of open space that could be reforested within the mitigation sites. This reforestation may include stream buffer planting and upland reforestation; both of which would improve habitat and water quality conditions.

Reforestation within the Proposed ICC ROW

Based on engineering concepts, there would be the creation of isolated parcels that are unsuitable for development, but possibly ideal for reforestation. Initial analysis has identified approximately 75 to 100 acres of reforestation can be expected from these areas. These areas exist throughout each corridor. In many cases, potential sites are adjacent to existing forest cover.

Unassigned SHA Reforestation Acreage within Montgomery and Prince Georges Counties

In addition to the potential reforestation sites identified above, the Lead Agencies have determined that reforestation credit exists within Montgomery and Prince George's County from planting that has occurred in response to previously completed projects. This credit is a result of planting that had occurred above and beyond what had been required under regulatory guidance for a particular SHA project. Thirty-seven sites are located with Montgomery County and 34 are in Prince George's County. Of the 114.1 acres that are located within Montgomery County, six of the sites totaling approximately 58 acres occur within WSSC property boundaries or within the vicinity of Triadelphia Lake Road. The 34 sites in Prince George's County comprise approximately 90 acres of the unassigned acreage. Field verifications have identified approximately 50 to 75 acres of unassigned sites that are either in good condition, or that could be reforested. Some of the sites were removed from the list due to the placement of noise walls, roadway improvements, or the inability to locate the reforestation area during the site verification process. Research on these sites will continue throughout the NEPA and mitigation processes.

The identified reforestation sites would be appropriate if either corridor is selected. In general, impacts associated with either corridor would be compensated using many of the same reforestation sites. The proximity of most of the reforestation sites to either corridor is

essentially the same. The exception to this is the use of proposed parkland mitigation sites. If Corridor 1 is selected, fewer parkland mitigation sites located along Corridor 2 may be considered for Section 4(f). Subsequently, these would not be available for reforestation purposes. If Corridor 2 is selected, more distant properties or properties in non-ICC watersheds such as DNR lands (e.g. Seneca Creek State Park) may not be needed for reforestation.

Based on the sites detailed above, the Lead Agencies have identified approximately 893 to 1,018 acres with a high reforestation potential. As the project evolves, correspondence with appropriate agencies will continue and sites will be confirmed.

b. Forest Interior Dwelling Species and Habitat

Direct and Conversion Impacts

Fragmentation of larger blocks of forest has been shown to cause a decrease in those species collectively known as FIDS. These species rely on large forest tracts to breed successfully (Robbins, 1979). Patch size has been shown to correlate to the number and type of species present within the forest interior. The larger the patch size of the interior forest, the greater the quantity and diversity of FIDS present. Smaller patch sizes tend to have less FIDS and more edge dwelling species (Forman, 1986). The larger patch sizes have more diverse microhabitats, with the necessary food sources, nesting sites, and required cover to protect FIDS from predator species (McIntyre, 1995). Foraging efficiency of FIDS is also shown to increase with an increase in patch size (Forman, 1986).

Forest fragmentation results in both direct and indirect impacts to FIDS habitat. Direct impacts include the actual loss of existing FIDS habitat. An indirect impact, presented in the following section, is essentially the conversion of forest interior on either side of the ROW to edge habitat. This edge habitat, typically 300 feet from a forest edge, is generally considered unsuitable for FIDS (varies among various FIDS). The Critical Areas Commission for the Atlantic and Coastal Bays (CAC) guidelines use a buffer of 300 feet from a forest border in determining true forest interior habitat. Impacts discussed below include the impacted area of the highway ROW and the converted FIDS habitat to edge or buffer (300 feet on either side of the limit of disturbance).

The No-Action Alternative would have no ICC project related impact on existing FIDS habitat in the study area.

Corridor 1 FIDS habitat direct impacts (83.2 to 98.9 acres) are greater than those associated with Corridor 2 (32.0 to 51.4 acres). In addition, Corridor 1 would impact two of the largest forest interior areas within the study area (Northwest Branch and Paint Branch). Corridors 1 and 2 would impact two other large forest interior areas (Rock Creek and North Branch Rock Creek). **Table IV-74** shows a summary of FIDS habitat impacts per corridor and the forest interior converted to edge.

Table IV-74
Summary of FIDS Habitat Impacts

Corridor	Existing FIDS Habitat Within Close Proximity to the ROW (Acres)	FIDS Habitat Impact (Acres)	FIDS Habitat Converted to Edge (Acres)	Remaining FIDS Habitat (Acres)
No-Action Alternative	N/A	0.0	0.0	N/A
Corridor 1 and 2 West of MD 97 Mainline Segments	176.4	17.2	39.2	120.0
Corridor 1 and 2 Rock Creek Options (select one)				
Rock Creek A	174.8	13.8	39.7	121.3
Rock Creek C- Olde Mill Run Grade Separation	174.8	3.0	12.9	158.9
Rock Creek C- Olde Mill Run Cul-de-Sac	174.8	3.0	8.6	163.2
Corridor 1 Mainline Segments (MD 97 to I-95)	304.6	42.5	95.8	166.3
Corridor 1 Northwest Branch Options (select one)				
Northwest Branch A- with Interchange at Layhill Road	143.9	24.8	48.3	70.8
Northwest Branch A- without Interchange at Layhill Road	143.9	24.8	48.3	70.8
Northwest Branch B- with Interchange at Layhill Road	143.9	19.9	45.4	78.6
Northwest Branch B- without Interchange at Layhill Road	143.9	19.9	45.4	78.6
Corridor 1 I-95 Interchange Options (select one)				
I-95 Interchange Option A (terminate ICC at US 1)	66.7	0.0	0.2	66.5
I-95 Interchange Option B (terminate ICC at I-95)	66.7	0.6	2.7	63.4
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)				
Corridor 2- with Interchange at Layhill Road	0.0	0.0	0.0	0.0
Corridor 2- without Interchange at Layhill Road	0.0	0.0	0.0	0.0
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)				
Norbeck A	37.9	10.6	11.0	16.3
Norbeck B- with ICC over Willow Grove	37.9	14.8	15.4	7.9
Norbeck B- with Willow Grove Access at Mt. Everest Lane	37.9	14.8	15.4	7.9
Spencerville A- with Burtonsville A	201.9	3.1	3.7	195.1
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	201.9	0.6	13.2	188.1
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	201.9	0.6	13.2	188.1
Spencerville A- with Burtonsville X	201.9	3.1	2.5	196.3
Spencerville B- with Burtonsville A	201.9	3.1	3.7	195.1
Spencerville B- with Burtonsville B	201.9	0.6	13.2	188.1
Spencerville B- with Burtonsville X	201.9	3.1	2.5	196.3
Spencerville C- with Burtonsville A	201.9	3.1	3.7	195.1
Spencerville C- with Burtonsville B	201.9	0.6	13.2	188.1
Spencerville D- with Burtonsville B	201.9	0.6	13.2	188.1
Fairland A	18.1	1.9	10.3	5.9
Fairland B	18.1	0.0	0.0	18.1
Corridor 2 I-95 Interchange Options (select one)				
I-95 Interchange Option A (terminate ICC at US 1)	66.7	0.6	5.1	61.0
I-95 Interchange Option B (terminate ICC at I-95)	66.7	0.6	2.7	63.4
Corridor 1 Range of Impacts	866.4	83.2 – 98.9	191.7 – 228.1	577.0 – 591.5
Corridor 2 Range of Impacts	675.8	32.0 – 51.4	64.0 – 122.9	541.8 – 577.3

Note: Total impacts for corridors are calculated for **Corridor 1** by selecting the **Corridor 1 and 2 West of MD 97 Mainline Segments** and adding one **Corridor 1 and 2 Rock Creek Option**, adding the **Corridor 1 Mainline Segments (MD 97 to I-95)**, adding one **Corridor 1 Northwest Branch Option** and one **Corridor 1 I-95 Interchange Option**; or for **Corridor 2** by selecting the **Corridor 1 and 2 West of MD 97 Mainline Segments** and adding one **Corridor 1 and 2 Rock Creek Option**, adding one **Corridor 2 Mainline Segments (MD 97 to I-95)**, one of each of the desired **Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options**, and adding one **Corridor 2 I-95 Interchange Option**.

Muddy Branch Watershed

No impacts would occur to FIDS habitat in the Muddy Branch watershed.

Upper Rock Creek Watershed

The 131.5-acre interior forest located near Rock Creek Options A and C would be impacted by both options. Rock Creek Option A would directly impact 13.8 acres of the interior forest and convert 39.7 acres of interior forest to edge habitat. The existing interior forest would be divided into three separate interior stands of 30.1 acres (south of the alignment), 46.4 acres and 1.4 acres (north of the alignment). The two larger remaining interior forests would still be suitable FIDS habitat based on CAC guidelines.

Rock Creek Option C – Olde Mill Run Grade Separation would directly impact 3.0 acres of the 131.5-acre interior forest located to the north and convert 12.9 acres of interior forest to edge habitat. The interior forest would be reduced to 115.6 acres. Rock Creek Option C – Olde Mill Run Cul-de-Sac would directly impact 3.0 acres of the 131.5-acre interior forest and convert 8.6 acres of interior forest to edge habitat. The interior forest would be reduced to 119.9 acres. A 43.3-acre interior forest located outside of the ROW to the north of Rock Creek Option C would not be impacted by either of the corridors.

North Branch Rock Creek Watershed

Approximately 17.2 acres of the 176.4-acre interior forest located in the North Branch Rock Creek watershed would be directly impacted by Corridors 1 and 2. An additional 39.2 acres of interior forest would be converted to edge habitat. The existing interior forest would be divided into two separate interior stands of 58.3 acres (north of the alignment) and 61.7 acres (south of the alignment). Both remaining interior forests would still be suitable FIDS habitat based on CAC guidelines.

Northwest Branch Watershed

The 143.9 acre interior forest located near the Northwest Branch Options would be impacted by both Northwest Branch Options A and B. Northwest Branch Option A (both sub-options) would impact 24.8 acres of interior forest and convert 48.3 acres to edge habitat. The existing interior forest would be divided into three separate interior stands of 31.8 acres (south of the alignment), 7.1 acres (west of the alignment), and 31.9 acres (east of the alignment). Both of the larger remaining stands would still be suitable FIDS habitat based on CAC guidelines.

Northwest Branch Option B (both sub-options) would impact 19.3 acres of interior forest and convert 45.4 acres to edge habitat. The existing interior forest would be divided into four separate interior stands of 63.1 acres and 2.6 acres (south of the alignment) and 12.7 acres and 0.2-acre (east of the alignment). The two larger remaining stands may still be suitable FIDS habitat based on CAC guidelines.

Both corridors would impact the 23.9-acre interior forest located near the merge of Corridors 1 and 2. Corridor 1 would impact 1.5 acres of the southern edge of the interior forest. An additional 5.0 acres of interior forest would be converted to edge habitat. The remaining interior forest would consist of 17.4 acres and would still be suitable FIDS habitat based on CAC guidelines.

Both Norbeck Option A and Norbeck Option B associated with Corridor 2 would impact interior forest. Norbeck Option A would directly impact 3.0 acres of the southern edge of the 23.9-acre interior forest. An additional 4.6 acres of interior forest would be converted to edge habitat. The remaining interior forest north of the alignment would be 16.3 acres and would still be suitable FIDS habitat based on CAC guidelines.

Norbeck Option B – with Willow Grove access over ICC would divide the 23.9-acre interior forest and directly impact 7.5 acres. An additional 8.7 acres of the interior forest would be converted to edge habitat. The two remaining forest stands of 0.6-acre (north of the alignment) and 7.1 acres (south of the alignment) would no longer be suitable FIDS habitat. Norbeck Option B – with Willow Grove access at Mt. Everest Lane would directly impact 7.7 acres of interior forest and convert an additional 8.5 acres to edge habitat. The two remaining forest stands of 0.7-acre (north of the alignment) and 7.0 acres (south of the alignment) would no longer be suitable FIDS habitat.

Both Norbeck Options A and B would impact the 14.0-acre interior forest located where Corridor 2 splits into Norbeck Options A and B. Norbeck Option A would directly impact 7.4 acres and convert an additional 6.5 acres of interior forest to edge habitat. Only 0.1 acre would be remaining.

Norbeck Option B – with Willow Grove access over ICC would directly impact 7.1 acres of the 14.0-acre interior forest. An additional 6.8 acres of interior forest would be converted to edge habitat. Only 0.1 acre would be remaining. Norbeck Option B – with Willow Grove access at Mt. Everest Lane would directly impact 6.7 acres of the 14.0-acre interior forest. An additional 7.2 acres of interior forest would be converted to edge habitat. Only 0.1 acre would be remaining.

The 19.3-acre interior forest located near the Spencerville Options would not be impacted by either corridor.

Paint Branch Watershed

Corridor 2 would not impact any of the interior forests located within the Paint Branch Watershed. Corridor 1 would impact the largest area of interior forest (251.5 acres) within the ROW of the corridors. Corridor 1 would be located along the northern edge of the interior forest and would cross the northwestern corner directly impacting a total of 32.3 acres. An additional 72.8 acres would be converted to edge habitat. The remaining 18.6 acres located in the northwestern corner would still be suitable FIDS habitat based on CAC guidelines. A small segment of 0.1-acre, located in the northeast corner, would no longer be suitable FIDS habitat. The large portion of the interior forest remaining south of the alignment would total 127.7 acres

and would still be suitable FIDS habitat based on CAC guidelines. A smaller 12.3-acre forest interior stand to the north of Corridor 1 would not be affected.

Little Paint Branch Watershed

Corridor 1 would impact the 40.8-acre interior forest located within the Little Paint Branch watershed. Corridor 1 would divide the forest and directly impact 8.8 acres. An additional 18.0 acres would be converted to edge habitat. The four remaining forest stands of 6.9 acres and 1.3 acres (north of the alignment) and 4.9 acres and 0.9-acre (south of the alignment) would no longer be suitable FIDS habitat based on CAC guidelines.

Fairland Option A would impact 1.9 acre of the 18.1-acre forest located west of Fairland Option A. An additional 10.3 acres would be converted to edge habitat. The remaining forest of 5.9 acres would no longer be suitable FIDS habitat.

Indian Creek Watershed

Corridors 1 and 2 I-95 Interchange Options A (terminate ICC at US 1) would have no direct impacts to the 23.9-acre interior forest located within the Indian Creek watershed. Option A would convert 2.3 acres of forest interior to edge habitat. The remaining interior forest would be 21.6 acres. I-95 Interchange Option B (terminate at I-95) would not impact the 23.9-acre forest.

The 13.3 acre interior forest located along the eastern edge of the Indian Creek watershed would not be directly impacted by either I-95 Interchange Option A or B. Both options would convert 0.1-acre of forest interior to edge habitat. The remaining 13.2-acre interior forest would still be suitable as FIDS habitat based on CAC guidelines.

Rocky Gorge Watershed

Corridor 2 would affect four of the five interior forest patches located within the Rocky Gorge watershed. Burtonsville Option A would impact 3.1 acres of the northwestern edge of the 21.7-acre interior forest. An additional 2.4 acres would be converted to edge habitat. The remaining 16.2-acre interior forest (south of the alignment) would still be suitable FIDS habitat based on CAC guidelines.

Burtonsville Option B would directly impact 0.6-acre of the northern tip of the 19.8-acre interior forest. An additional 6.2 acres of the interior forest would be converted to edge habitat. The remaining 13.0-acre interior forest (south of the alignment) would still be suitable FIDS habitat based on CAC guidelines.

Burtonsville Option B would not directly impact the 52.6-acre forest immediately north of the alignment. Approximately 5.7 acres of the FIDS buffer would be impacted. The remaining interior forest of 46.9 acres (north of the alignment) would still be suitable FIDS habitat based on CAC guidelines.

The 74.0-acre interior forest located north of Burtonsville Option B would not be directly impacted by either of the corridors. Less than 0.1-acre of the FIDS buffer would be impacted.

Upper Patuxent River Watershed

Corridors 1 and 2 I-95 Interchange Option A would directly impact 0.6-acre of the eastern edge of to the 16.7-acre interior forest, and convert, 0.1-acre to edge habitat. The remaining 16.0-acre forest would still be suitable FIDS habitat based on CAC guidelines. Corridors 1 and 2 I-95 Interchange Option B (terminate ICC at I-95) would directly impact 0.6-acre of the eastern edge of the 16.7-acre interior forest. An additional 2.7 acres would be converted to edge habitat. The remaining 13.4-acre interior forest located east of the alignment would still be suitable FIDS habitat based on CAC guidelines.

Additional Indirect Impacts

Several potential indirect FIDS impacts can occur as a result of the construction of a highway such as the ICC. The isolation and further splitting of forest areas into smaller patches results in the decrease of forest interior and, especially in urban areas, an increase in human disturbances. In addition, more ecological disturbances can occur, such as the presence of opportunistic edge species, some considered predatory and parasitic, which can replace interior species. The proximity of a roadway may also result in noise-related indirect impacts.

The ability of a forest to support FIDS depends not only on the size of the forest but on the amount of forest remaining in the surrounding landscape. The suitability is also affected by the distance from the forest stand in question to the nearest 100-acre forest. Forest fragmentation from agricultural or urban development is damaging to FIDS populations because it represents a permanent loss of habitat. Fragmentation not only decreases the amount of habitat available for FIDS, but also allows for greater disturbance into the interior forest due to the creation of new edge habitat in what used to be forest interior.

When forest interior is converted to edge habitat several negative effects can occur over time and thus be considered indirect impacts. These indirect impacts include increased penetration of light and wind into the forest and the establishment of invasive plants and other competing and predatory species. Changes in moisture and vegetative composition can occur due to an increase of light and wind penetrating into the forest. Interior forests typically are more moist and have more leaf litter, which is very important in the maintenance of food sources (insects, spiders, etc.) on which birds feed. When forests become fragmented, this important food source for interior birds can decrease. Also, FIDS species are typically not as tolerant of the dryer conditions.

An increase of predatory species within the forest leads to a higher amount of nest predation. One predatory avian species which can be found along forest edge is the brown-headed cowbird. This species lays eggs in the nests of other species. Once the eggs hatch they out compete the host species and often kick the unhatched eggs and fledglings out of the nest. Other generalist predator species (as it relates to FIDS) include raccoons, opossums, and red fox. Kurtz (2000) and others have found that these edge species often influence ecosystem dynamics by preying on, out-competing, or parasitizing interior species.

Songbirds have been shown to decrease in density when inhabiting areas within close proximity to a highway. Due to the noise levels, a decline in breeding success has been documented when highways are located within a few hundred yards of nesting sites and traffic volumes are between 8,000 to 15,000 vehicles per day (Forman, 2002). Highway noise levels may be disruptive to the ability of species to receive vocalizations during the breeding season.

The construction of either Corridor 1 or 2 is likely to result in indirect FIDS effects. Both corridors west of MD 97 would extend through Rock Creek Park and North Branch Rock Creek Park, parkland with suitable FIDS habitat. Indirect FIDS effects are anticipated with Corridor 1, especially through Northwest Branch Park and Paint Branch Park. Corridor 2 indirect FIDS effects are limited to smaller, non-parkland FIDS habitat.

Avoidance, Minimization, and Mitigation

To encourage conservation of FIDS habitat within the study area, DNR provided several guidelines to be incorporated into the project design. Use of the following recommendations should help to minimize the impacts to FIDS habitat. Many of the avoidance or minimization measures described by DNR are being incorporated into the project.

General avoidance and minimization measures recommended by DNR include limiting roadway construction to non-forested areas. When this is unavoidable, older, unfragmented forests, as well as those that are wider than 300 feet and larger than 50 acres should be minimized, as they provide higher quality FIDS habitat. When large, contiguous, high quality forests are impacted, impacts should be limited to the edge, no further than 300 feet into the forest, and the amount of forest interior should be maximized by limiting the forest edge to area ratio. Impacts to forests that are in close proximity to other forests should also be limited as these provide higher quality FIDS habitat than isolated forests. Wildlife corridors should be maintained between forested areas. Any impacts to forest habitat should be avoided, if possible, from April to August, which is the breeding season for most FIDS. Reforestation should be concentrated along streambanks that lack forested buffers, forested riparian areas less than 300 feet wide, and open areas within or adjacent to existing FIDS habitat.

Impacts to forested areas are unavoidable for each of the corridors; however, efforts to minimize the projected forest impacts are ongoing. For example, at most large forested stream valley crossings, bridges and more narrowly cleared ROW are proposed. The proposed ROW is based on 2:1 slopes which are steeper than the Lead Agencies would normally use in low cuts and fills. Additional efforts to reduce impacts, such as moving SWM underground in some locations, are also underway. Areas where FIDS habitat impacts were minimized include Upper Rock Creek, North Branch Rock Creek, Paint Branch, and Little Paint Branch watersheds.

Efforts to avoid parklands, minimize impacts to park interiors, and consider non-parkland options are also consistent with forest avoidance efforts. In addition, efforts are in place to accommodate wildlife connectivity especially along stream valley parks. Agency coordination is ongoing to ensure that drainage crossings account for opportunities for wildlife movement including FIDS. A search for potential reforestation areas is underway. The location of each site

includes consideration of surrounding habitat in order to link or create contiguous forested habitat including habitat for FIDS.

It is understood that it would take considerable time to fully realize the maximum benefits of a forest mitigation project with respect to FIDS habitat. For eastern hardwood forests such as those possibly affected, nearly 40 years could be needed to realize the full compensation of mature forests. Where FIDS habitat replacement is the primary goal, it is possible to replant with the fastest growing hardwoods such as maples, river birch, and certain ash species to achieve reasonable canopy closure sooner than four decades. This is particularly true in riparian areas, where these faster growing hardwoods are very well-suited.

Despite the inherent challenges associated with forest compensation and FIDS habitat creation, the Lead Agencies are preparing to fully comply with the Maryland Reforestation Law should a Build Alternative be selected, and will coordinate with interested agencies in specific FIDS habitat restoration goals as requested.

c. **Champion and Specimen Trees**

Impacts

The No-Action Alternative would have no ICC project related impact on county champion or specimen trees within the study area.

Muddy Branch Watershed

No county champion trees are known to be located in the portion of the Muddy Branch watershed within the ICC study area.

Upper Rock Creek Watershed

No county champion trees are known to be located in the portion of the Upper Rock Creek watershed within the ICC study area.

North Branch Rock Creek Watershed

No county champion trees are known to be located in the portion of the North Branch Rock Creek watershed within the ICC study area. In the DEIS, a 74.1 inch tulip poplar was initially impacted as a result of Corridor 1 and 2. This tree is no longer impacted based on additional engineering revisions.

Northwest Branch Watershed

Four county champion trees would be impacted within the Northwest Branch watershed. Three trees – an umbrella magnolia (*Magnolia tripetala*), a Norway spruce (*Picea abies*), and an American chestnut (*Castanea dentata*) – would be impacted by Corridor 1. All of these trees are located in a tulip poplar/mixed oak forest on an upland plateau. The dbh of the trees are 11.9, 39.1, and 12.9 inches respectively.

Northwest Branch Option A would impact a fourth tree. A bitternut hickory (*Carya cordiformis*) is situated in a tulip poplar forest on an upland ridge and has a dbh of 36.5 inches.

Based on engineering shifts since the DEIS, Northwest Branch Option B would not impact a pin oak (*Quercus palustris*) with a dbh of 49.8 inches. As part of the DEIS, this tree was impacted.

The 66.8-inch dbh black oak and the 66.2 inch dbh swamp white oak located within this watershed would not be impacted.

Paint Branch Watershed

No county champion trees are known to be located in the portion of the Paint Branch watershed within the ICC study area.

Little Paint Branch Watershed

Corridor 1 would impact two county champion trees in the Little Paint Branch watershed. A bur oak (*Quercus macrocarpa*) with a dbh of 38.3 inches is located in a mixed deciduous forest on an upland ridge. The other tree is a chestnut oak (*Quercus prinus*) situated in a mixed oak forest on an upland ridge. It has a dbh of 51.2 inches.

Indian Creek Watershed

No county champion trees are known to be located in the portion of the Indian Creek watershed within the ICC study area.

Rock Gorge Watershed

No county champion trees are known to be located in the portion of the Rocky Gorge watershed within the ICC study area.

Upper Patuxent River Watershed

No county champion trees are known to be located in the portion of the Upper Patuxent River watershed within the ICC study area.

Specimen trees associated with both corridors are found throughout the study area. Further detailed field investigations to identify specific locations will be conducted for the selected alternative.

Avoidance, Minimization, and Mitigation

Impacts to several of the champion and specimen trees are unavoidable based on the current alignments. Efforts are ongoing to consider shifting alignments in order to avoid or minimize impacts to each champion and groups of specimen trees. Most of the champion and specimen trees are located within parkland. Subsequently, avoidance efforts associated with parkland,

included in the Final Section 4(f) Evaluation, are consistent with opportunities to avoid champion and specimen trees.

Shifting the alignment to avoid many champion and specimen trees, would result in impacts to other important natural resources including jurisdictional Wetlands and Waters of the U.S., 100-year floodplains, and steep slopes. Coordination is ongoing with the design engineers in order to avoid as many champion and specimen trees as possible without affecting resources with equal or greater regulatory protection. Further, as the level of roadway design advances, it may be found that specimen or champion trees are located near the outer edge of the required ROW or even just outside the ROW. If this condition exists, the Lead Agencies will coordinate with the final design team to mark and provide a buffer for any such tree to avoid its removal during clearing and grubbing activities. This would be conditional on the compatibility of the large tree with the safe operation of the facility.

d. Invasive Plant Species

Impacts

The No-Action Alternative would not encourage further establishment of invasive plants in the study area.

There would be an indirect effect as it relates to the establishment of invasive species with either corridor. Through the construction of any new roadway, areas that were previously vegetated will be cleared, increasing the opportunity for invasive species to become established. The unvegetated areas within the ROW are particularly vulnerable to the establishment and expansion of invasive species. Limiting the removal of native vegetation along either side of the new roadway will minimize impacts.

Avoidance, Minimization, and Mitigation

Avoidance efforts focused on minimizing impacts to forest areas, with special emphasis on minimizing forest interior impacts. This includes consideration of options that impact existing forest edge instead of bisecting existing forest interior. It is recommended that a control plan be developed, especially within more sensitive areas, such as the stream valley parks.

The Lead Agencies currently have a program in place to control certain invasive species including bull and Canada thistle with the use of herbicides. In addition, the SHA is required to control State listed noxious weeds as defined by the Maryland Department of Agriculture.

9. Terrestrial Wildlife

For the purposes of this assessment, direct impacts to wildlife are defined as those impacts that would result in an immediate change in wildlife populations, their behavior, and their habitats. Indirect impacts are defined as those impacts to wildlife that could result from short-term or long-term changes in population size and density, animal behavior, or animal health as a result of other impacts associated with the project over a period of time. In general, both direct and

indirect wildlife impacts resulting from any of the Build Alternatives would be most apparent or pronounced in those areas where wildlife habitat is presently abundant and not subject to the numerous ongoing influences of minor road construction and residential and commercial development. These areas are generally the stream valley parks and other larger forested areas that make up a relatively small percentage of the overall ICC study area.

a. Direct Impacts (All Terrestrial Wildlife)

The No-Action Alternative would have no direct ICC project related impact on terrestrial wildlife within the study area.

Direct impacts to terrestrial wildlife resulting from either corridor could be in the form of habitat loss, creation of physical barriers restricting movement of wildlife between habitats, mortality during roadway construction, and mortality from collisions with vehicles. While Corridors 1 and 2 would have a similar amount of total habitat loss, Corridor 1 would have the higher amount of forest habitat loss. Both corridors cross numerous existing wildlife travel corridors, and the roadway and its associated infrastructure – especially areas with steep slopes and retaining walls, ROW fencing, and noise walls – would serve as a physical barrier that could restrict animal movement.

During construction of the highway, the direct mortality of wildlife species that are within the ROW could occur. This is especially true for species that are sessile, slow moving, living in vegetation or wetlands that are cleared, and burrowing.

After the roadway has been constructed, mortality from collisions is the greatest direct impact to wildlife and can be a significant human safety concern, especially for larger mammals such as deer (described in further detail in later sections). Typically, mortality generally increases with traffic volume and speed, although some species are less likely to be killed on high-speed roads than medium-speed roads because the former usually have vegetation cleared back further from the road's shoulder, creating less attractive habitat and greater visibility for both animals and drivers. Other species are attracted to the modified edge habitat alongside and in the medians of high-speed roads, placing them in harm's way and possibly making these areas population sinks (Trombulak, 2004).

b. Indirect Impacts (All Terrestrial Wildlife)

The No-Action Alternative would have no indirect impact on terrestrial wildlife within the study area.

Indirect impacts to terrestrial wildlife resulting from the Build Alternatives could be in the form of habitat fragmentation, degradation or modification, behavioral modifications, physical influences, and chemical influences that may result in an overall change in makeup and/or health of a population. The indirect impacts described below apply to wildlife species including those specific species described below.

Habitat Fragmentation, Degradation, or Modification

Construction of either corridor would result in habitat fragmentation, where large contiguous areas of one particular, and possibly critical, habitat type would be reduced to smaller patches of that habitat type, which may be separated by other, more common or less critical habitats. Fragmentation creates a larger edge-to-interior ratio, as discussed in **Chapter IV.F.8.b** in greater detail concerning FIDS. The loss of interior habitat is of concern for edge-sensitive species, with reduced patch sizes possibly resulting in a loss of area-sensitive species. These edge areas also become areas where non-native, invasive, or exotic species may begin to dominate the highway edge, thus resulting in habitat degradation. Other likely impacts from the construction of the ICC project include modification in habitat conditions, including a break, or at a minimum, a reduction in canopy density; changes in vegetation community type and structure; and a shift in available food sources.

Indirect effects associated with these impacts could include a shift in wildlife community structure from a diverse community of species requiring very specific habitat needs, to an edge community that often consists of generalists that are relatively abundant throughout urban and suburban areas. This indirect impact would be more pronounced in the larger forested areas of the stream valley parks because less of a change would occur in the already “edge dominated” suburban landscape typical of the majority of the study area.

Animal Behavior Modification

Highway construction in either corridor could result in negative or positive modifications in animal behavior, including home range shifts, altered movement patterns, altered reproductive success, altered escape response, and altered physiological state. Many animals requiring large home ranges will shift their home ranges away from areas with high traffic roadways to avoid visibility, while others, such as vultures and hawks, may be drawn to the openness of the habitat and potential areas for feeding along roads.

While some roadways may cause physical barriers that prevent animal movement, as discussed above under direct impacts, animal movement patterns may also be altered in other ways. Many animals such as mice and voles will avoid crossing roadways, especially those with high traffic volumes. As a result, roads may act as barriers to gene flow between populations of the same species separated by the roadway, possibly leading to genetic differentiation among populations and/or mutation or poor physical health due to inbreeding of isolated populations over time. Again, this effect will be more apparent in the less-developed areas of study area. Other animals such as woodchucks may actually thrive along the edge habitat created within the ROW of highways.

Reproductive success of animals could also be affected. For some raptors, the high amount of human disturbance associated with roads could reduce their reproductive success, while for others such as mallards, reproductive success could be increased due to a lower level of predation from typical predators of a particular species along roadways.

Animals could also alter their escape response due to the presence of traffic, with some animals fleeing more frequently or at a shorter disturbance distance than normal, and others becoming more immune to the presence of the traffic and not fleeing quickly enough to avoid the high speed traffic, thus resulting in roadkills. The physiological reaction of animals to roads is less well known, although some animals have been found to have an increased heart, metabolic rate, and rate of energy expenditure (Trombulak, 2004).

Physical Influence

Highway construction in either corridor would result in indirect effects on wildlife due to physical influences. As stated earlier, the project would transform the physical conditions on and adjacent to the roadway and create an edge effect on the surrounding habitat and wildlife. This edge effect would include increases in temperature, light, and dust. Heat stored on a roadway surface during the day gets released into the atmosphere at night, creating heat islands around road surfaces that some animals, such as snakes and small birds, may be attracted to, increasing their risk of being struck by vehicles.

Sections of the roadway constructed through forested areas would increase the amount of light reaching the remaining forest floor, thus changing plant community composition along the edge. This often leads to a relatively high incidence of non-native, invasive, or exotic species becoming introduced along the edge area that, overtime, could begin to disperse further into the interior of the forest. Roadways often provide dispersal corridors for many exotic species that overtake native species and endanger the overall ecological health of an ecosystem. Other factors that facilitate the spread of exotic plants along roadways include soils modified during roadway construction, and alterations to the canopy structure of forests. In some instances, exotic species are introduced over native species for the sake of quick erosion control of disturbed areas. Few animal species prefer areas dominated by exotic or invasive vegetation, especially areas where these species are essentially a monoculture with little to no plant diversity. However, this could be eliminated or minimized through BMPs that would require only native seeds to be used for erosion control.

Dust along highways becomes mobilized and transported to aquatic ecosystems or settles on surrounding plants, resulting in decreased photosynthesis, respiration, and transpiration that can cause physical injuries or mortality to plants, thus altering the plant community available to wildlife species (Trombulak, 2004).

Chemical Influence

Highway construction in either corridor could result in indirect effects to wildlife due to changes to the chemical environment along the roadway, resulting in long-lasting and detrimental effects on populations. Traffic on roads and regular maintenance activities for upkeep of roads have been found to contribute at least four different classes of chemicals to the environment, including heavy metals from gasoline additives, salts from de-icing activities, organic molecules, and nutrients from roadway runoff. The amount of these contaminants entering the environment is often related to the amount of vehicular traffic and maintenance practices used on the road.

The alteration of the chemical environment could result in a number of consequences for living organisms. The growth and overall physical health of many plants along roadways could become stressed, and many types of plants that provide food or habitat for wildlife may not survive. The chemical composition of some plants may change in response to pollutants, thus lowering their nutritional value for herbivores. Accumulation of toxins could also occur in wildlife exposed to or feeding on plant/soil material affected by pollutants, and depending on their level of exposure and accumulation, they may pose health hazards to humans or other animals exposed to or feeding on those organisms.

Some animals that may be highly sensitive to chemical changes because of the sensitivity of their skin, such as reptiles and amphibians, may be killed or otherwise displaced as a result of chemical exposure – especially when the exposure results from a surge of chemicals introduced into the ecosystem, such as a spill or runoff/snowmelt that transports accumulated chemicals to terrestrial or aquatic systems. Increased concentrations of salt near roadsides could also attract some animals, such as large mammals, putting them more at risk for being killed by vehicles.

Over the long-term, the abundance of species less tolerant to roadway disturbances, overall number, diversity, and composition of animal species within an environment could be altered as a result of habitat changes, modified behavior, and physical and chemical influences caused by roadway construction and maintenance. Below is a more detailed description of potential impacts to specific types of terrestrial wildlife, as well as a description of avoidance, minimization, and mitigation measures that will be utilized to reduce those impacts.

c. **Mammals (Specific Impact Discussions and Avoidance, Minimization, and Mitigation)**

Impacts

A detailed description of potential impacts on deer, beaver, and other mammals is provided in the following sections.

Deer

Montgomery County has identified white-tailed deer hotspots as areas where the greatest numbers of deer-human interactions have been reported (**Figure II-18**). The hotspots are identified in the *Comprehensive Management Plan for White-tailed Deer in Montgomery County, Maryland* by the Montgomery County Deer Management Work Group (DMWG, 1995). For each hotspot the DMWG identified site-specific impacts from deer and provided recommendations for herd management. The impacts and recommendations for each hotspot within the study area are listed in **Table IV-75**. Prince George's County does not have a comparable deer management plan or hotspot data; however, deer-human conflicts do not appear to be as significant in this county's portion of the study area.

Seven of the 19 hotspots are located within the ICC study area. The four hotspots that would be crossed by Corridor 1 include Hotspot 2 in Rock Creek Regional Park, Hotspot 3 in North Branch Stream Valley Park, Hotspot 5 at the Northwest Branch Area, and Hotspot 12 in the Paint

Branch Area. The two hotspots that would be crossed by Corridor 2 include Hotspot 2 (**Appendix A, Plates 3-11**) in Rock Creek Regional Park and Hotspot 3 in North Branch Stream Valley Park. The other three hotspots – Hotspot 4 at the Ag/History Farm Park, Hotspot 15 in Wheaton, and Hotspot 16 at Rock Creek Manor – are within the overall ICC study area, but are not directly impacted by either corridor.

Table IV-75
Deer Management Working Group (DMWG) Hotspots and Recommendations
for FY 2003

ID	Identified Hotspot Areas	Major Impacts	FY 2000 Recommendations (numbers refer to text below)
2	Rock Creek Regional Park*	DVC, CC, NV	1,2,4,5,6
3	North Branch Stream Valley Park*	DVC, CD, CC, NV**	1,2,4,5,6
4	Ag/History Farm Park	DVC, CD, CC, NV	1,2,4,5,6
5	NW Branch Area	DVC, CC, NV	1,2,4,5,6
12	Paint Branch Area*	DVC, CD, CC	1,2,4,5
15	Wheaton	DVC, CC, NV	1,2,4
16	Rock Creek Manor	CC, NV	1,2,4,5

Source: (MCDMWG, 2003)

DVC-deer-vehicle collision; CD-crop damage; CC-citizen complaints; NV-natural vegetation damage.

* Affecting natural vegetation in parks with species/communities of countywide significance.

** Population estimates are made on regional level by DNR using region-wide forward looking infrared (FLIR) Index to deer density.

Key to Recommendations

Non-lethal

- Continue efforts in educating the public about deer issues, particularly on available non-lethal methods to reduce deer damage to personal property. Focus on communities in these areas.
- Continue efforts with DPWT and SHA to make improvements to road fencing, signage, and design to reduce deer vehicle collisions at specific locations.
- Continue to encourage more local community involvement in deer management efforts.

Lethal

- Continue efforts to encourage effective deer population management on large parcels of private property.
- Continue and expand population reduction programs on select State and county lands.

The Large Animal Removal and Reporting System (LARRS) highway-deer-mortality data from SHA was plotted on a map with the Montgomery County and Prince George's County parks layer and the DMWG hotspot locations to examine the correlation. The LARRS data is collected only for State roads, and therefore does not completely cover all areas of the county. All of the hotspots occur in areas that include relatively large amounts of parklands, which tend to have a much higher frequency of county-only roads. Therefore, examining only the LARRS data would result in an under-representation of the deer collisions in the park areas.

The area between Hotspots 2 and 3 is an area where the LARRS data shows a strong correlation with the Montgomery County hotspots. MD 115, which has a high number of deer-vehicle collisions (DVCs), is located just outside the boundaries of Hotspots 2 and 3. Corridors 1 and 2 would cross Hotspots 2 and 3, and MD 115. East of Hotspot 3, along MD 97 a high amount of deer strikes occurred according to the LARRS system. Hotspot 12 currently incorporates a segment of MD 650 along the western boundary.

Hotspot 12 currently incorporates a segment of MD 650 along the western boundary. According to the LARRS data, MD 650 has a high occurrence of DVCs. West of Hotspot 12, a potentially high deer/highway interaction might occur along MD 650.

Based on review of the latest LARRS data, several additional locations within or adjacent to the alignment ROWs stand out as having a pattern of DVCs. These areas are not located within Montgomery County designated hotspots, but are noteworthy due to their proximity to the proposed alignments. Southeast of Hotspot 12, Corridor 1 would cross Columbia Pike (US 29) in between the intersections of US 29 with Good Hope Road and with Briggs Chaney Road. Both of these intersections have several recorded deer strikes.

Along Corridor 2, a high number of deer strikes were reported at the intersection of Norbeck Road (MD 28) and Layhill Road (MD 182) and at the intersection of New Hampshire Avenue (MD 650) and Spencerville Road (MD 198). Please refer to the avoidance, minimization, and mitigation section below for information on deer fencing and proposed underpasses that are designed to minimize any deer-vehicle interaction.

The significance of the LARRS data will increase as more time passes and more data is incorporated into the database. The data will be analyzed again during final design to identify any new trends that may have developed.

Beaver

Beaver inhabit the major stream systems throughout the study area, and can be quite common in the stream valley parks. Beavers generally adapt well to human infrastructure and even exploit features such as SWM facilities, culverts and areas around major highway bridges. The primary impact from any of the Build Alternatives would be from the direct loss of wetland and adjacent upland habitat and general living space. No significant long term impact would occur to beavers and their habitat, since most major stream crossings would be spanned by bridges, and the wetland functions and values would be replaced in area watersheds.

Other Mammals

Mammals other than deer and beaver would be affected by the ICC construction and operation in varying ways. The more disturbance-sensitive mammals that favor mature forest and interior habitats would be directly affected through the loss of their preferred habitats and/or indirectly affected by the introduction of new edge habitat. Examples of forest-dependant and large forest block dependant mammals in the study area include the southern flying squirrel (*Glaucomys volans*), gray fox (*Urocyon cinereoargenteus*), and most bat species. Nearly all other mammal species found in the study area such as raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis marsupialis*), cottontail rabbits (*Sylvilagus floridanus*), and certain mice, voles, and shrews are generalists and typically adapt to the introduction of a new roadway in their environment. Despite the actual direct loss of possible habitat from the paved roadway surfaces, these species often adapt to newly created “edge” habitat along the roadway, large interchanges, and SWM facilities, provided other suitable core habitats remain adjacent to the facility.

Species such as woodchucks (*Marmota monax*) and red fox (*Vulpes fulva*) almost always benefit from newly created grassland and edge habitat and are surprisingly adaptable to the open space adjacent to highways. The creation of new grassland and edge habitat also increases the opportunity for mortality from vehicle collisions. Coyotes (*Canis latrans*) and black bears (*Ursus americanus*), though very rare or transient in the study area, are also known to use and travel along large highway ROWs which act as dispersal corridors.

Overall, there is a relative scarcity of mature forest interior and other large blocks of minimally disturbed habitats and open space in the project study area except for the large stream valley parks.. Therefore, while not quantified, the construction of either ICC corridor would have a negative effect on the more disturbance sensitive and forest dependant mammals, and likely have far less effect on the generalist mammals. The increase of edge habitat could result in certain species using habitat immediately adjacent to the highway, resulting in more vehicle-related mortalities.

Corridor 1 would affect more overall mature forest than Corridor 2, and therefore would result in the greatest impact to more undisturbed forest habitat including more FIDS. With either corridor; however, the impact from fragmentation of forested areas would be mitigated by the proposed bridges and would thus allow for dispersal of most mammal species.

Avoidance, Minimization, and Mitigation

Montgomery Countywide Deer Management Initiatives

To slow the increase in DVCs in Montgomery County, several management approaches are being considered or implemented by the County (per the *Montgomery County Deer Management Program, Annual Report and Recommendations, FY 2004* [Gibbs (a), 2003]). These include wildlife reflector system test sites and experimental warning signs. Wildlife passages in conjunction with fencing, described in more detail below as it pertains to the ICC, can also be designed to allow deer and other wildlife to safely cross underneath roadways. Other recommendations that may be implemented at the local level include repellents and scare devices, immunocontraception, trapping and removal, and an increase in the number of hunting days and number of doe permits to reduce the breeding population.

Specific ICC Planning Recommendations from the Deer Management Working Group

A series of recommendations specific to the ICC were developed by the DMWG. The primary concern is the number of DVCs that could occur on the proposed roadway. The multi-lane, high-speed design of the roadway could increase the DVCs. High-speed roadways generally have more DVCs than lower speed roadways, regardless of deer density. In addition, the roadway is proposed to have a parkway design. Research has found that landscaped medians and roadsides, while visually appealing to drivers, could attract deer to the roadway, thus increasing the number of collisions (Gibbs [b], 2003).

However, the Lead Agencies have found that high volume roadways, such as suburban/urban, multi-lane highways, can form a fluid barrier to deer movement. This barrier effect can reduce

the number of attempted crossings and actually reduce the incidence of DVCs. A limited access highway, with normal ROW fencing and high-volume, high-speed traffic, reduces the DVCs even further.

The ICC corridors would pass through four stream valleys that are known to have exceptionally high deer concentrations: Rock Creek, North Branch Rock Creek, Northwest Branch, and Paint Branch. The DMWG has made several design recommendations for the ICC project to decrease the potential for collisions. These recommendations are detailed below (Gibbs [b], 2003).

- Bridges, with adequate underpass space for wildlife should be used for all large stream crossings. The design of the bridge should be as long as possible and should include fencing to funnel wildlife to the underpass.
- Culverts, when used in place of a bridge, should have a minimum height of eight feet with sufficient openness to allow animal passage. The openness relates to the animals' point of view when looking from one side of the tunnel to the other. To allow entry into the tunnel, the height and width must increase in proportion to the length.
- Fencing for long stretches of roadway should be eight feet high and securely attached to the ground so that wildlife cannot go underneath. Deer, which force their way under or through gaps in fencing, may need as little as six inches of clearance to do so. An annual fencing inspection schedule should be established to maintain the fencing.
- One-way wildlife gates, or comparable escape structures, should be included in the fencing in order to provide escape routes for wildlife that enter the roadway along access ramps.
- Retaining walls should be used in areas requiring large amounts of fill. These would serve to reduce the amount of disturbed habitat, prevent access to the road, and incorporate escape structures.
- Wildlife reflectors (Strieter-lite) should be used in areas where fencing is not suitable.
- Landscaping of the roadway should be minimal and, if necessary, limited to species not preferred by deer. Roadsides and medians should be made as unappealing to deer as possible.

Recommended Wildlife Crossing Locations and Types

Coordination has been ongoing with the DMWG to develop the safest and most effective roadway design for the ICC with respect to white-tailed deer. A group of representatives from the M-NCPPC, DNR, USFWS, USACE, and others have worked closely with a team of Lead Agency planners and engineers specifically on the task of determining appropriate areas for wildlife crossings along the Build Alternatives. This coordination will continue throughout all phases of the project.

Partly in response the concerns described above, special wildlife crossing structures are being considered as part of the roadway design to provide protection for humans and wildlife. These structures will help maintain the connectivity between wildlife communities, and enable wildlife to maintain their range of habitat by allowing safe passage through areas that would otherwise be bisected and isolated by a new roadway. The structures under study include bridges and different sized culverts depending on wildlife known to be within proximity to each crossing and adjacent existing and proposed land uses.

Table IV-76 lists the proposed structures and **Figure IV-6** shows the location of each structure.

Table IV-76
Proposed Structures at Select Drainage Crossings

Station No.	Prior Structure Identifier #	Corridor	Watershed	Location	Proposed Structure
370 Ramps (4 locations)	None	1&2	Mill Creek	West of Shady Grove Road	Small mammal culvert
Sta.150	1-1	1&2	Mill Creek	West of Shady Grove Road	Deer culvert
Sta. 173	1-2		Mill Creek	West of Redland Road	Deer Culvert (May provide pedestrian connectivity)
Sta.193	1-3	1&2 (Rock Creek Option A)	Mill Creek	East of Redland Road	Hydraulic culvert
Sta.204	1-4		Mill Creek	East of Nedham Road	Bridge
Sta. 225	1-5		Rock Creek	North of Needwood Road	Bridge
Sta. 207	None	1&2 (Rock Creek Option C)	Rock Creek	North of Garrett Road	Hydraulic culvert
Sta. 240	1-7	1&2 (Rock Creek Option C)	Rock Creek	Northwest of Needwood Road Garrett Road	Bridge
Sta. 276	None	1&2	Rock Creek	Southwest of Muncaster Mill Road	Deer culvert
Sta.285	None	1&2	North Branch Rock Creek	East of Muncaster Mill Road	Small mammal culvert
Sta.297	W3.13	1&2	North Branch Rock Creek	East of Muncaster Mill Road	Deer Culvert
Sta.320	1-8	1&2	North Branch Rock Creek	Northwest of Promontory Court	Bridge
Sta.327	1-9		North Branch Rock Creek	North of Promontory Court	Bridge
Sta.360	None	1&2	North Branch Rock Creek	East of Emory lane	Small mammal culvert
Sta.415	None	1	Batchellor's Run	East of Georgia Avenue	Hydraulic culvert
Sta.420	None	1	Batchellor's Run	East of Georgia Avenue	Hydraulic culvert
Sta.433	None	1	Batchellor's Run	South of Trotters Glen Golf Course	Hydraulic culvert
Sta.435	None	1	Batchellor's Run	South of Trotters Glen Golf Course	Hydraulic culvert

Table IV-76
Proposed Structures at Select Drainage Crossings

Station No.	Prior Structure Identifier #	Corridor	Watershed	Location	Proposed Structure
Sta.533	1-10	1 (Northwest Branch Option A)	Northwest Branch	Northwest of Bonifant Road	Bridge
Sta. 555	1-11		Northwest Branch	Bonifant Road	Bridge
Sta.595	1-12		Northwest Branch	South of Bonifant Road	Bridge
Sta.654	None	1	Northwest Branch	West of New Hampshire Avenue	Small mammal culvert
Sta. 673	1-13	1 (Good Hope Trib.)	Paint Branch	East of MD 650	Hydraulic Culvert
Sta. 690	1-14	1 (Paint Branch Option A)	Good Hope	East of Cape May Road	Bridge
Sta. 740	1-15	1	Gum Springs	Southwest of Crest Hill Lane	Bridge
Sta. 750	1-16		Paint Branch	Southeast of Crest Hill Lane	Bridge
Sta. 839	None		Little Paint Branch	East of US 29	Hydraulic culvert
Sta. 880	1-17		Little Paint Branch	South of Greencastle Road	Bridge
Sta. 974	None	1&2	Indian Creek	East of I-95	Small mammal culvert
Sta. 414	None	2	Batchellor's Run	East of Georgia Avenue	Hydraulic culvert
Sta.419	None	2	Batchellor's Run	East of Georgia Avenue	Hydraulic culvert
Sta.425	None	2 (Norbeck Option B)	Batchellor's Run	East of Georgia Avenue	Deer culvert
Sta. 434	2-1	2 (Norbeck Option A)	Batchellor's Run	South of Trotters Glen Golf Course	Deer culvert
Sta. 435	2-2		Batchellor's Run	South of Trotters Glen Gold Course	Hydraulic culvert
Sta. 458	2-3		Batchellor's Run	East of Trotters Glen Golf Course	Small mammal culvert
Sta. 473	2-4	2	Batchellor's Run	East of Trotters Glen Golf Course	Bridge
Sta. 558	2-5		Northwest Branch	East of Llewellyn Fields	Bridge
Sta. 570	2-6		Nursery Run	East of Llewellyn Fields	Bridge
Sta. 620	None	2	Nursery Run	West of New Hampshire Avenue	Hydraulic culvert
Sta. 642	None	2	Nursery Run	West of New Hampshire Avenue	Deer Culvert
Sta. 758	2-7	2 (Burtonsville Option A)	Paint Branch	South of Spencerville Road	Bridge
Sta. 795	2-8		Rocky Gorge	South of Bell Cote Drive	Deer culvert
Sta. 820	2-9		Rocky Gorge	West of Bell Road	Deer Culvert
Sta. 763	2-10	2 (Burtonsville Option B)	Rocky Gorge	West of Oursler Road	Bridge
Sta. 773	2-11		Rocky Gorge	West of Kruhm Road	Hydraulic culvert

Table IV-76
Proposed Structures at Select Drainage Crossings

Station No.	Prior Structure Identifier #	Corridor	Watershed	Location	Proposed Structure
Sta. 790	2-12		Rocky Gorge	East of Kruhm Road	Deer Culvert
Sta. 795	2-13		Rocky Gorge	West of Bell Road	Small mammal culvert

The initial agency coordination began in the fall of 2003, with an emphasis on the larger streams and rivers. The column labeled “Prior Structure Identifier Number” gives the original number coding assigned to the 30 crossing locations that were initially considered. As part of the ongoing and more comprehensive wildlife passage consideration, the Lead Agency team expanded the assessment by 20 crossings, bringing the total to 50 locations. As a result, several additional locations were recommended for enhanced wildlife passage. This more comprehensive list is organized by station number for consistency. Additional details regarding the type of wildlife crossings and crossing features are found in the *NETR* (SHA, 2004).

Four categories of crossing structures have been identified and are described below.

Deer Culvert: This culvert is specially designed to accommodate deer passage. Deer in the study area are extremely abundant and adaptable to the human landscape and have been found to use a wide variety of culverts for passage under existing roads. Based on discussions with the IAWG including MNCPPC, deer culverts will consist of rectangular culverts with a minimum size of 12 feet by 12 feet with a natural bottom. Minimal clearing will be 12 feet wide and 10 feet high. It is anticipated that one to two feet of sediment will accumulate within each culvert. Other culvert designs (round, arch) may also be considered as additional engineering efforts continue.

Small Mammal Culvert: This culvert is specially designed to accommodate small mammal passage. Some deer passage may be possible, depending on the final sizing. These culverts could include the use of a two-foot wide dry “shelf” alongside the waterway, which small mammals have been found to readily use, or the addition of a dry culvert cell alongside the culvert that carries the primary stream flow. These are generally proposed in areas where there is some nearby open space or habitat, but where a much larger deer culvert is not warranted because of expense, surrounding existing and proposed land use, or distance from another large deer crossing opportunity, such as deer culvert or bridge.

Hydraulic Culvert: This culvert is designed to accommodate hydraulic conditions; however, small mammal passage and some deer passage may be possible depending on the final sizing. Hydraulic culverts have been proposed in areas where there is likely to be a lack of any adjacent core habitat, or in areas where future development plans have been proposed. These hydraulic-only culverts will likely still provide some degree of safe passage to the local wildlife that exists in that immediate area. This likelihood is based on evidence of high wildlife usage of culverts in the study area and elsewhere in Maryland where no special design techniques were employed.

Bridge: A bridge structure would afford passage to all wildlife under the span. Studies will continue on these bridge crossings to determine if any enhancement techniques could be employed under the span to further encourage herptile and smaller mammal crossing. These techniques could include strategic placement of woody debris to help retain moisture and provide refuge. Studies are also continuing at other non-bridge locations to determine the need for techniques to enhance herptile crossings, possibly in areas near concentrations of vernal pools.

The Lead Agencies and the resource agencies reviewed each proposed alignment as part of a “landscape ecology” approach to evaluate the most appropriate crossing structure with respect to wildlife. This regional approach took into account the following:

- the frequency of the bridge crossings along the corridor
- the frequency and distribution of recommended deer culverts
- the presence of either eight-foot deer fencing or noise walls along significant segments of the corridor
- the distribution of public and private open space, including parkland and golf courses (representing the larger blocks of core habitat)
- future development plans

Based on the above criteria, a proposed structure was recommended for 50 different crossings throughout both corridors (final decision pending on six locations) (**Table IV-76**). Design efforts for each crossing, including size and any special ecological features, will continue to be coordinated with the agencies.

The Lead Agencies are committed to evaluating methods that create natural stream bottoms at all proposed culvert crossings. All of the above wildlife passage efforts are closely tied to an effective and well-maintained ROW fencing design and a “deer-unfriendly” landscape plan. Continuous eight-foot fencing will be required in many locations. In the case where hiker/biker paths encounter fencing, spring gates or similar features may be considered to prevent deer from accessing roadside areas.

d. Reptiles and Amphibians (Specific Impact Discussions and Avoidance, Minimization, and Mitigation)

Impacts

The No-Action Alternative would have no ICC project related impact on reptiles and amphibians or vernal pools within the study area.

General

The Build Alternatives for the ICC would impact reptiles and amphibians through the loss of habitat resulting from construction of the roadway. These affected habitats include vernal pools (discussed below), wetlands (see **Chapter IV.F.7**), forests (see **Chapter IV.F.8**) and stream habitats (see **Chapter IV.F.5**). Reptiles and amphibians are also susceptible to impact from less measurable habitat reduction such as fragmenting forested areas, isolating patches of habitat from breeding areas, and other indirect effects such as local increases in roadway and bridge runoff.

Reptiles and amphibians are also often negatively affected by the operation of a transportation facility. Far less effective at traversing roadways than other more mobile wildlife species, studies worldwide have found that reptiles and amphibians are often the most frequently killed vertebrates on roads. This can lead to localized decreases in populations. Because of the importance of vernal pools to a wide range of herptiles, specific direct impacts are quantified and described in the following section. Secondly, the wetlands impact section (**Chapter IV.F.7.a**) also provides an indication of the degree of impact on herptiles by the project.

Vernal Pools

Corridors 1 and 2, including the various options, would directly impact up to 31 vernal pools in six watersheds. The two corridors would have a shared impact on 11 vernal pools; all are located in the North Branch Rock Creek watershed. In addition, one vernal pool would be impacted in the Upper Rock Creek watershed by choosing either of the Rock Creek Options (**Table IV-77**).

Muddy Branch Watershed

No vernal pools would be impacted within the Muddy Branch watershed.

Upper Rock Creek Watershed

One vernal pool would be impacted by Rock Creek Option A and one would be impacted by Option C within the Upper Rock Creek watershed. The pool that would be impacted by Rock Creek Option A is 99 square feet and contained no reptile or amphibian species at the time of investigation. The pool that would be impacted by Rock Creek Option C is 65 square feet and contained wood frog (*Rana sylvatica*) habitat. These pools are associated with Wetlands 1ND and 1MD.

North Branch Rock Creek Watershed

Eleven vernal pools would be impacted within the North Branch Rock Creek watershed. All 11 pools contain habitat for the wood frog and spotted salamander (*Ambystoma maculatum*). Two vernal pools are associated with Wetland 1Z while the other nine pools are located on an old nursery. One pool is 161 square feet, one is 538 square feet, and the rest average 65 square feet.

Table IV-77
Summary of Vernal Pools Impacts

Corridor	Vernal Pools (Square Feet)
No-Action Alternative	
Corridor 1 and 2 West of MD 97 Mainline Segments	699
Corridor 1 and 2 Rock Creek Options (select one)	
Rock Creek A	99
Rock Creek C- Olde Mill Run Grade Separation	65
Rock Creek C- Olde Mill Run Cul-de-Sac	65
Corridor 1 Mainline Segments (MD 97 to I-95)	5,749
Corridor 1 Northwest Branch Options (select one)	
Northwest Branch A- with Interchange at Layhill Road	0
Northwest Branch A- without Interchange at Layhill Road	0
Northwest Branch B- with Interchange at Layhill Road	3,552
Northwest Branch B- without Interchange at Layhill Road	3,552
Corridor 1 I-95 Interchange Options (select one)	
I-95 Interchange Option A (terminate ICC at US 1)	0
I-95 Interchange Option B (terminate ICC at I-95)	0
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)	
Corridor 2- with Interchange at Layhill Road	1,180
Corridor 2- without Interchange at Layhill Road	1,180
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)	
Norbeck A	585
Norbeck B- with ICC over Willow Grove	585
Norbeck B- with Willow Grove Access at Mt. Everest Lane	585
Spencerville A- with Burtonsville A	3,233
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	2,690
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	2,690
Spencerville A- with Burtonsville X	3,233
Spencerville B- with Burtonsville A	330
Spencerville B- with Burtonsville B	0
Spencerville B- with Burtonsville X	213
Spencerville C- with Burtonsville A	213
Spencerville C- with Burtonsville B	0
Spencerville D- with Burtonsville B	2,112
Fairland A	0
Fairland B	0
Corridor 2 I-95 Interchange Options (select one)	
I-95 Interchange Option A (terminate ICC at US 1)	0
I-95 Interchange Option B (terminate ICC at I-95)	0
Corridor 1 Range of Impacts	6,513 – 10,099
Corridor 2 Range of Impacts	2,529 – 5,796

Note: Total impacts for corridors are calculated for **Corridor 1** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding the *Corridor 1 Mainline Segments (MD 97 to I-95)*, adding one *Corridor 1 Northwest Branch Option* and one *Corridor 1 I-95 Interchange Option*; or for **Corridor 2** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding one *Corridor 2 Mainline Segments (MD 97 to I-95)*, one of each of the desired *Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options*, and adding one *Corridor 2 I-95 Interchange Option*.

Northwest Branch Watershed

Four vernal pools would be impacted within the Northwest Branch watershed. Corridor 1 would impact two vernal pools. One is associated with Wetland 2G and is approximately 861 square

feet. The other is associated with Wetland 3B and is 538 square feet. Only wood frog egg masses were observed.

Northwest Branch Option B would impact a total of 3,552 square feet of pools. Both pools were observed to contain wood frog egg masses and were associated with Wetland 2DD.

Paint Branch Watershed

Up to five vernal pools would be impacted within the Paint Branch watershed. Corridor 1 would impact three vernal pools located in a narrow upland forest between residential communities. At least three wood frog egg masses were present in the pools during the field investigations. The combined impact would be 259 square feet and are associated with Wetlands 3P and 3PA.

Spencerville Option A would impact two vernal pools. One is a 2,690 square foot farm pond linked to Wetland 7AA. It has limited amphibian habitat and had one wood frog egg mass. The other is a 330-square-foot farm pond and is associated with Wetland 7B. It is in an upland forest and contained numerous wood frog and spotted salamander egg masses, as well as American toad egg masses during the field investigations. Spotted salamander spermatophores were also present.

Little Paint Branch Watershed

Up to six vernal pools would be impacted within the Little Paint Branch watershed for a combined total of 3,506 square feet. Two pools are isolated depressions on a golf course. Spotted salamander egg masses, American toad (*Bufo americanus*) egg masses, and wood frog tadpoles were observed during the field investigations. Four pools with spotted salamander egg masses were present, one of which also contained wood frog egg masses. One pool contained wood frog egg masses only. One pool is located in a wetland within the floodplain of Little Paint Branch. Spotted salamander egg masses were present. These vernal pools are associated with Wetlands 3TA, 3TA1, 3TF, and 3TG.

Indian Creek Watershed

No vernal pools would be impacted within the Indian Creek watershed.

Rocky Gorge Watershed

Three vernal pools would be impacted within the Rocky Gorge watershed for a combined impact of 3,505 square feet. One pool contained wood frog egg masses and tadpoles and is situated in a large wetland, Wetland 5XA. Another pool, associated with Wetland 5ND2, was observed to contain wood frog, American toad, and bullfrog (*Rana catesbeiana*) egg masses with bullfrog tadpoles. In addition, VP7L, a 213-square foot vernal pool containing wood frog egg masses and tadpoles was located.

Upper Patuxent River Watershed

No vernal pools would be impacted within the Upper Patuxent River watershed.

The combined total of Corridor 1 impacts to vernal pools would be a minimum of 6,513 square feet and a maximum of 10,099 square feet. The combined total of Corridor 2 impacts to vernal pools would be a minimum of 2,529 square feet and a maximum of 5,796 square feet.

Additional information on the impacts to vernal pools can be found in the *NETR* (SHA, 2004).

Avoidance, Minimization, and Mitigation

Studies for the avoidance and impact minimization of vernal pools closely paralleled those for protected wetlands and floodplains as the majority of vernal pools are associated with wetlands. As described in **Chapter IV.F.7.c**, the goal of ongoing design efforts is, by regulation, to avoid as many wetlands as practicable. As a result, many vernal pools impacts have been avoided. In many cases, bridges would span large sections of the 100-year floodplain and wetlands, thus avoiding direct impacts to vernal pools.

To help minimize impacts to reptile and amphibian populations along the corridors, consideration of amphibian passage has been included as part of the roadway design. In areas where deer or small mammal culverts are proposed, particular consideration will be given to enhancing amphibian passage opportunities. These techniques may include designing the culverts to have natural substrates that maintain some debris for cover and moisture retention. The incorporation of mesh along the bottom three feet of deer fencing has also been proposed to minimize amphibian movement along the proposed highway. Prior to considering vernal pool creation or replacement, avoidance and/or protection of other nearby vernal pools and forested buffer zones will be explored. If protection of other vernal pools and their buffer zones is not an option, replacement of impacted vernal pools will be considered. Efforts are ongoing with M-NCPPC to consider vernal pool creation immediately along the proposed ROW

e. Birds (Specific Impact Discussions and Avoidance, Minimization, and Mitigation)

Impacts

The No-Action Alternative would have no ICC project related impact on bird species within the study area.

Implementation of any of the corridors would result in the conversion of natural habitats to pavement and revegetated or landscaped ROW. These direct impacts to natural habitats are summarized in **Chapter IV.F.8**. Direct impacts to habitat would affect bird communities within the study area; however, the degree of impact would vary between corridors and from watershed to watershed. In addition, indirect impacts to birds would occur within the highway ROW, as habitats would be altered, and bird species distributions and populations would be modified. Adams and Geis (1978) estimated that for a typical interstate highway, the loss or modification

of habitat would total approximately 60 acres per mile. In general, loss of natural habitats would result in the loss of individuals, and in some cases, species of birds from those habitats. However, the creation of edge habitat through contiguous forest could result in an increase in species diversity (Robbins et al., 1989; Robbins, 1979; Anderson, 1979; Michael, 1975).

Fragmentation of larger blocks of forest has been shown to cause a decrease in some bird species such as FIDS that rely on large forest tracts to breed successfully (Robbins, 1979). This fragmentation effect is compounded by the creation of additional edge habitat that is unsuitable to FIDS. This edge effect on FIDS may vary depending upon the species; however, a buffer of 300 feet from a forest edge is used in determining true forest interior habitat by the Critical Areas Commission for the Atlantic and Coastal Bays (CAC) (Jones et al., 2001). Therefore, the impacted area of the highway ROW would include the direct forest impacts plus 300 feet on either side of the limit of disturbance. **Table IV-78** indicates the numbers of FIDS potentially affected by corridor, option, and watershed, and identifies the amount of forest interior habitat existing within the corridors. The FIDS identified in the table are those species reported by either the Maryland-DC Breeding Bird Atlas Project, M-NCPPC, or MCDEP cited above. While the data are somewhat limited and do not represent equal sampling efforts throughout each watershed and within each corridor and option, the apparent correlation between the amount of forest interior habitat impacted and the number of FIDS present does suggest that areas with more FIDS habitat have more FIDS. Generally speaking, the greatest impact to FIDS and interior forest habitat would occur along Corridor 1, as this alignment extends through large areas of undeveloped, forested stream valleys. Corridor 2 crosses these stream valleys higher in the watershed where development pressures have been greater and the forest cover is not as extensive. The one exception is the portion of Corridor 2 that traverses the Rocky Gorge watershed. Large, undeveloped forest areas still exist within the Patuxent River Watershed Conservation Park and the T. Howard Duckett Reservoir. The small amount of FIDS data from this area is likely due to an absence of a sufficient survey effort rather than an absence of FIDS. Even so, Corridor 2 encroaches only on the edges of these forests rather than fragmenting large blocks of habitat into smaller parcels, thus minimizing the impact on FIDS.

Muddy Branch, Upper Rock Creek, and North Branch Rock Creek Watersheds

Corridors 1 and 2

As indicated above, suburban/urban cover types predominate along much of the project corridor from MD 97 to the western project limits at I-370. Conversion of remnant patches of vegetation in these more suburban/urban settings will likely result in displacement of more common bird species adapted to habitat edges or more disturbed cover types. Most of these common edge species will likely persist in the area, even though their numbers may decrease from a loss of habitat, as small patches of natural habitat will remain adjacent to the corridor and within more mature residential communities. Within the alignment of Corridors 1 and 2, between Shady Grove Road and MD 97, larger, more mature forested habitat would be impacted within the Mill Creek Stream Valley Park and within Rock Creek and North Branch Stream Valley Parks. Some of this habitat contains forest interior and is either suitable for FIDS or is documented FIDS habitat. As noted in **Table IV-78**, recent breeding bird surveys within Rock Creek and North Branch Stream Valley Parks have documented ten and seven FIDS species within or adjacent to

proposed Corridors 1 and 2, respectively. Fragmentation and the reduction in size of forest interior habitat resulting from construction of the proposed corridor through Rock Creek and North Branch Stream Valley Parks could reduce the numbers of breeding FIDS in those areas and could result in the complete loss of red-shouldered hawk (*Buteo lineatus*) and Kentucky warbler (*Oporornis formosus*), species that are highly habitat-sensitive. Selection of Option C across Rock Creek would minimize the impact to forest interior and to FIDS in this location by crossing a narrower section of the forested stream valley just downstream of Muncaster Mill Road.

Table IV-78

Amount of Existing FIDS Habitat Present and Numbers of FIDS Affected by ICC Corridors by Watershed

Watershed ¹	Corridor	Option	No. FIDS ²	Existing Forest Interior (Ac.)
MB	1&2		6	0.0
URC	1&2	Rock Creek A-B	10	174.8
NBRC	1&2		7	176.4
NWB	1		12	143.9
NWB	2	Norbeck A-B	9	57.2
PB	1		11	263.8
PB	2	Spencerville A-C	2	0.0
PB	2	Burtonsville A	2	0.0
LPB	1		5	40.8
LPB	2	Fairland A-B	0	18.1
IC	1&2		3	37.2
IC	I-95		3	0.0
IC	2		0	0.0
RG	2	Spencerville D	0	0.0
RG	2	Burtonsville A	2	21.7
RG	2	Burtonsville B	2	160.9
RG	2	Fairland A-B	0	0.0
UPR	I-95		2	29.5

¹ MB = Muddy Branch, URC = Upper Rock Creek, NBRC = North Branch Rock Creek, NWB = Northwest Branch, PB = Paint Branch, LPB = Little Paint Branch, IC = Indian Creek, RG = Rocky Gorge, UPR = Upper Patuxent River

² Number of FIDS taken from various data sources and may include records from areas immediately outside the ICC study area.

Northwest Branch Watershed

Corridor 1

Corridor 1 would extend southeast from MD 97 through the Northwest Branch watershed. It would traverse a narrow vegetated corridor within otherwise well developed residential communities, except where the corridor would cross Northwest Branch Park. Primarily edge species of birds would be impacted through the residential areas, not likely resulting in the complete loss of species. However, both Northwest Branch Option A and B would create a broad swath of open, developed land within a mostly mature contiguous forest along Northwest Branch. Option A, which would cross Northwest Branch and its floodplain more perpendicularly than Option B, would likely have less impact on FIDS than Option B, particularly on the more sensitive ones, because those species typically nest either along the streambanks (Louisiana waterthrush - *Seiurus motacilla*) or within the floodplain canopy (red-shouldered hawk, barred owl - *Strix varia*, and American redstart - *Setophaga ruticilla*). Construction of Northwest

Branch Option A or B would create large openings within forest interior habitat that would reduce the suitability of the habitat to support FIDS and other forest bird species.

Corridor 2

From MD 97 to MD 650, Corridor 2 would extend east within the Northwest Branch watershed, crossing Batchellors Run, the Northwest Branch mainstem, and Nursery Run. Much of this area is characterized by residential development or is rapidly converting to residential development. Also, the portion of the corridor between Layhill Road and MD 650 follows newly constructed Norbeck Road extended. Remnant patches of forest occur adjacent to the tributary streams, but little in the way of forest interior is present. Therefore, impacts to birds would mostly be displacement of edge species and species adapted to smaller woodlots. Nine FIDS were identified as at least “potential breeders” along this segment of the corridor, most of which were likely observed along Batchellors Run. On-going construction of residential homes in the area, coupled with construction of the ICC, could fragment the forest sufficiently to eliminate viable breeding populations of many of these FIDS in this location.

Paint Branch and Rocky Gorge Watersheds

Corridor 1

Corridor 1 between MD 650 and US 29 would traverse a large portion of Upper Paint Branch Park. This portion of the corridor is primarily vegetated with more mature and less disturbed hardwood forest along Good Hope tributary and Gum Springs. Forest interior habitat is present throughout this section. Avian impacts within this portion of the corridor would be to general forest birds and 11 documented FIDS, including the highly habitat-sensitive red-shouldered hawk, barred owl, and Kentucky warbler. Corridor 1 impacts to FIDS and FIDS habitat within the Paint Branch watershed would exceed those of Corridor 2. These impacts are also more significant because they represent fragmentation of the only remaining contiguous forest tracts within an otherwise developed landscape.

Corridor 2

Between MD 650 and US 29, Corridor 2 is split into four options in the Spencerville area and two options in the Burtonsville area. Spencerville Options A and C would follow along or just south of MD 198 within the Upper Paint Branch watershed, while Spencerville Option D would extend east on the north side of MD 198 within the Rocky Gorge watershed. These alignments would traverse mostly older residential communities with scattered trees and ornamental vegetation and some agricultural land with open pasture habitat. Because these habitats occur in relatively small parcels, bird impacts would likely be more common and widespread to edge species.

Burtonsville Option A would traverse both the Paint Branch and Rocky Gorge watersheds, while Burtonsville Option B would lie completely within the Rocky Gorge watershed. Where Burtonsville Option A would cross tributaries of Paint Branch, mostly younger-aged forested habitat occurs. Where this option would cross through the upper portion of the Rocky Gorge

watershed, older residential development is the primary land use type. Impacts to these habitats would therefore mostly result in impacts to edge species of birds. Burtonsville Option B and the northernmost section of Burtonsville Option A would extend through more forested habitat associated with the Patuxent River Watershed Conservation Park and the T. Howard Duckett Reservoir. Much of this area is forested, with some forest interior habitat present. FIDS documented within this portion of the project corridor include the highly habitat-sensitive red-shouldered hawk as well as the pileated woodpecker (*Dryocopus pileatus*), red-eyed vireo (*Vireo olivaceus*), and ovenbird (*Seiurus aurocapillus*). Impacts to these birds and their habitat would be slightly greater for Burtonsville Option B because of the greater extension of this option through the more sensitive habitats.

Little Paint Branch Watershed

Corridor 1

Corridor 1 would cross the Little Paint Branch watershed through a relatively narrow forested corridor surrounded by new and older developments. This corridor would primarily impact birds' characteristic of suburban areas. Some FIDS habitat is present along the alignment that could result in an impact of five FIDS (**Table IV-78**). Further planned development of upland areas adjacent to the corridor would further reduce the suitability of the remaining forested habitat to support FIDS.

Corridor 2

A portion of Fairland Options A and B would cut across the headwaters of Little Paint Branch. This area is presently characterized by relatively mature deciduous forest bisected by open grassland habitat within an overhead transmission ROW. While no FIDS have been documented within this portion of the Little Paint Branch watershed, habitat appears suitable to support FIDS. Both highway options would traverse forested habitat; however, Fairland Option A, which would parallel the overhead transmission line, would impact 1.9 acres and convert 10.3 acres of the existing 18.1-acre interior forest to edge habitat, thus rendering the remaining 5.9-acre interior forest unsuitable for FIDS habitat. However, if the ICC is not built along Fairland Option A, this interior forest would be cleared for a proposed subdivision.

Indian Creek and Upper Patuxent River Watersheds

Corridors 1 and 2

Active and abandoned gravel mines characterize the portion of Corridor 2 that would traverse primarily north to south through the Indian Creek watershed. This is also true of the east-west segment of Corridors 1 and 2 between Old Gunpowder Road and Virginia Manor Road and I-95 from the crossing of Old Gunpowder Road to north of MD 198. The actively mined areas are nearly devoid of bird life, as very little habitat other than bare ground exists. Therefore, no significant impacts to birds would be anticipated within these areas. Abandoned mine areas, grassland and scattered shrub predominate the uplands, and open water ponds and emergent wetlands predominate the depressions left from the mining operation. In these areas, impacts

would occur to grassland and shrubland nesting birds as well as marsh birds. Impacts would occur through the fragmentation and disturbance of the grassland habitat and through the filling of open water and emergent wetlands. Impacts to these habitats are likely, regardless of construction of the ICC because of plans for a large Planned Unit Development within much of the abandoned mine land adjacent to the ICC corridor.

Avoidance, Minimization, and Mitigation

Minor alignment shifts to further avoid or minimize impacts to especially sensitive habitats for birds, such as forest interior, would be considered during the final design phases of the project. Mitigation of impacts to bird habitat will be accomplished through required reforestation for tree clearing. An emphasis will be placed on creating or enhancing large, contiguous blocks of forest important as forest interior habitat for birds.

10. Rare, Threatened, And Endangered Species (RTE)

a. Direct Impacts

The No-Action Alternative would have no ICC project related impact on Federally-listed species, State RTE species, or Ecologically Significant Areas (ESAs) within the study area.

Federally-Listed Species

Corridor 1 & Corridor 2 would not impact any Federally listed RTE species.

No bog turtles were found within the study area and, based on field investigations, would not be impacted by the proposed ICC alternatives. A potential habitat area that was considered marginally suitable bog turtle habitat was surveyed. Only an area measuring several hundred square foot within a portion of the wetland that had somewhat mucky soils, indicative of a potential bog turtle wetland was identified.

While no bog turtles were encountered within the less than one-acre wetland, several other turtle and wildlife species were observed. Many other reptiles and amphibians were observed within the wetland during each survey date. The survey team found two spotted turtles (*Clemmys guttata*) within the portion of the wetland most suitable for bog turtles. Also, during vernal pool surveys in late March 2004, four adult spotted turtles with worn carapaces (shells) were found within this same wetland. Worn spotted turtles with no visible spots on the carapace can look superficially like a bog turtle at first glance, because of the small size and overall dark plain carapace.

As stated in *Chapter II*, an active bald eagle nest exists in the Rocky Gorge Dam area, approximately one half mile north of the closest alignment under consideration. Based on ongoing coordination with both DNR and USFWS, no further investigations or analysis is required for this species. Distances over a quarter of a mile for a project such as highway construction are considered beyond the range of concern for both agencies. In addition, there is considerable protected land between both the nest and the closest potential ICC corridor and

option. Land to the north of Burtonsville B consists of Washington Suburban Sanitary Commission (WSSC) reservoir land. SHA will continue to coordinate with both agencies throughout the project to determine if any other nesting areas are identified.

State-Listed RTE and Locally Significant Plant Species

For the purpose of this section, the term RTE is used to signify both state listed and locally significant species.

Impacts due to the construction and operation of the ICC within the study area could affect State-listed RTE plant species. Direct impacts to habitat or changes surrounding each of the species could also affect the State-listed RTE species.

Both corridors could affect State endangered or threatened species, specifically trailing stitchwort and halberd-leaved greenbrier. Featherbells are not expected to be affected directly, however, Spencerville Options A, B, and C to Burtonsville Options A and X could affect the surrounding habitat. Rough-leaved aster and halberd-leaved greenbrier associated with Wetland 6J will be avoided due to a southern shift to the alignment located between proposed I- 95 interchange and US 1.

Potential impacts to other State listed or locally significant species are described below. Impacts to each RTE species per watershed are described below and listed in **Tables IV-79 and 80**. In some cases, species have been included in these tables that may not have a State ranking (no current State listing) but have been identified as being of a local significance by M-NCPPC who has requested that these local species also be considered as part of the FEIS. This list contains species that are considered to be uncommon or of local significance and may not necessarily be considered for protection under Annotated Code of Maryland regulations.

Muddy Branch Watershed

Neither corridor would directly impact any known habitat areas of RTE species in the Muddy Branch watershed. No State endangered or threatened species would be affected.

Upper Rock Creek Watershed

Rock Creek Option A would directly impact known habitat of the following uncommon species: bashful bulrush, chinquapin chestnut, chinquapin oak, shingle oak, showy skullcap, and Small's ragwort. Rock Creek Option C – Olde Mill Run Grade Separation would impact known habitat of shingle oak and Small's ragwort. No known RTE species would be impacted by Rock Creek Option C – Olde Mill Run Cul-de-Sac, or Corridors 1 and 2. No State endangered or threatened species would be affected.

North Branch Rock Creek Watershed

Corridors 1 and 2 would directly impact known habitat for two species, low bindweed and shingle oak. Trailing stitchwort, a State endangered species, would also be affected by Corridors 1 and 2.

Northwest Branch Watershed

Corridor 1 would directly impact known habitat of American chestnut, chinquapin chestnut, and umbrella magnolia. Northwest Branch Option A (both sub-options) would impact known habitat of bashful bulrush, butternut, rough avens, shingle oak, showy skullcap, tall boneset, Small's ragwort, and Virginia snakeroot. Northwest Branch Option B (both sub-options) would impact known habitat of butternut, Carolina leaf-flower, purple sneezeweed, shingle oak, Small's ragwort, tall boneset, and woolly sedge.

No RTE species would be impacted by Corridor 2 within Northwest Branch watershed.

Paint Branch Watershed

Corridor 1 would directly impact known habitat of American chestnut, chinquapin chestnut, Small's ragwort, and Virginia snakeroot. No State endangered or threatened species would be affected.

No RTE species would be impacted by Corridor 2 within Paint Branch watershed. Direct impacts to the featherbells population are not anticipated, however, Spencerville Options A, B, and C to Burtonsville Options A and X could affect the surrounding habitat.

Little Paint Branch Watershed

Corridor 1 would directly impact known habitat of American chestnut. No State endangered or threatened species would be affected.

Halberd-leaved greenbrier, a State threatened species would be affected by Corridor 2 within Little Paint Branch watershed. Direct impacts could occur with both Fairland Option A and B.

Indian Creek Watershed

Based on shifts to the DEIS alignment between the proposed I-95 interchange and Rte 1, there are no longer impacts to known habitat for rough-leaved aster (State endangered) and halberd-leaved greenbrier (State threatened) at Wetland 6J. The habitat for rough-leaved aster and halberd-leaved greenbrier in Wetland 6J and a 100-foot buffer surrounding the wetland, will be preserved with a conservation easement. Halberd-leaved greenbrier may still be affected by both Fairland Option A and B. The initial known location of this species was actually within the PEPCO ROW. Smaller populations of this species have also been found throughout the portions of forest edge for both Fairland options. The location of this species within Aitcheson Bog would not be directly affected. Gray birch, a possibly State rare species, has been identified east of I-95 and would be impacted from either corridor.

Rocky Gorge Watershed

Neither corridor would directly impact any known habitat areas of RTE species in the Rocky Gorge watershed.

Upper Patuxent River Watershed

Neither corridor would directly impact any known habitat areas of RTE species in the Upper Patuxent River watershed.

State Threatened Fish Species – Comely Shiner

As described in Chapter 2, the ICC study team has recently identified a fish species within the ICC study area currently listed as State threatened by DNR. Coordination has been ongoing with DNR regarding the shiner including avoidance and minimization measures. Based on recent correspondence, the DNR has provided the following recommendations:

- In North Branch of Rock Creek, the Northwest Branch and a tributary to Little Paint Branch where this species is known to be found a time of year restriction pertaining to the development window itself should be imposed. To ensure that adequate conditions will exist to allow for normal procreation of this species in these locations there should be no activity affecting the stream segments identified from April 15 through July 31. This will ensure that spawning activities for this particular fish can occur without disturbance.
- When construction activities do take place it is imperative that the most effective BMP strategies possible pertaining to erosion control are utilized. Silt loads, accidental in-stream disturbance, or other activities lending themselves to an outcome that might reduce water quality in any way must be strictly avoided.
- To ensure that appropriate BMPs and time of year restrictions are in fact employed it will be essential to provide guidance and oversight to the contracted entities which will eventually be employed to complete this project. The use of an agency sponsored "environmental monitor" is recommended to work directly with the contractors as they build-out each crossing. Provisions for this type of arrangement are already under consideration for the entire project as a whole. DNR's interest would be in seeing that these particular sites receive direct attention as part of that effort to be sure that water quality in these areas especially does not become inadvertently degraded.
- With an understanding that good water quality is important to the long-term viability of this species at these sites, it is recommended that steps be taken to help abate the degradation that can be expected over time due to the inevitable influx of foreign borne surface materials into these waters. Specifically, DNR would like to see the mitigation activities already under consideration relating to stormwater retrofits be targeted into these three sub-watersheds.

Table IV-79 and **Table IV-80** list the potential impacts to State listed or locally significant species for each corridor.

ESAs

ESAs as mentioned in **Chapter II**, are areas where a state listed species or unique plant community has been identified by DNR. The ESA boundary represents the appropriate limits of the surrounding habitat for each species.

Table IV-79

Summary of RTE Impacts for Corridor 1 (State Listed and Locally Significant Species)

Corridor 1	RTE Impacts
Rock Creek Watershed	
Rock Creek Option A	bashful bulrush (State rare / watchlist) chinquapin chestnut (no current state listing, locally significant) chinquapin oak (no current state listing, locally significant) shingle oak (no current state listing, locally significant) Small's ragwort (no current state listing, locally significant) showy skullcap (watchlist)
Rock Creek Option C – Olde Mill Run Grade Separation	shingle oak (no current state listing, locally significant) Small's ragwort (no listing)
North Branch Rock Creek Watershed	
Base Alignment ¹	low bindweed (State rare) shingle oak (no current state listing, locally significant) trailing stitchwort (State Endangered) comely shiner (State Threatened)
Northwest Branch Watershed	
Base Alignment ¹	American chestnut (State rare / watchlist) chinquapin chestnut (no current state listing, locally significant) umbrella magnolia (watchlist) comely shiner (State Threatened)
Northwest Branch Option A (both sub-options)	Butternut (State rare / watchlist) bashful bulrush (State rare / watchlist) rough avens (watchlist) wooly sedge (state rare) shingle oak (no current state listing, locally significant) showy skullcap (watchlist) Small's ragwort (no current state listing, locally significant) tall boneset (watchlist) Virginia snakeroot (no current state listing, locally significant) comely shiner (State Threatened)
Northwest Branch Option B (both sub-options)	Butternut (State rare / watchlist) Carolina leaf-flower (watchlist) purple sneezeweed (no listing) shingle oak (no current state listing, locally significant) Small's ragwort (no current state listing, locally significant) tall boneset (watchlist) comely shiner (State Threatened)
Paint Branch Watershed	
Base Alignment ¹	American chestnut (State rare / watchlist) chinquapin chestnut (no current state listing, locally significant) Virginia snakeroot (no current state listing, locally significant) Small's ragwort (no current state listing, locally significant)
Little Paint Branch Watershed	
Base Alignment ¹	American chestnut (State rare / watchlist) comely shiner (State Threatened)
Indian Creek Watershed	
Base Alignment ¹ (I-95 Interchange Options)	Gray birch (possibly rare)
Rocky Gorge Watershed	
Base Alignment ¹ and Options	No Impact
Upper Patuxent River Watershed	
Base Alignment ¹	No Impact

¹ Base refers to the acreages within the ROW of the corridor without any options included. Impact acres for each corridor option should be added to this base number to develop an impact total for a corridor.

Table IV-80
Summary of RTE Impacts for Corridor 2

Corridor 2	RTE Impacts
Rock Creek Watershed	
Rock Creek Option A	bashful bulrush (State rare / watchlist) chinquapin chestnut (no current state listing) chinquapin oak (no current state listing) shingle oak (no current state listing) Small's ragwort (no current state listing) showy skullcap (watchlist)
Rock Creek Option C – Olde Mill Run Grade Separation	shingle oak (no current state listing) Small's ragwort (no current state listing)
E North Branch Rock Creek Watershed	
Base Alignment ¹	low bindweed (State rare) trailing stitchwort (State Endangered) shingle oak (no current state listing) comely shiner (State Threatened)
Northwest Branch Watershed	
Base Alignment ¹ and Options	No Impact
Paint Branch Watershed	
Base Alignment ¹	No Impact
Spencerville and Burtonsville Options	No Impact
Little Paint Branch Watershed	
Fairland Option A	Halberd-leaved greenbrier (State Threatened)
Fairland Option B	Halberd-leaved greenbrier (State Threatened)
Indian Creek Watershed	
Base Alignment ¹ (I-95 Interchange Options)	No Impact
Fairland Option A	Halberd-leaved greenbrier (State Threatened)
Fairland Option B	Halberd-leaved greenbrier (State Threatened)
Rocky Gorge Watershed	
Fairland Option A	No Impact
Fairland Option B	No Impact
Upper Patuxent River Watershed	
Fairland Option A	No Impact
Fairland Option B	No Impact

¹ Base refers to the acreages within the ROW of the corridor without any options included. Impact acres for each corridor option should be added to this base number to develop an impact total for a corridor.

Impacts affecting the ESAs within the study area, and resulting from the construction and operation of the ICC could disturb the rare habitats found within these areas. Direct impacts to habitat or changes in hydrology, runoff, or sedimentation rates could impact the ESAs within or adjacent to the ROW of the proposed highway. Impacts to each ESA are described below and listed in **Table IV-81**

Upper Rock Creek Watershed

Rock Creek Option A would bisect the Redland Spring ESA and impact 9.1 acres. Rock Creek Option C – Olde Mill Grade Separation would impact 1.6 acres of the western corner of the Redland Spring ESA.

Table IV-81
ESA Impacts

ESA	Type of Impact
Redland Spring	Bisected (9.1 ac) by Rock Creek Option A. Western corner impacted (1.6 ac) by Rock Creek Option C – Olde Mill Grade Separation.
Northwest Branch – Bonifant Floodplain	Bisected by Northwest Branch Option A (6.0 ac) and Northwest Branch Option B (15.1 ac).
Spencerville Seeps	Bisected by Spencerville Option A to Burtonsville Option A (3.4 ac), Spencerville Option B to Burtonsville Option A (1.8 ac), Spencerville Option C to Burtonsville Option A (1.7 ac), and both Spencerville A and B to Burtonsville X (1.8 ac).
McKnew Bog	Bisected by Fairland Option A (20.4 ac) and Option B (10.4 ac).
Aitcheson Bog	Northern and eastern portion of ESA within ROW of Corridors 1 and 2 I-95 Interchange with extension to US 1 (7.2 ac) and I-95 Interchange – Truncated (7.2 ac).

Northwest Branch Watershed

Northwest Branch Option A (both sub-options) would bisect the Northwest Branch – Bonifant Floodplain ESA and impact 6.0 acres. Northwest Branch Option B (both sub-options) would bisect the Northwest Branch-Bonifant Floodplain ESA and impact 15.1 acres.

Paint Branch Watershed

Spencerville Options A, B, and C to Burtonsville Option A would bisect the Spencerville Seeps ESA. Spencerville impacts for Options A, B, and C would be 3.4 acres, 1.8 acres, and 1.7 acres respectively. Spencerville Options A and B to Burtonsville Option X would bisect the Spencerville Seeps ESA and impact 1.8 acres.

Little Paint Branch Watershed

Fairland Option A would bisect the McKnew Bog ESA and impact 20.4 acres. Fairland Option B would impact the eastern side of the ESA for 10.4 acres.

Indian Creek Watershed

Corridors 1 and 2 I-95 Interchange would impact the northern and eastern edge of the Aitcheson Bog ESA. Both I-95 Options would impact 7.2 acres.

Rocky Gorge Watershed

There are no ESA impacts within the Rocky Gorge watershed.

Upper Patuxent River Watershed

There are no ESA impacts associated within the Upper Patuxent River watershed.

Table IV-82 shows a summary of the impacts for each corridor and option.

Table IV-82
Summary of ESA Impacts per Corridor

Corridor	ESAs (Acres)
No-Action Alternative	0.0
Corridor 1 and 2 West of MD 97 Mainline Segments	0.0
Corridor 1 and 2 Rock Creek Options (select one)	
Rock Creek A	9.1
Rock Creek C- Olde Mill Run Grade Separation	1.6
Rock Creek C- Olde Mill Run Cul-de-Sac	0.0
Corridor 1 Mainline Segments (MD 97 to I-95)	0.0
Corridor 1 Northwest Branch Options (select one)	
Northwest Branch A- with Interchange at Layhill Road	6.0
Northwest Branch A- without Interchange at Layhill Road	6.0
Northwest Branch B- with Interchange at Layhill Road	15.1
Northwest Branch B- without Interchange at Layhill Road	15.1
Corridor 1 I-95 Interchange Options (select one)	
I-95 Interchange Option A (terminate ICC at US 1)	7.2
I-95 Interchange Option B (terminate ICC at I-95)	7.2
Corridor 2 Mainline Segments (MD 97 to I-95) (select one)	
Corridor 2- with Interchange at Layhill Road	0.0
Corridor 2- without Interchange at Layhill Road	0.0
Corridor 2 Norbeck, Spencerville/Burtonsville, and Fairland Options (select one option of each segment - Norbeck, Spencerville/Burtonsville, and Fairland)	
Norbeck A	0.0
Norbeck B- with ICC over Willow Grove	0.0
Norbeck B- with Willow Grove Access at Mt. Everest Lane	0.0
Spencerville A- with Burtonsville A	3.4
Spencerville A- with Burtonsville B (Relocated Good Hope Road)	0.0
Spencerville A- with Burtonsville B (ICC over Good Hope Road)	0.0
Spencerville A- with Burtonsville X	1.8
Spencerville B- with Burtonsville A	1.8
Spencerville B- with Burtonsville B	0.0
Spencerville B- with Burtonsville X	1.8
Spencerville C- with Burtonsville A	1.7
Spencerville C- with Burtonsville B	0.0
Spencerville D- with Burtonsville B	0.0
Fairland A	20.4
Fairland B	10.4
Corridor 2 I-95 Interchange Options (select one)	
I-95 Interchange Option A (terminate ICC at US 1)	7.2
I-95 Interchange Option B (terminate ICC at I-95)	7.2
Corridor 1 Range of Impacts	13.2 – 31.4
Corridor 2 Range of Impacts	17.6 – 40.2

Note: Total impacts for corridors are calculated for **Corridor 1** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding the *Corridor 1 Mainline Segments (MD 97 to I-95)*, adding one *Corridor 1 Northwest Branch Option* and one *Corridor 1 I-95 Interchange Option*; or for **Corridor 2** by selecting the *Corridor 1 and 2 West of MD 97 Mainline Segments* and adding one *Corridor 1 and 2 Rock Creek Option*, adding one *Corridor 2 Mainline Segments (MD 97 to I-95)*, one of each of the desired *Corridor 2 Norbeck, Spencerville/Burtonsville, Fairland Options*, and adding one *Corridor 2 I-95 Interchange Option*.

b. Indirect Impacts

Potential indirect impacts to RTE species or habitat may occur with both corridors. Specifically, potential indirect impacts are possible for several RTE plant species. As described above, there are no known Federally listed animal species, and one State listed animal species, comely shiner, within the study area.

State listed RTE plant species, such as many of those found within the study area, are typically poor competitors with other more common species, are sensitive to disturbance or require a specific habitat. The indirect impact would result from the new roadway passing near the known RTE species locations and through similar suitable habitats. This, over time, could jeopardize the species' ability to colonize new adjacent areas.

Many of the State listed RTE plant species in the study area are found within the forested interiors of the parklands. These species, such as featherbells and rough leaved aster, are adapted only to their specific habitats, principally forested floodplains and forested wetlands. Both corridors would extend through portions of the forested parkland as well as other natural communities. The proposed alignments, if constructed, would fragment many of the natural communities in question and result in the creation of a new forest edge. As a result, the composition of the dominant woody and herbaceous vegetation along the new edge could change over time (see **Chapter IV.8.a.** - Forest Characterizations – Indirect Impacts). As described earlier, recently created edge is a common place for invasive and exotic plant species to become established. Invasive species, especially those considered aggressive, could colonize into the adjacent forest, outcompeting RTE species, particularly spring ephemerals and other herbaceous varieties. Invasive and exotic species could have significant biological and ecological effects if they disrupt the structure or function of an ecosystem (US Forest Service, 1999).

State listed RTE plant species populations that happen to be located along or near a newly created forest edge from the highway could also be affected by changes in the soil. The increase in light penetration along the edge could create drier soil conditions, ultimately affecting which species may grow or become established. As mentioned above, RTE species are typically found within very specific habitat conditions (e.g. certain soil types, hydrologic regimes, etc.). Changes to the surrounding vegetation, soil, and hydrology could affect the RTE habitat as well. This includes those species associated with ESAs within the study area.

Indirect impacts to RTE habitat are expected to occur within several of the parkland systems where RTE species have been identified (primarily consisting of State rare species and those of local significance). Corridors 1 and 2 would traverse through Rock Creek Park and North Branch Rock Creek Park. Corridor 1 would also affect Northwest Branch Park and Paint Branch Park. Other non-parkland areas that harbor RTE species which could be indirectly affected include the McKnew Bog ESA, Spencerville Seeps ESA, and Aitcheson Bog ESA. Corridor 2 would affect all three ESAs with Corridor 1 only affecting the Aitcheson ESA.

c. Avoidance, Minimization, and Mitigation

Field reviews of the State plant species considered endangered and threatened were conducted to determine the importance and sensitivity of the habitat associated with each plant species and the potential direct or indirect impact associated with the proposed alignments. Field reviews for each species included an assessment of other resources within or adjacent to the rare species habitat to determine whether alignment shifts are warranted or feasible.

Impacts to several of the ESAs and the rare plant species would be unavoidable based on the current alignments. Efforts have included potential alignment shifts in order to avoid or

minimize impacts to each ESA or rare species. Most of the ESAs and rare species are located within parkland. Consequently, avoidance efforts associated with parkland, including Section 4(f), overlap the opportunities to avoid ESAs and rare species.

Avoidance efforts have included coordination with DNR representatives, with special emphasis on State endangered and threatened species including trailing stitchwort, rough-leaved aster, and halberd-leaved greenbrier. Even though there would be no direct impacts to featherbells, a State threatened species, avoidance measures have included studies to minimize, indirect impacts to featherbells habitat. Spencerville Options A, B, and C to Burtonsville A would impact the surrounding habitat associated with the featherbells. All other Spencerville options would avoid indirect impacts to the featherbells habitat.

Coordination between SHA and DNR was conducted in an effort to potentially avoid three other State endangered and threatened species, including trailing stitchwort, halberd-leaved greenbrier, and rough-leaved aster.

Avoidance opportunities for the trailing stitchwort are limited due to the presence of extensive wetlands located on either side of the proposed alignment, especially to the south (approximately Station 322, Corridors 1 and 2). The location of the bridge over North Branch Rock Creek is aligned with a knoll minimizing impacts to wetlands and the 100-year floodplain.

Alignment shifts were studied to avoid or minimize impacts to trailing stitchwort. Trailing stitchwort would be impacted by both Corridors 1 and 2 in the North Branch Rock Creek watershed. The alignment in this area has been located to utilize a reserved transportation corridor through the North Branch Stream Valley Park. Shifting the alignment to the north would increase impacts to trailing stitchwort, add new impacts to the community of Oakdale, shift the alignment further out of the reserved corridor increasing parkland impacts, and increase impacts to wetlands 1W and 1ZA. Shifting the alignment to the south to minimize impacts to trailing stitchwort would cause the crossing of North Branch Rock Creek and its tributary to be at wider sections of the 100-year floodplain potentially increasing the length of proposed bridges. In addition, the shift would increase impacts to wetland 1Z and potentially add new impacts to wetland 1Y, depending upon the shift distance.

There are several locations of the halberd-leaved greenbrier throughout the McKnew Bog area (Fairland Options A and B). The main population of the halberd-leaved greenbrier would be avoided because it is located within the right-of-way of the powerlines located between Fairland Options A and B. Both Fairland Options A and B would impact portions of the greenbrier habitat and a few scattered plants of this species. Complete avoidance efforts are limited due to residences to the west of Fairland A and existing roadway infrastructure to the east of Fairland Option B.

Alignment shifts were studied to avoid or minimize impacts to the halberd-leaved greenbrier. Both Fairland Options A and B would impact this species. Fairland Option A would impact the halberd-leaved greenbrier along the western edge of wetland 6AA. Shifting the alignment to the west in this area to reduce impacts to this species would add a new impact to the Isaac Burton Jr. House historic site and further impact residences along the east side of Birmingham Drive.

Shifting the alignment to the east is not feasible due to the PEPCO right-of-way which Fairland Option A currently follows. If shifting the ICC alignment to the east were feasible, it would greatly increase impacts to the halberd-leaved greenbrier, the McKnew Bog, and wetland 6AA as the resources broaden in this direction.

Fairland Option B would impact the halberd-leaved greenbrier along the eastern edge of wetland 6AA. Shifting the alignment to the west in this area would further increase impacts to the halberd-leaved greenbrier, the McKnew Bog, and wetland 6AA as the resources broaden in this direction. Shifting the alignment to the west would also place the proposed MD 198 bridge over the ICC closer to existing PEPCO towers, making construction and maintenance of traffic difficult. Shifting the alignment to the east would place the ICC closer to MD 198 and the intersection of MD 198 and Riding Stable Road, causing the design and construction of the proposed bridge and maintenance of traffic to be problematic. The sharp skew angle between the ICC and MD 198 would also further complicate this issue. This shift would also create a new business displacement and potentially impact additional natural resources located east of Old Gunpowder Road.

There are several locations for this species along the proposed I-95 interchange. Engineering efforts, in coordination with DNR and other resource agencies, have refined and reduced the alignment right-of-way west of I-95 to significantly minimize impacts to Aitcheson Bog. Retaining walls will be constructed to further reduce impacts to Aitcheson Bog.

Several efforts have been considered to avoid impacts to the rough-leaved aster located along a portion of wetland 6J. The Lead Agencies considered both a shift to the north and to the south of the DEIS alignment to address concerns of impacts to the aster species. The rough-leaved aster can be avoided completely by either shift, but impacts would be reduced more by shifting to the south versus the north. In coordination with the USACE, MDE, and USFWS, the southern shift was selected. Wetland complex 6J, where the aster was located, was deemed to be a higher value wetland and worth protecting. The Lead Agencies, USACE, MDE, and USFWS, as well as the private owner of this property, have agreed to create a conservation easement for this area to prevent future development of it.

Shifting the alignment to avoid many rare plant species, including those considered uncommon or watchlist species, would in most cases result in impacts to other important natural resources including jurisdictional wetlands, Waters of the U.S., 100-year floodplains, and steep slopes. Coordination was conducted with the design engineers in order to avoid RTE species and habitat without affecting resources with equal or greater regulatory protection.

Minimization efforts, including reduced side slopes, limits of disturbance, and other measures such as retaining walls have been considered. Sediment and erosion control will be an important consideration in minimizing impacts to sensitive species and their habitat. Mitigation efforts for State species that would be affected have been coordinated with DNR, however, no mitigation is currently required.

11. Montgomery County Unique And Sensitive Areas

a. Direct Impacts

The No-Action Alternative would have no ICC project related impact on unique and sensitive areas within the study area.

Impacts to unique and sensitive areas within the study area, resulting from the construction and operation of the ICC, could disturb the high quality natural features and habitats within these areas. Changes in hydrology, runoff, or sedimentation rates could impact these sensitive areas surrounding the ROW of the roadway. Impacts to each unique and sensitive area are described below. It should be noted that the boundaries for several of the different types of unique and sensitive areas overlap each other. However, each area has been identified by either DNR or M-NCPPC as separate unique or sensitive features.

Special Protection Areas

SPAs are areas within a watershed that have high quality water resources and related natural features, such as streams or wetlands, which are planned for development densities that may threaten the quality of those resources (*Figure IV-13*). These watersheds need special protection measures beyond existing laws and regulations to ensure that their high quality will be maintained. Special protection measures within these areas are applied to new development and land use redevelopment. The Montgomery County Council is responsible for determining which areas within the county attain SPA status and where implementing overlay zones are applied.

Upper Rock Creek SPA

Corridors 1 and 2 would impact 34.3 acres of the southern edge of the Upper Rock Creek SPA.

Upper Paint Branch SPA

The Corridor 1 mainline would impact approximately 102.1 acres of the Upper Paint Branch SPA. Impacts from Corridor 2 would range from 15.8 to 122.3 acres depending on the options. The impacts from Burtonsville Option A to the Spencerville Options are as follows: Spencerville Option A would impact 109.2 acres; Spencerville Option B would impact 113.6 acres; and Spencerville Option C would impact 121.0 acres. The impacts from Burtonsville Option B (*Plates 73-75*) to the Spencerville Options are as follows: Spencerville Option A to Burtonsville B (relocated Good Hope Road) would impact 60.2 acres; Spencerville A to Burtonsville B (ICC over Good Hope Road) would impact 58.8 acres; Spencerville Option B would impact 64.1 acres; Spencerville Option C would impact 54.3 acres; and Spencerville Option D would impact 15.8 acres. Impacts from Spencerville Option A to Burtonsville Option X would be 113.6 acres and impacts from Spencerville Option B to Burtonsville Option X would be 115.3 acres.

Biodiversity Areas

Biodiversity Areas are areas which contain at least one of the following features: RTE plant or animal species, watchlist species, or those species having a high local importance, unique or unusual habitat areas, or natural communities of high quality or significance.

Corridor 1 would impact between 67.8 and 106.6 acres of biodiversity areas and Corridor 2 would impact between 27.8 and 49.2 acres.

Both of the Rock Creek options would impact the Needwood North Biodiversity Area. Rock Creek Option A would impact 27.3 acres. Rock Creek Option C – Olde Mill Run Grade Separation would impact 5.9 acres and Rock Creek Option C – Olde Mill Run Cul-de-Sac would impact 6.0 acres.

Approximately 10.1 acres of the North Branch Biodiversity Area would be impacted by Corridors 1 and 2.

Northwest Branch Option A (both sub-options) would impact 16.9 acres of the Bonifant Meadows Biodiversity Area and Northwest Branch Option B (both sub-options) would impact 7.4 acres.

Northwest Branch Option A (both sub-options) would impact 20.5 acres of the Bonifant Biodiversity Area and Northwest Branch Option B (both sub-options) would impact 12.6 acres.

The base alignment of Corridor 1 would impact 31.8 acres of the Good Hope Biodiversity Area.

Burtonsville Option B of Corridor 2 would impact 11.8 acres of Oursler Road Biodiversity Area.

Best Natural Areas

Areas of high quality natural land within the Montgomery County parks system have been designated by M-NCPPC as Best Natural Areas. Areas receive this designation for containing large acres of high quality, contiguous forest; RTE plant species; Biodiversity Areas; unique plant and wildlife habitat; high quality wetlands; good aquatic biological areas; or special trout management areas.

Corridors 1 and 2 (*Figure II-19*) would impact 15.7 acres of the North Branch Stream Valley Unit 2 Best Natural Area.

Corridor 1 would impact approximately 54.9 acres of the Upper Paint Branch Best Natural Area.

b. Indirect Impacts

Each unique and sensitive area described earlier is primarily forested. In addition, most consist of FIDS habitat and maintain RTE populations. Therefore, indirect impacts would be similar to those discussed in the vegetation (Chapter IV.8.a. Forest Characterizations Indirect Impacts and Chapter IV.9.FIDS habitat), terrestrial wildlife, and RTE sections.

c. Avoidance, Minimization, and Mitigation

Impacts to many of the unique and sensitive areas would be unavoidable due to the geographic size of many of the areas. Efforts to minimize impacts include a reduction in the right-of-way of the alignments and considering different options that avoid SPAs, Biodiversity Areas, and Best Natural Areas.

A key component to the avoidance and minimization efforts for these large areas is consideration of key resources within each area. These key resources include but are not limited to steep slopes, individual wetlands, forests, and RTEs. Avoidance and minimization efforts for each of these have been described throughout previous sections. Mitigation efforts include ongoing coordination with both counties and M-NCPPC on their current protection efforts.

G. Noise Impacts

1. Noise Prediction Methodology and Sound Barrier Fundamentals

Prediction modeling was conducted to assess projected 2030 design year noise levels and to assess noise abatement options, using FHWA Traffic Noise Model (TNM) Version 2.1. This evaluation was also completed in accordance with the SHA's Sound Barrier Policy, dated May 1998. The ICC corridor project is a Type I noise project as defined in 23 CFR, Part 772. A Type I project provides evaluation of noise mitigation for new highways or significant modification of existing roadways that increase highway capacity. Mitigation was investigated where 2030 build noise levels either approached or exceeded 67 dBA, or where 2030 build noise levels had a 10 dBA or more increase in noise levels over existing peak hour noise levels for most receptors. SHA considers "approach or exceed 67 dBA" to be 66 dBA or greater (57 dBA at the Free Methodist Church Camp Meeting Ground). When mitigation is investigated, feasibility and reasonableness criteria established by the SHA Sound Barrier Policy must be met.

Several types of sound barriers, including reflective walls, absorptive walls, and earth berms, can be used to reduce noise levels at sensitive receptors. Other methods such as depressing the roadway and berm/wall combinations were also considered where feasible. When barriers are constructed, reflective walls are generally used. Absorptive walls can be used where reflective barriers would exacerbate noise levels on the opposite side of the highway, or when parallel barriers on each side of the highway are proposed. This is generally the case, when the roadway width to barrier height ratio would need to be 10:1 or less. Due to the wide proposed roadway cross-section, reflective walls were deemed acceptable and absorptive barriers were specifically not analyzed in this study.

IV. Environmental Consequences – K
8. Cumulative Impacts

density residential use with large areas of open space and small rural centers. Corridor 2 would result in 441 more acres of secondary development within the Agricultural Wedge than Corridor 1 (1,397 acres for Corridor 2 vs. 956 acres for Corridor 1). Of the 956 acres of secondary development within the Agricultural Wedge for Corridor 1, 482 acres would impact farmland. In comparison with Corridor 2, 796 of the 1,397 acres of the secondary development within the Agricultural Wedge would impact farmland.

The only resource for which a quantitative analysis was not completed is groundwater. The secondary impacts to groundwater could occur in the areas in which potential secondary development associated with the ICC Build Alternatives is expected to occur. This additional development could result in secondary impacts to groundwater through reduced infiltration due to increased impervious area as a result of the secondary development. The greater amounts of secondary development and impervious area associated with Corridor 2 could result in greater secondary impacts to groundwater in the Corridor 2 scenario.

These quantitative impacts were also calculated for each subwatershed within the SCEA boundary as shown in *Appendix P, P-4*. The subwatersheds with the greatest amount of impacts to natural resources by secondary development are the Anacostia River, Lower Monocacy River and Rocky Gorge Dam subwatersheds. For most natural resources the secondary impacts are only slightly greater for Corridor 2 as compared to Corridor 1. Within the Rocky Gorge Dam, however, there is a significant difference between Corridor 1 and Corridor 2 due to the large amount of secondary development identified in the Burtonsville area associated with the Corridor 2 alternative.

8. Cumulative Impacts

Cumulative effects include impacts on the environment which would conceivably result from the incremental impact of the ICC project when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Therefore, cumulative effects would include all past impacts that have occurred within the ICC SCEA boundary, impacts associated with the ICC project itself, impacts associated with present/near future pipeline projects, and impacts associated with anticipated future 2030 projects, including government-funded as well as private development projects. In addition, secondary impacts are considered a component of cumulative effects. As such, cumulative effects are the summation of all past, present and anticipated future impacts within the ICC SCEA boundary, including impacts associated with secondary induced growth.

a. Other Actions in the Near Future and Future Time Frame

Numerous other significant actions slated to occur regardless of the ICC have been identified within the SCEA boundary for both the near future and future time frames. These projects have been identified through Master Plans, the CIRP and through coordination with county planners.

Within the near future time frame, over 1,000 development projects and over 60 transportation projects are currently planned regardless of the ICC project. These projects alone total more than 23,600 acres of new development within the near future time frame (*Appendix P, P-5*).

Although a large amount of planned development is anticipated within the SCEA boundary in the near future time frame the overall density of this development varies. Development densities are dependent on the established county zoning codes in place. Areas with lower development densities include the eastern portion of Montgomery County (specifically Laytonsville, Burtonsville and Cloverly) and smaller portions of Frederick and Prince George's Counties. Lower development densities would include 0.2 to 5 dwelling units per acre. Areas with higher development densities include portions throughout Montgomery County (specifically Germantown, Gaithersburg, Deer Park, White Oak, Wheaton and Bethesda) and smaller portions throughout Prince George's County. Higher development densities would include 6 to 100 dwelling units per acres. These areas have a more urban feel with more intense development.

In addition, over 50 development projects and over 40 transportation projects are planned to occur in the future 2030 time frame independent of the ICC project. These future planned projects total over 7,660 acres of new development regardless of the ICC project (*Appendix P, P-2*). Note that future 2030-planned development does not account for future unforeseen private development projects (especially residential) since these types of projects typically require shorter planning periods. It is likely that because of population growth, residential development will continue in the future 2030 time frame, however, the extent, location and size of these projects is not known since planning for these types of projects has not yet initiated.

Some of the larger planned development and transportation projects slated to occur in the near future and future time frames are described below. Please note that any resource impacts associated with these planned projects will occur regardless of an ICC selected alternative since none of these projects are dependent on construction of the ICC. Any impacts associated with these projects, along with all other past, present/near future and future projects will contribute to overall cumulative effects to resources.

Some of the larger/major planned development and/or transportation projects slated to occur in the near future time frames are described below.

I-95/ Contee Road Improvement Study

The I-95/ Contee Road Improvement Study is in the project planning phase. This study examines a series of alternates that stretch from Old Gunpowder Road across I-95 to Van Dusen Road. Increased traffic is expected for this area within Prince George's County. The purpose of this proposed roadway is to provide adequate capacity for the anticipated increases in travel demand.

Konterra

Konterra is located on either side of I-95, stretching as far south as the planned ICC Corridors and as far north as MD 198. This proposed mixed-use Regional Center would be comprised of commercial, retail, residential and transportation-oriented uses. An industrial site along Sweitzer Lane and a business campus are two components within the Konterra area that will be completed prior to 2010. The development of the Villages at Wellington, also part of Konterra, is also expected to be completed within the near future time frame and will consist of residential development. The proposed town center and regional upscale mall proposed within Konterra are

Cultural resources on a large scale are protected throughout the SCEA boundary through various degrees of zoning and planning restrictions placed by the county and State. Transportation projects under USDOT would be required to follow guidelines for Section 4(f) of the 1966 Department of Transportation Act and Section 106 of the Historic Preservation Act. Montgomery and Prince George's Counties' Historic Preservation Commissions, M-NCPPC's Department of Park and Planning Archeology Program, and Frederick County's Historical Preservation, in conjunction with state and Federal regulations, are anticipated to minimize impacts to cultural resources in the future time frame.

Corridors 1 and 2

Impacts under the Corridor 1 and 2 scenarios are anticipated to be nearly identical within the SCEA boundary. Potential secondary impacts to cultural resources as discussed in *Section K.6.c., Secondary Impacts*, will contribute to overall cumulative effects. Secondary impacts would primarily occur in central Montgomery County and northeastern Prince George's County. Cultural resources adjacent to potential secondary development areas (either Corridor 1 or 2) occur in Kemptown, Gaithersburg, Rockville, Mount Zion, Laurel, Fairland, Beltsville, Montpelier, Greenbelt and Contee. Cumulative impacts have the potential for impacting cultural resources within the SCEA boundary; however, county preservation laws and regulations would help minimize the loss of resources from secondary and cumulative effects by ensuring that proposed projects and developments are in compliance with Federal, State and local laws as well as County Preservation Ordinances.

The Natural Environment

In general, natural resources within the SCEA boundary have experienced negative cumulative effects during the SCEA time frame primarily due to the pressures caused by the large population growth that the area has experienced. It is expected that these trends will continue with additional growth in the present/near future and future time frames although not always at the same rate due to current laws and regulations that could reduce the rate and extent to which natural resources are affected. The natural resources that have been analyzed as part of the ICC SCEA include floodplains, surface water/aquatic habitat, wetlands, farmland, forests/terrestrial habitat, groundwater, rare, threatened and endangered species, impervious area and reservoirs.

Cumulative impacts to natural resources within the ICC SCEA boundary have been determined based upon qualitative and quantitative analysis. For select natural resources for which there was readily available data, a GIS overlay analysis was applied to compute quantitative impacts (*Table IV-129*). This involved overlaying the near future/future development and the secondary development associated with each of the ICC build alternatives with the select natural resource layers, including farmlands, forest, floodplains, wetlands, RTE and streams (*Figures IV-29 and IV-30, Volume II*). These impacts are estimations based upon the occurrence of the development in the same locations as the select natural resources. These calculations are not based upon specific site plans nor do they consider laws or regulations that could limit impacts. The additional impervious area that could potentially be added due to development was also quantified for the entire ICC SCEA boundary, including the reservoir subwatersheds.

Table IV-129

Potential Secondary and Cumulative Impacts of Select Natural Resources within the SCEA Boundary

Resource	No-Action			Corridor 1		Corridor 2	
	Near Future Development Impacts (2010)	Future Development Impacts (2030)	Cumulative Impact of No-Action	Secondary Impact of Corridor 1 Potential Development	Cumulative Impact of Corridor 1	Secondary Impact of Corridor 2 Potential Development	Cumulative Impact of Corridor 2
Farmland (Acres) ¹	7,764	2,434	10,197	1,319	11,516	1,565	11,763
Forest (Acres) ¹	9,000	2,365	11,364	2,213	13,578	2,236	13,600
Floodplain (Acres) ²	1,169	431	1,600	253	1,853	251	1,851
Wetland (Acres) ³	615	128	743	160	903	166	909
RTE (Acres) ⁴	520	62	582	33	614	33	614
Stream (Acres) ⁵	287,656	92,520	380,177	78,803	458,980	80,794	460,971
Impervious Area (Acres) ⁶	7,225	2,315	9,540	2,500	12,040	2,818	12,358

Notes:

¹Based on GIS overlay with MDP Land Use Data

²Based on GIS overlay with FEMA 100 Year Floodplain

³Based on GIS overlay with NWI Wetlands

⁴Based on GIS overlay with Sensitive Species Project Review Areas, SSPRA's are not a definitive boundary of RTE habitat, they merely represent a general location of documented RTE species.

⁵Based on GIS overlay with Statewide Stream Layer (Linear Feet)

⁶Based on additional impervious area added by planned/secondary development. Determined from impervious percentage of MDP land use categories.

Impacts are estimations based upon overlaying development with natural resources layers and do not take into consideration specific site plans nor development regulations that could limit impacts.

Floodplains

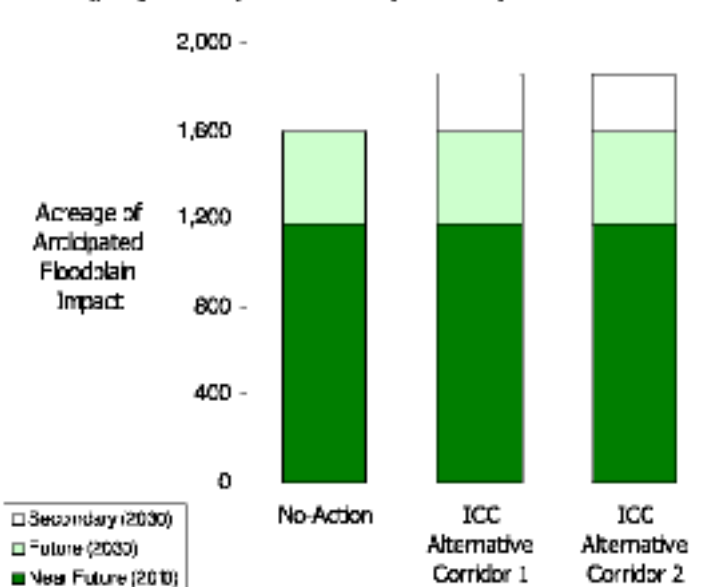
Floodplains provide important natural functions and values including temporary storage of floodwaters, moderation of peak storm flows, maintenance of water quality, groundwater recharge, and prevention of erosion. Floodplains also provide important habitat for plants and wildlife as well as recreation opportunities and aesthetic benefits (MDE 2004).

No-Action

Floodplains have been historically impacted by development within the SCEA boundary. These impacts to floodplains primarily occurred in areas throughout the SCEA boundary where substantial development has occurred. Past stresses in the SCEA boundary have included reducing the floodplain area with artificial drainage, altering the flood elevation as a result of construction within the floodplains, and the impacts of storm drainage structures and increasing impervious area with no quantity control.

As shown in *Table IV-129* and *Figure IV-31* approximately 1,200 acres of floodplains could be impacted by Near Future development. These impacts could be primarily due to the large amount of additional residential development that has been identified in the near future time frame. *Figure IV-29, Volume II* shows the near future development overlaid with floodplains.

Figure IV-31
Acreage of Anticipated Floodplain Impact



Future development could impact approximately 430 acres of floodplains. The total cumulative impact for the No-Action alternative could be approximately 1,600 acres (*Table IV-129* and *Figure IV-31*). *Figure IV-30, Volume II* shows the future development overlaid with floodplains. All development is required to abide by local, county and State laws and regulations that protect floodplains, which could reduce the cumulative impacts.

Corridors 1 and 2

The direct impacts associated with the ICC build alternatives will impact floodplains. Corridor 1 could impact about 29.4 to 42.4 acres depending on options and Corridor 2 could impact about 35.7 to 48.3 acres. The build alternatives will avoid longitudinal crossings, wherever possible, since these impacts would involve floodplain filling and affect conveyance. The Environmental Stewardship component of the ICC project includes opportunities for retrofitting existing stormwater management facilities, which could benefit the floodplains/floodflows associated with the build alternatives (See *FEIS Section IV.F.3* for more details).

The options considered in *Section IV.F.* of this Chapter do not include all sub-options, but include options that are representative of all the options being considered. Impact calculations for these options may have slight variations than what is presented in this section. Any differences in overall impact numbers would be negligible. More detailed impact calculations will be completed upon refinement of these options during the design process.

As previously discussed secondary impacts associated with the ICC build alternatives are expected to occur. Approximately 250 acres of floodplains could be impacted by development for residential and employment for both Corridor 1 and Corridor 2 (*Figure IV-31*). The cumulative impact of the ICC build alternatives would be approximately 1,850 acres (*Table IV-129 and Figure IV-31*). *Figure IV-30, Volume II* shows the secondary development overlaid with floodplains. All development is required to abide by county and State laws and regulations that protect floodplains, therefore cumulative impacts would likely be reduced.

Surface Water/Aquatic Habitat

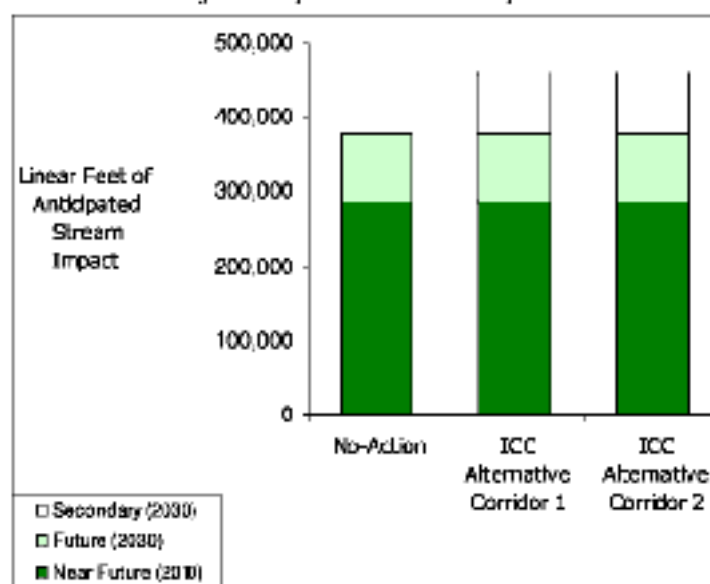
Surface Water is a vital resource to the natural and human environment. Surface water supports balanced and diverse populations of aquatic plants and wildlife. It provides a water supply for agricultural and industrial uses and provides opportunities for recreation fishing and hunting which are vital to Maryland's economy.

No-Action

Past stresses to surface water/aquatic habitat within the SCEA boundary have included agricultural runoff, stormwater runoff, sediment/siltation and channelization of waterways. In recent years due to increased regulation, protection and restoration, conditions for some indicators of water quality have been improved, but future stresses will continue to be detrimental to improving the water quality.

Planned development projects for the present/near future time frame could have negative impacts to surface water/aquatic habitat. Based upon an overlay analysis of near future development and a Statewide stream layer, approximately 288,000 linear feet of streams could potentially be impacted by near future development (*Table IV-129 and Figure IV-32*). *Figure IV-29, Volume II* shows the near future development overlaid with streams. These impacts would be primarily from the large amount of near future residential development identified in the SCEA boundary.

Figure IV-32
Linear Feet of Anticipated Stream Impact



As shown in *Table IV-129* and *Figure IV-32*, approximately 93,000 linear feet of streams could potentially be impacted by future development. The total cumulative impact of the No-Action alternative is approximately 380,000 linear feet. *Figure IV-30, Volume II* shows the future development overlaid with streams. These future impacts could result in increased stresses to surface water/aquatic habitat through sedimentation/siltation as a result from soil erosion/disturbance due to residential and commercial development and increased stormwater runoff from developed areas which could increase nutrient and pollutant runoff. Laws and regulations that protect surface water/aquatic habitat could reduce the cumulative impacts.

Corridors 1 and 2

Water quality impacts are anticipated to occur as a direct and indirect result of the build alternatives. Direct impacts to perennial and intermittent streams for Corridor 1 range from 32,667 to 39,158 linear feet depending on options, and for Corridor 2 they range from 24,525 to 37,584 linear feet depending on options. These impact ranges are based on all options being considered.

The Lead Agencies have committed to implementing Stormwater Management (SWM) facilities that will exceed the requirements of MDE and redundant Erosion and Sediment Control (ESC) devices in sensitive areas will minimize these direct impacts. Accidental spills will be controlled through special measures put in place and the Lead Agencies commitment of exceeding MDE's minimum requirements for SWM (See *FEIS Section IV.F.7* for more details). The Environmental Stewardship component of the ICC project includes opportunities for retrofitting existing stormwater management facilities, and the creation/enhancement of wetland areas, which could benefit the surface water/aquatic habitat.

As previously discussed, secondary impacts associated with the ICC build alternatives could potentially impact surface water/aquatic habitat. Corridor 1 secondary development could result in approximately 79,000 linear feet of secondary impacts. Corridor 2 could result in approximately 81,000 linear feet of secondary impacts (*Table IV-129 and Figure IV-32*). *Figure IV-30, Volume II* shows the secondary development overlaid with streams. These secondary impacts would contribute to the cumulative impacts for Corridor 1 and Corridor 2, which could be approximately 459,000 and 461,000 linear feet, respectively (*Table IV-129 and Figure IV-32*).

Wetlands

Wetlands are important natural resources that provide numerous functions and values to society including fish and wildlife habitat, flood protection, erosion control and water quality maintenance. Wetlands are also recognized as important habitat for waterfowl, migratory birds and wildlife (Tiner and Burke 1995).

No-Action

Wetlands within the SCEA boundary have declined over time. This decline has been the result of the development and agricultural activities that have occurred in the area. Current laws and regulations have slowed this decline and the goal of no net loss of wetlands has been set for the future.

As shown in *Table IV-129 and Figure IV-33*, near future development could potentially impact approximately 615 acres of wetlands. This calculation is based upon a GIS overlay of the near future development and National Wetlands Inventory (NWI) wetlands. These impacts to wetlands could be primarily from the large amount of near future residential development identified in the near future time frame. *Figure IV-29, Volume II* shows the near future development overlaid with NWI wetlands.

Future development could impact approximately 128 acres of wetlands, which along with the near future impacts, would result in approximately 743 acres of cumulative impacts associated with the No-Action alternative (*Table IV-129 and Figure IV-33*). *Figure IV-30, Volume II* shows the future development overlaid with NWI wetlands. These impacts could result in negative effects to wetlands resulting in loss of stormwater/floodflow retention, decreased groundwater recharge/discharge, reduced water quality toxic retention/nutrient removal, decreased sediment stabilization/retention and decrease in terrestrial and aquatic habitat and diversity. These affects could be reduced due to current laws and regulations that have been put into place to protect wetlands.

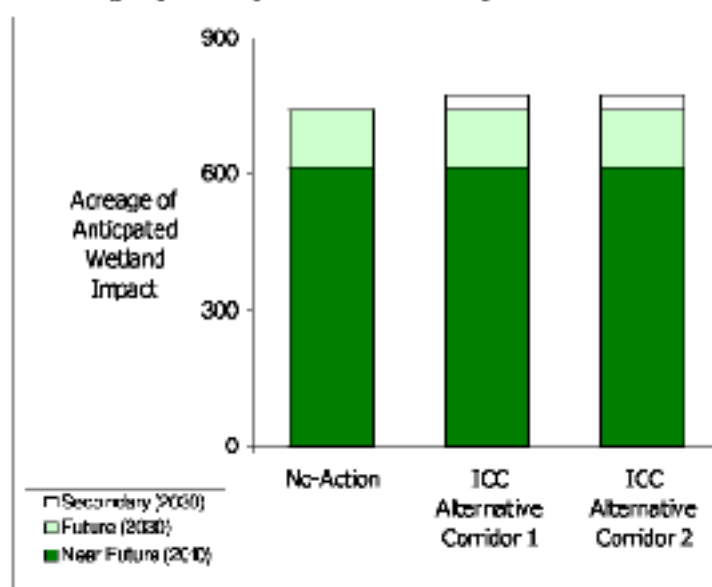
Corridors 1 and 2

The ICC build alternatives would result in direct impacts to wetlands. Impacts to wetlands would occur from filling, shading, roadway runoff, sedimentation and other direct and indirect effects. These impacts would lead to a decrease in available wetland and waterway habitat within the study area and ultimately a possible decrease in plant and animal species that inhabit these areas. Corridor 1 (and associated options) could impact approximately 16.30 to 17.97 acres of wetlands, approximately 28.83 to 30.35 acres of lower-quality, emergent wetlands associated with mining in the area of the I-95 interchange, and 32,667 to 39,158 linear feet of Waters of the US. The range

of impacts associated with Corridor 2 and all its options would vary from 15.97 to 21.02 acres of wetlands, approximately 31.53 to 33.94 acres of lower-quality, emergent wetlands associated with mining in the area of the I-95 interchange, and 24,525 to 37,584 linear feet of Waters of the US. Of course, Federal and State laws will require mitigation or wetland replacement for wetlands that cannot be avoided. In addition the Environmental Stewardship component of the ICC project includes additional opportunities for the creation/enhancement of wetland areas not impacted by an ICC (see *FEIS Section IV.F.7 for details*).

Secondary development could result in impacts to wetlands. As shown in *Table IV-129 and Figure IV-33*, secondary impacts associated with Corridor 1 could be approximately 160 acres. Corridor 2 secondary impacts could be slightly greater, estimated at approximately 166 acres. *Figure IV-30, Volume II* shows the secondary development overlaid with NWI wetlands. These secondary impacts could result in cumulative impacts of approximately 903 and 909 acres for Corridor 1 and Corridor 2, respectively. Cumulative impacts would result in negative effects to the functions and values of wetland systems throughout the SCEA boundary, but would be mitigated under Federal, State and county laws and regulations. Although replacement would occur it could take decades for newly planted land to function exactly like the system that was lost did.

Figure IV-33
Acres of Anticipated Wetland Impact



Farmland

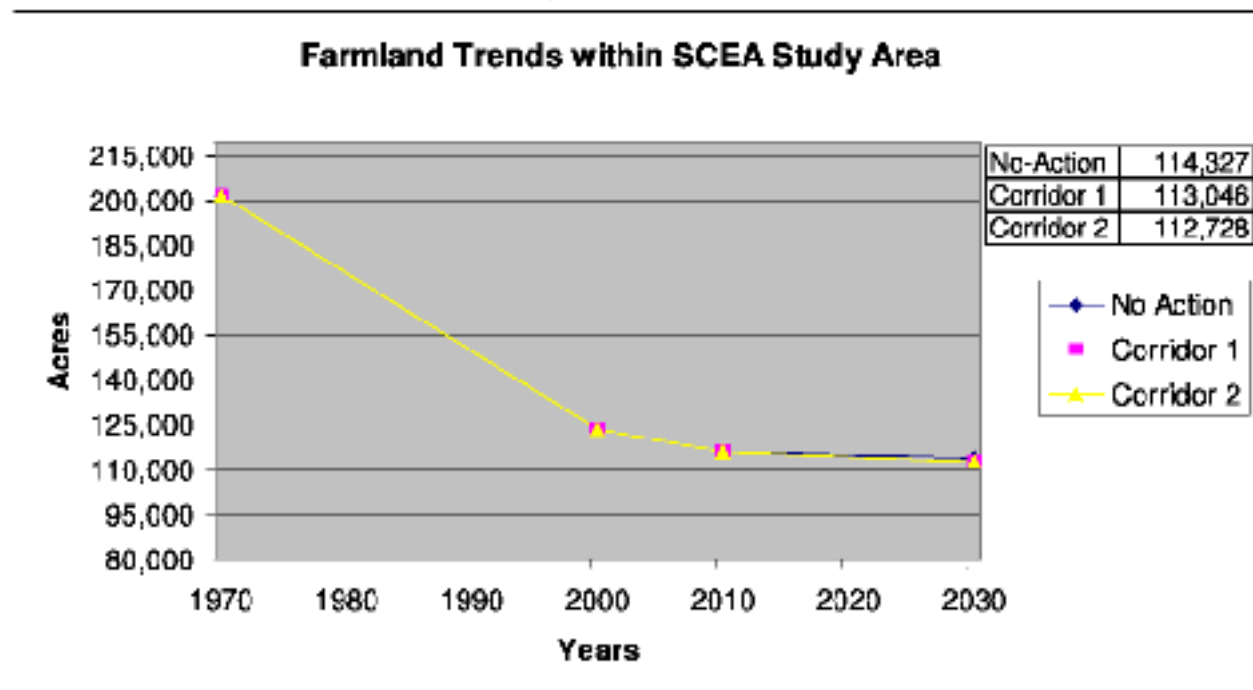
Farmland is an important resource that is vital to the State's economy. Farming and associated industries are an important and viable way of life for many people within the SCEA boundary. The agricultural sector is important to Maryland in terms of goods and services provided as well as the preservation of the rural nature of many areas within the SCEA boundary.

No-Action

The number and total land area of farmlands in both the State and within the SCEA boundary has declined during the past time frame. This decrease in farmland is due to the increased residential and commercial growth that has resulted from the increased population. **Figure IV-34** shows the decline in farmland during the SCEA time frame. The graph shows the decrease of farmland from 1973 to 2030. This data was derived from MDP land use data, and shows the land use change that could result for each ICC alternative. At the same time, approximately one-third of Montgomery County has been placed in a designated Agricultural Reserve and of Prince George's County in a designated Rural Tier.

Figure IV-34

Farmland Trends within SCEA boundary

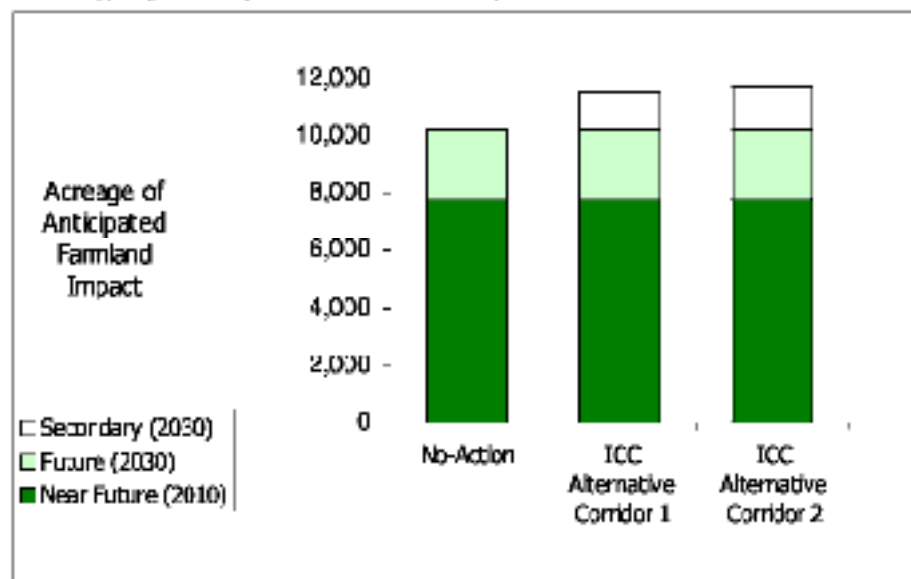


During the present/near future time frame there is the potential for farmland to be impacted by near future planned development. Approximately 7,800 acres of farmland could be impacted by near future development (**Table IV-129** and **Figure IV-35**). **Figure IV-29, Volume II** shows the near future development overlaid with farmland. These impacts would occur primarily as a result of conversion of farmland to residential use.

As shown in **Table IV-129** and **Figure IV-35**, future development could result in approximately 2,400 acres of impact to farmland. **Figure IV-30, Volume II** shows the future development overlaid with farmland. These future impacts combined with the near future impacts could result in approximately 10,200 acres of cumulative impact for the No-Action alternative (**Table IV-129** and **Figure IV-35**). These cumulative impacts could result in loss of agricultural land, reduction

in the farming sector of the economy and the loss of the rural nature of portions of the SCEA boundary. Impacts to farmlands could be reduced by Federal, State and local regulations along with agricultural land preservation by public and private organizations.

Figure IV-35
Acreage of Anticipated Farmland Impact



Corridors 1 and 2

Direct impacts to existing farmland properties are anticipated to occur as a result of the build alternatives. The largest amount of impacts to farmlands properties would occur in the Rocky Gorge watershed. Corridor 1 could impact between 61.6 and 66.2 acres of farmland properties, and Corridor 2 between 105.2 and 123.1 acres (See *FEIS Section IV.F.4* for more details).

As previously discussed in the secondary impacts section and as shown in *Table IV-129* and *Figure IV-35*, secondary impacts associated with the Corridor 1 alternative could result in approximately 1,300 acres, and Corridor 2 approximately 1,600 acres of secondary impacts. *Figure IV-30, Volume II* shows the secondary development overlaid with farmland. These secondary impacts combined with the near future and future development impacts could result in approximately 11,500 and 11,800 acres for Corridor 1 and Corridor 2, respectively (*Table IV-129* and *Figure IV-35*). Cumulative impacts could result in negative effects to farmland but these impacts could be reduced by Federal, State and local regulations along with agricultural land preservation by public and private organizations. These include but are not limited to the Federal Farmland Protection Act, the Federal Farm and Ranch Lands Protection Program and the Maryland Land and Water Conservation Act.

Forests/Terrestrial Habitat

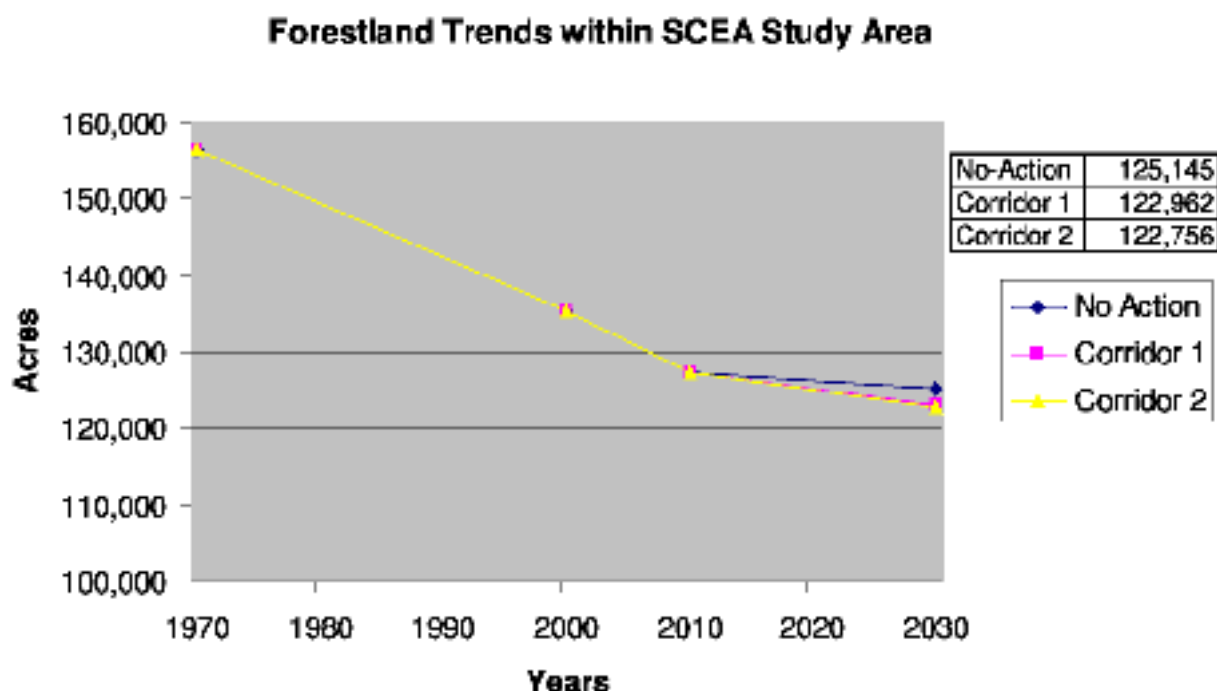
Forests are an integral part of Maryland's environment and economy. Forestland provides habitat for many species of plants and wildlife including Forest Interior Dwelling Species (FIDS), whose

habitat is limited to forest interiors. Forests are important resources for protecting water quality and clean air. Forestland is also vital to the State's economy by providing forest products and recreational opportunities. Maryland and Montgomery and Prince George's Counties have forest preservation laws in place, requiring reforestation and afforestation for new development.

No-Action

Within the SCEA time frame, forestland has declined since the past time frame due to agriculture and development pressures from the population growth that has occurred. Forestland not only decreased in amount of total area but just as significantly, fragmentation of forests has occurred over time. This fragmentation decreases the value of the forestland to wildlife. **Figure IV-36** shows the decline in forestland during the SCEA time frame. The graph shows the decrease of forestland from 1973 to 2030. This data was derived from MDP land use data, and shows the land use change that could result for each ICC alternative.

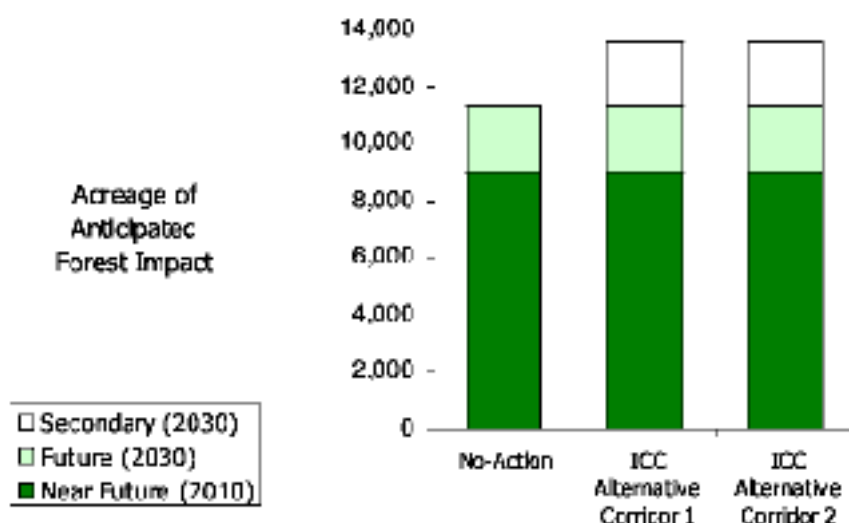
Figure IV-36
Forestland Trends within SCEA boundary



Quantitative impacts were calculated for forestland through a GIS overlaying MDP land use with near future, future and secondary development. Near future development could potentially impact approximately 9,000 acres of forestland (**Table IV-129** and **Figure IV-37**). **Figure IV-29, Volume II** shows the near future development overlaid with forestland. These impacts would be primarily a result of the large amount of residential identified for the near future time frame.

As shown in *Table IV-129* and *Figure IV-37*, future development could impact approximately 2,400 acres of forestland. This future development along with the impacts associated with the near future development could result in approximately 11,400 acres of cumulative forest impacts. *Figure IV-30, Volume II* shows the future development overlaid with forestland. These impacts could result in decreased habitat through direct loss of forest and increased fragmentation of the remaining forestland, making it less suitable for many types of forest inhabiting species especially FIDS for which interior forest habitat is vital. DNR has developed a tool called the Green Infrastructure Assessment that is used to identify undeveloped land that is vital, to the State's numerous ecological resources. This tool identifies and prioritizes the States Green Infrastructure (GI). Maryland's GI is a network of undeveloped land that serves as the primary natural support system for the State's numerous ecological resources. GI is made up of two important types of resource lands the first of which are the "hubs". These "hubs" are unfragmented areas hundreds to thousands of acres in size and are vital to maintaining the State's ecological health. The second type of GI are the "corridors," which are linear remnants of natural land that ensure the long-term survival and continued diversity of plants and wildlife (DNR, Maryland's Green Infrastructure Assessment). The GI hubs and corridors were overlaid with near future, future and secondary development to determine the impacts that the ICC alternatives could have on Maryland's GI. *Figures IV-38* and *IV-39, Volume II* show the GI overlaid with near future and future development. Impacts to forestland could be reduced by Federal, State and local reforestation and afforestation regulations along with forestland preservation by public and private organizations.

Figure IV-37
Acreage of Anticipated Forest Impact



As shown in *Appendix P, P-3*, near future development could impact approximately 2,500 acres of hubs and 2,700 acres of corridors. Future development could impact approximately 90 acres of hubs and 1,100 acres of corridors. The combination of the near future and future impacts could result in approximately 2,600 acres of cumulative impact to hubs and 3,900 acres of impact to

corridors associated with the No-Action alternative. The cumulative impacts to GI are indicators that the near future and future development could result in both direct loss of existing GI hubs and the increased fragmentation of the remaining hubs due to impacts to the corridors that connect the hubs.

Corridors 1 and 2

For the build alternatives, impacts to some forest resources would be unavoidable (See *FEIS Section IV.F.8* for details). Impacts range from 672.4 to 747.2 acres for Corridor 1 (depending on option) and 532.1 to 650.1 acres for Corridor 2 (depending on option).

As shown in *Table IV-129* and *Figure IV-37*, the secondary impact associated with the ICC build alternatives could result in impacts of approximately 2,200 acres of forestland. *Figure IV-30, Volume II* shows the secondary development overlaid with forestland. The Corridor 2 alternate could impact approximately 30 more acres of forestland. The secondary impacts to GI hubs by the build alternatives could result in approximately 240 acres of impacts associated with each build alternative. The secondary impacts to GI corridors could be slightly greater for Corridor 1, with approximately 380 acres, compared to 350 acres of impacts associated with Corridor 2 (*Appendix P, P-3*). The cumulative impacts of the build alternatives on forestland could be approximately 13,600 acres for each alternative. The cumulative impacts to GI could be approximately 2,800 acres of impact to hubs and approximately 4,200 acres of impacts to corridors for each alternative. As with the No-Action alternative, these cumulative impacts could result in loss of forest habitat value and function, but these impacts could be reduced by Federal, State and local reforestation and afforestation regulations along with forestland preservation by public and private organizations. Although replacement would occur, it could take decades for newly planted land to function like a mature ecosystem.

Groundwater

Groundwater is one of the most important natural resources; it replenishes our streams and wetlands, provides fresh water for irrigation and drinking water for many citizens.

Groundwater quality is affected by surface water quality and quantity controls. Stormwater management using best management practices creates infiltration, which allows for recharge of groundwater. The addition of impervious surface would lead to a decrease in infiltration, which would reduce the rate of groundwater recharge. A sustainable aquifer cannot have a recharge rate that is less than its withdrawal rate. The same regulatory measures that protect surface water can protect groundwater.

No-Action

Near future development could impact groundwater through the addition of impervious area (*Appendix P, P-10*). As shown in *Appendix P, P-10*, approximately 23,617 acres of near future development has been identified to occur throughout the SCEA boundary. *Figure IV-29, Volume II* shows the near future development overlaid with environmental resources.

Future development could add additional negative effects to groundwater; approximately 10,161 acres of future development has been identified. *Figure IV-30, Volume II* shows the future

development overlaid with environmental resources. As shown in *Appendix P, P-2*, for the No-Action alternative approximately 33,778 acres of cumulative development has been identified. Much of the SCEA boundary is served by public water and sewer, therefore this additional development would not have a significant effect on the drinking water, but in areas where groundwater is the source of drinking water this additional development could negatively impact groundwater.

Corridors 1 and 2

Groundwater impacts from the build alternatives would occur as quantity and/or quality alterations. The build alternatives have the potential for reducing infiltration into shallow portions of aquifers, reducing or redirecting available hydrology for wetlands and streams. There is no appreciable difference in potential quantity impacts between Corridor 1 and Corridor 2. Water quality impacts to groundwater would likely be minimal with both alternatives since roadway pollutants would be of low concentrations and would likely be retained in vegetation found in SWM facilities.

As shown in *Appendix P, P-2*, secondary development associated with the ICC build alternatives could result in additional impacts to groundwater throughout the SCEA boundary. Corridor 1 could add approximately 4,945 acres of secondary development. Corridor 2 could add 5,546 acres of secondary development. *Figure IV-30, Volume II* shows the secondary development overlaid with environmental resources. The cumulative development associated with the build alternatives could be approximately 37,594 acres for Corridor 1 and 38,643 acres for Corridor 2. As for the No-Action alternative this additional development could negatively effect groundwater but due to current laws and regulations these effects would likely be reduced.

Rare, Threatened and Endangered (RTE) Species

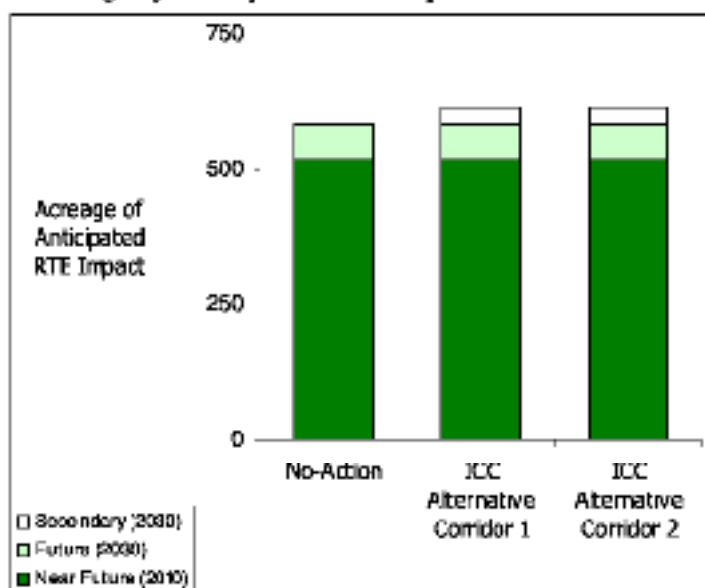
No-Action

Past effects to RTE species include loss of habitat from land conversion activities (e.g. wetland and forest clearing as part of development), mortality from development pressures or human activity (vehicular collisions). Additional effects as a result of the growth in the area during the past time frame can include human disturbance, especially during sensitive life cycle periods such as breeding, changes in drainage or hydrology in general, forest or habitat fragmentation, and noise pollution. During the past time frame the Endangered Species Act was passed (1973) which decreased the rate of decline of RTEs throughout the nation, likely paralleling similar declines within the SCEA boundary.

RTE impacts were estimated by overlaying near future/future and secondary development with Sensitive Species Project Review Areas (SSPRA). These estimated impacts may not be representative of loss of actual RTE habitat; the SSPRA's merely represent the general location of documented RTE species. *Figure IV-40, Volume II* shows these designated areas that include various types of regulated areas under the Critical Area Criteria and other areas of concern, including: Natural Heritage Areas, Listed Species Sites, Other or Locally Significant Habitat Areas, Colonial Waterbird Sites, Waterfowl Staging and Concentration Areas, Nontidal Wetlands of Special State Concern and Geographic Areas of Particular Concern. These areas represent state-regulated and designated areas involving sensitive and listed species.

As shown in *Table IV-129* and *Figure IV-41*, near future development could impact approximately 520 acres of SSPRA's throughout the SCEA boundary. *Figure IV-29, Volume II* shows the SSPRA areas within the SCEA boundary and proposed near future land development. These impacts could be primarily from residential development and transportation improvements. Future development could impact approximately 62 acres of SSPRA's. The total cumulative impact to SSPRA's by the No-Action alternative could be approximately 580 acres (*Table IV-129* and *Figure IV-41*). *Figure IV-30, Volume II* shows the SSPRA areas within the SCEA boundary and proposed future land development. Endangered and threatened species are protected and regulated by the 1973 Federal Endangered Species Act, the Maryland Endangered Species Act of 1973, and the 1975 Maryland Nongame and Endangered Species Conservation Act. In addition, Federal and State permitting programs (e.g., wetlands) require the review of public development applications before the development is permitted. Given the existing regulatory framework to protect rare, threatened, and endangered species, and assuming planned development within the SCEA boundary has been reviewed to address these requirements, cumulative impacts to State-listed species within the SCEA boundary are not anticipated to change significantly over any current trend.

Figure IV-41
Acres of Anticipated RTE Impact



Corridors 1 and 2

Direct impacts of the ICC build alternatives could occur to State endangered or threatened species, specifically trailing stichwort, halberd leaved greenbrier, and rough leaved aster. Featherbells are not expected to be impacted directly but Spencerville Options A, B and C to Burtonsville A could affect the surrounding habitat. It is anticipated that Corridor 1 would encroach upon 13.2 to 31.4 acres of ecologically significant areas (ES Areas) (depending on the option) and Corridor 2 would encroach upon 17.6 to 40.2 acres, depending on option (*See FEIS Section IV.F.10 for details*).

As previously discussed in the Secondary impacts section, the ICC build alternatives could impact approximately 33 acres of SSPRA's for each alternative. These secondary impacts combined with the near future and future development could result in approximately 615 acres of cumulative impact to SSPRA's by the ICC build alternatives (*Table IV-129 and Figure IV-41*). *Figure IV-30, Volume II* shows the SSPRA areas within the SCEA boundary and proposed future land development. As for the No-Action alternative, cumulative impacts to State-listed species within the SCEA boundary are not anticipated to change significantly over any current trend, due to current laws and regulations.

Impervious Area

An assessment of impervious area is included as a component in the SCEA analysis as it relates to both direct and indirect effects on the natural resources within the study area. Aside from actual displacement / loss of a resource by a new impervious footprint, potential effects include: reduced infiltration to groundwater table, increased runoff and subsequent erosion, flooding, and increases in surface water temperatures of receiving streams. These effects may result in negative impacts to the surrounding environment.

No-Action

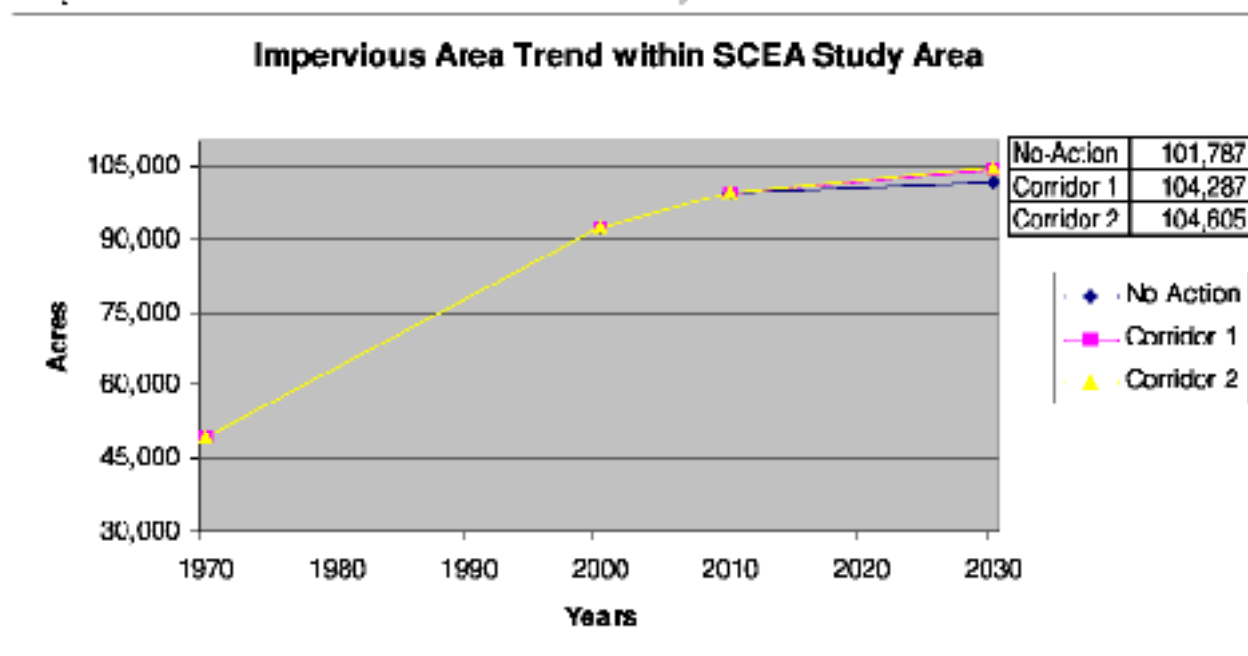
As the population increased within the SCEA boundary, the development associated with the growth increased the impervious area due to the land use change that occurred throughout the area. Additional increases as a result of the planned development will occur in the present/near future and future time frame.

MDP Land use data was used to estimate the trend in impervious area for the entire SCEA area. The method used to estimate the impervious area was based upon DNR's *Surf Your Watershed Percent Impervious Surface Indicator* (DNR 2004). The impervious surface was calculated for MDP land use categories including residential (low, medium and high), commercial, industrial, institutional, barren land and transportation. The amount of acres of each land use type per watershed was multiplied by the percent of impervious surface of each land use type. The percent impervious surface for each land use type was based on the US Soil Conservation Services TR-55 Manual.

Based upon the 1973 MDP land use data the amount of impervious area for the entire SCEA boundary was 10.1 percent. *Appendix P, P-10* shows the percent impervious surface by subwatershed and Special Protection Areas within the SCEA boundary. *Figure IV-42* shows the increase in impervious area from 1973 to 2030. Based on the 2000 MDP land use data the amount of impervious area for the entire SCEA boundary increased to 18.9 percent. This increase is attributed to the addition of residential and commercial development that has occurred throughout the SCEA boundary, as shown in *Figures IV-23 and Figure IV-30, Volume II*.

Near Future development could result in approximately an 8 percent change from 2000 to 2010, resulting in 20.4 percent impervious cover for the entire SCEA boundary (*Appendix P, P-10*). This increase could be attributed to the large amount of residential development identified during the near future time frame.

Figure IV-42
Impervious Area Trends within the SCEA Boundary



Future development could result in approximately a 2.3 percent change from 2010 to 2030, resulting in 20.9 percent impervious cover for the entire SCEA boundary under the No-Action scenario (*Appendix P, P-10*). As previously stated, these increases in imperviousness could result in reduced infiltration to groundwater table, increased runoff and subsequent erosion, possible flooding, and increases in surface water temperatures of receiving streams. As new development occurs, county agencies will require new stormwater controls and reserve stream buffer areas to offset the impacts of the altered land surface on increased surface runoff, runoff quality, and groundwater replenishment. The goal of the stormwater controls and related site planning, stream buffer, and forest conservation and reforestation requirements is to minimize the extent of necessary impervious surfaces associated with approved land uses, capture and slow down runoff peak flows to mimic predevelopment flows to the extent feasible, and reduce pollutants in runoff.

Corridors 1 and 2

Direct impacts from the construction of an ICC build alternative would result in the addition of impervious surface. Corridor 1 would result in approximately 340.5 to 391.9 acres of new impervious surface. Corridor 2 would result in approximately 361.2 to 408.9 acres of new impervious surface. This addition of impervious area as a result of a build alternative would be minimized and mitigated by the Lead Agencies implementation of SWM that exceeds MDB's requirements (See *FEIS Section IV.F.5* for details).

Secondary development associated with the build alternatives could result in additional increases in impervious area. Corridor 1 secondary development could result in approximately a 4.8 percent change from 2010 to 2030, resulting in 21.38 percent impervious cover for the entire SCEA boundary under the Corridor 1 scenario. Corridor 2 secondary development could result in

a 5.2 percent change from 2010 to 2030, resulting in 21.44 percent impervious cover for the entire SCTA boundary under the Corridor 2 scenario.

Reservoirs

There are two WSSC reservoirs within the SCEA boundary: the Triadelphia Reservoir and the Rocky Gorge Reservoir (also known as the T. Howard Duckett Reservoir). These reservoirs are vital to the drinking water supply throughout much of the SCEA boundary, especially within Montgomery, Prince George's and the District of Columbia. In addition to drinking water supply these reservoirs provide aesthetic value and recreational opportunities. Both are located within the Patuxent River Watershed; the Triadelphia Reservoir is located in the Brighton Dam subwatershed and the Rocky Gorge Reservoir is located in the Rocky Gorge subwatershed. Both reservoirs were created prior to 1964. Up to that time, development within the subwatersheds in which these reservoirs are located was minimal.

No-Action

As shown in *Appendix P, P-10*, the percent impervious area within the reservoir subwatersheds increased from 0.7 percent to 2.2 percent and from 3.6 percent to 9.7 percent from 1973 to 2000, for Brighton Dam and Rocky Gorge Dam, respectively.

Near future development could result in approximately 50 percent change for Brighton Dam from 2000 to 2010, resulting in 3.2 percent impervious cover. For Rocky Gorge Dam near future development could result in approximately 20 percent change from 2000 to 2010, resulting in 11.6 percent impervious cover (*Appendix P, P-10*). This additional development is primarily the result of near future residential development within these watersheds.

Future development could result in approximately a 3 percent change from 2010 to 2030, resulting in 3.3 percent impervious cover for Brighton Dam and a 2 percent change from 2010 to 2030 for Rocky Gorge Dam, resulting in 11.9 percent impervious cover (*Appendix P, P-10*). This addition of impervious area as a result of new development within the reservoir watersheds would continue to add negative pressures to the drinking water supply through pollution runoff, sedimentation/siltation, possible accidental spills and decreased surface/ground water quality. Laws and regulations could reduce the negative effects of the additional development.

Corridors 1 and 2

Future direct impacts of an ICC alternative on the reservoirs would be from Corridor 2, which would cross several tributaries to the Rocky Gorge Reservoir and could potentially have a range of impacts to water quality. The direct impacts to the streams range from 8,441 to 13,468 linear feet of impacts within the reservoir watershed. In addition to the stream impacts, between 54.7 acres and 86.6 acres of new impervious surface could be added by Corridor 2. These direct impacts would be minimized by the Lead Agencies' implementation of SWM that exceeds MDE's requirements and redundant ESC measures within the Rocky Gorge subwatershed. In addition to exceeding MDE's SWM requirements, within the Rocky Gorge subwatershed the Lead Agencies are committed to providing an additional 10,000 gallons of stormwater storage and isolation valves in each stormwater treatment pond (*FEIS Chapter IV-E.5.c*).

Secondary development associated with the ICC build alternatives could result in additional impervious area being added to the Rocky Gorge Dam subwatershed. Corridor 1 could result in approximately 10 percent change from 2010 to 2030, resulting in 12.8 percent impervious cover for the Rocky Gorge Dam. Corridor 2 could result in an approximately 19 percent change from 2010 to 2030, resulting in 13.8 percent impervious cover for the Rocky Gorge Dam (*Appendix P, P-10*). There is no additional impervious area as a result of secondary development within the Brighton Dam subwatershed. As with the No-Action alternative, the cumulative effects to the reservoir watersheds could be reduced due to current laws and regulations.

The Lead Agencies have voluntarily undertaken development of a spreadsheet based nonpoint source (NPS) pollutant load model for the purpose of estimating and comparing annual pollutant loads for a variety of NPS pollutants for pre- and post-ICC land use conditions. Two analyses were performed: 1) to compare pollutant loads from roadway build alternatives by analyzing the strip right of way, and 2) to understand the effects that an ICC on Corridor 2 would have on the Rocky Gorge watershed. The first analyses performed focus on the strip of land anticipated to be the ICC right of way (assuming a "build" alternative is selected) and summarize the NPS pollutant loads for each of the major watersheds crossed by the build alternatives, including the Rock Creek, Anacostia River, and Patuxent River. Analyses of the right of way strip were performed using representative alignments under study for Corridor 1 and Corridor 2. To better understand the cumulative effects of NPS pollution impacts resulting from highway construction within the Rocky Gorge Reservoir watershed, an analysis was performed to determine the effects of land use change within the SCEA boundary.

The Lead Agencies performed non-point source stormwater pollutant load analyses to determine the effects of potential ICC construction on receiving watersheds. The pollutant load analyses computations were performed using custom designed spreadsheets that incorporate different nationally recognized modeling approaches and land use associated pollutant loads. Different scenarios were modeled including the effects of land use change within the right of way strip for three potential alternative combinations. Additionally, scenarios were modeled within the Rocky Gorge watershed based on the SCEA boundary and the potential secondary and cumulative affects within.

The analysis indicates ICC construction along either Corridor 1 or Corridor 2 would not significantly change existing water quality when compared to existing land use within the right of way strips and for the pollutants being studied. Additional information on this analysis can be found in *Section IV.F.5.c*. However, construction of Corridor 2 could potentially have an effect on water quality within the Rocky Gorge watershed when considering the pollutants chosen for study and the future SCEA land use scenario in the watershed. Of the six pollutants studied five of them increased in the future time frame, Fecal Coliform, Total Nitrogen, Total Phosphorous, Total Copper and Total Zinc. The projected increases in annual loads for these pollutants are higher based on the increase in area of medium density residential and institutional land uses. Total suspended solid annual loads are predicted to decrease because of the conversion from agricultural land use to other land uses. *Table IV-130* highlights the change in pollutant loads from the existing to future time frame. Please refer to the *Comparative Water Resource Hazard Assessment* conducted in July 2005 for more details.

Table IV-130

Modeled Pollutant Loads to the Rocky Gorge Reservoir from the ICC Corridor 2 and the SCEA

Pollutant	Annual Pollutant Load (lbs./year)		
	Existing	Future	Change
Fecal Coliform ¹	397,554	559,635	162,085
Total Suspended Solids	1,282,297	1,263,009	-19,288
Total Nitrogen	58,974	63,236	4,262
Total Phosphorous	4,957	5,774	817
Total Copper	85	156	71
Total Zinc	571	1,044	473

Source: SHA, ICC Pollutant Load Study, July 2005, Rev. September 2005. Note: Modeling was conducted for representative alignments of Corridor 1 and Corridor 2 rather than all options and configurations.

¹Fecal Coliform is expressed in billion colonies/year. All other parameters are in lbs./year.

These increases in pollutant loads in the Rocky Gorge watershed should not implicate human health as WSSC is required to meet drinking water standards through treatment practices currently in place. Increases in non point source loads to the reservoir may exacerbate existing water quality conditions (which may impact aquatic life) and require WSSC to augment treatment practices but this will not change what they are required to produce in terms of safe drinking water.

Subwatershed Cumulative Impacts

Cumulative impacts were also assessed at the subwatershed level for select natural resources. The subwatersheds with the greatest potential impact were selected and highlighted on both **Figure IV-43** and **Appendix P, P-4**.

The subwatersheds with the greatest potential cumulative impact were selected by determining which subwatersheds fall in the 80th percentile of resource impact as a percent of the total resource quantity for each alternative (No-Action, Corridor 1 and Corridor 2). For example, as shown in **Appendix P, P-4**, the greatest cumulative impact to farmland under all the ICC alternatives is the same. The Little Patuxent River, Anacostia River and the Cabin John Creek subwatersheds all exceed the 80th percentile of resource impacts as a percent of the total resource quantity. The Little Patuxent River subwatershed contains a total of 1,577 acres of farmland and expects a cumulative impact of 926 acres (58.7 percent) under the No-Action, and 992 acres (62.9 percent) under Corridor 1 and Corridor 2 scenarios, which all exceed the 80th percentile for cumulative resource impacts (**Figure IV-43**). The Anacostia River subwatershed contains a total of 2,096 acres of farmlands and anticipates a cumulative impact of 1,025 acres (48.9 percent) under the No-Action scenario, 1,348 acres (64.3 percent) under the Corridor 1 scenario and 1,259 acres (60.1 percent) under the Corridor 2 scenario. Cabin John Creek subwatershed contains a total of 128 acres of farmland and anticipates a cumulative impact of 53 acres (41.2 percent) for all of the ICC alternatives. Please refer to **Figure IV-43** and **Appendix P, P-4** for additional impacts at the subwatershed to Forests, Floodplains, Wetlands, RTE species, Streams and Impervious Areas.

