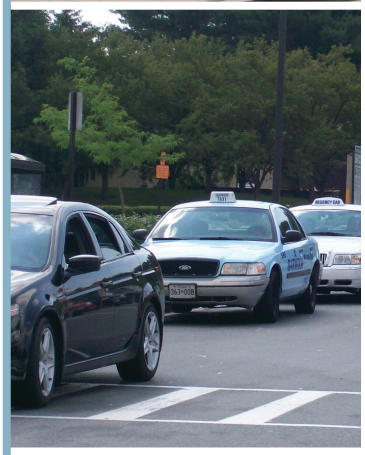
Corridor Cities Transitway



CHAPTER V

Section 4(f) Evaluation Summary and Update

CORRIDOR CITIES TRANSITWAY
SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

Chapter V – Section 4(f) Evaluation Summary and Update

Overview of Section 4(f) Regulations

Section 4(f) of the US Department of Transportation Act of 1966, 49 USC 303(c), as implemented through 23 CFR 774 jointly by the Federal Highway Administration (Administration) and the Federal Transit Administration (Administration), requires that the proposed use of land from any publicly-owned public park, recreation area, wildlife and/or waterfowl refuge, or any significant historic site, as part of a federally funded or approved transportation project, is not permissible unless:

a) The Administration determines there is no feasible and prudent avoidance alternative to the use of land from the property, and the action includes all possible planning to minimize harm to the property resulting from such use [23 CFR 774.3(a)]; or

b) The Administration determines the use of the Section 4(f) property, including any measures to minimize harm (such as avoidance, minimization, mitigation, or enhancements measures) committed to by the applicant, will have a *de minimis* impact on the property [SAFETEA-LU Section 6009(P.L. 109-53) and 23 CFR 774.3(b)].

Further, Section 4(f) defines the use of property as:

- Land from a 4(f) resource is permanently incorporated into a transportation facility;
- A temporary occupancy of land that is adverse in terms of the Section 4(f) statute's preservationist purposes;
- A constructive use; or
- A *de minimis* impact on the property, as defined in 23 CFR 774.17:

For historic sites, *de minimis* impact means that the Administration has determined, in accordance with 36 CFR part 800, that no historic property is affected by the project or that the project will have "no adverse effect" on the historic property in question.

For parks, recreation areas, and wildlife and waterfowl refuges, a *de minimis* impact is one that will not adversely affect the features, attributes, or activities qualifying the property for protection under Section 4(f).

Background

The 2002 DEIS and Section 4(f) Evaluation and 2009 AA/EA identified two National Register eligible historic properties in the Gaithersburg area that might be affected by the long standing Original CCT Alignment, as well as the proposed alignment and station modifications that are the primary subject of this supplemental document. In addition, properties under public ownership were identified in the vicinity of the alignments and Operations and Maintenance (O&M) sites since the 2009 AA/EA was published.

Where potential impacts to properties protected by Section 4(f) are discovered or anticipated, analysis is required to determine if there are feasible and prudent ways to avoid the use (so-called "avoidance alternatives") and/or to determine if the impacts are of a *de minimis* nature.

This chapter includes

- The further examination and conceptual design of possible Section 4(f) avoidance alignments
- A discussion of possible impacts associated with the avoidance alignments

The purpose of this chapter is to help inform a future selection of a Locally Preferred Alternative (LPA) for the transit element of the I-270/US 15 Multi-Modal Corridor Study. This chapter is not intended to bring conclusion to the Section 4(f) evaluation process or the feasibility determination of any of the avoidance alignments presented. Coordination is ongoing with the appropriate owners and/or stewards of the parks and historic sites in question, as well as appropriate interested parties.

Section 4(f) Resources Associated with the Alignment Modifications and O&M Sites

Chapter IV of the **2009 AA/EA** has a complete listing of Section 4(f) resources in the entire I-270/US 15/CCT project study area, including both park/recreational resources and historical resources. Being focused on just the potential transit alignment modifications and new stations through the Crown Farm, Life Sciences Center (LSC) and Kentlands areas and the two remaining O&M sites under study located at Observation Drive and Metropolitan Grove, this document only covers the following Section 4(f) resources:

- Muddy Branch Stream Valley Park (SVP)
- Crown Farm
- Belward Farm

These resources are described individually below.

Public Park and Recreation Areas

Muddy Branch Stream Valley Park

Muddy Branch Stream Valley Park is a large passive park. It is a greenway beginning in Gaithersburg and connecting to the Potomac River. The corridor is owned by Maryland-National Capital Park and Planning Commission (M-NCPPC) and the City of Gaithersburg. At this time, there are no active uses on this property and it is not open to the public in the vicinity of the CCT alignment. A connection to the Rock Creek Greenways is planned. A trail linking Blockhouse Point Park and the C&O Canal National Historical Park has been proposed. Further coordination with M-NCPPC will be necessary to ascertain the future of this property as an active park or recreational area.

Historical Resources

Belward Farm (Maryland Inventory of Historic Places #M: 20-21)

Belward Farm is located on the north side of MD 28 west of Great Seneca Highway in the vicinity of Gaithersburg. (Sheet **TRAN 3, Appendix A**). It is eligible for listing in the National Register of Historic Places (NRHP) under Criterion A and Criterion C for its association with agrarian history in Montgomery County and the architectural character of the farmstead

Belward Farm

building. The historic site is a remnant of a dairy farm continuously operated by members of the same family who established it in the mid-nineteenth century. The farmhouse is an excellent example of an 1890s Victorian frame dwelling. Since 1998, a portion of the historic site located east of the farmstead building cluster has undergone development as the first portion of the approved 1996 Johns Hopkins University Belward Research Campus.

The 107-acre property eligible for the NRHP is privately owned and is currently a fallow farm field approved for an additional 1.4 million square feet of development as part of the approved 1996 Johns Hopkins University Belward Research Campus.

The Maryland Historical Trust concurred that the project, if built along the Original CCT Alignment, will have an adverse effect on this resource. The anticipated effects of proposed modified alignments S2 and S2c would also have an adverse effect on this resource if built, therefore a use under Section 4(f) would occur.

England/Crown Farm (Maryland Inventory of Historic Places #M: 20-17)

England/Crown Farm is located within the Gaithersburg City limits (**Sheet TRAN 1, Appendix A**) and is eligible for listing in the NRHP under Criterion A for its association with the agrarian history of Montgomery County. The dwelling is part of a well-preserved early to mid-twentieth century farm complex originating with the England family in the late nineteenth century. It exhibits architectural significance because of its detailing and the presence of a log dwelling, possibly originally a tenant house during the ownership by the Hunter

Crown Farm

family predating the England family ownership. The England/Crown Farm has been identified as a rare link to the agrarian past of the Gaithersburg area, which is increasingly covered by subdivision construction.

This 76-acre property is privately owned and is currently a fallow farm field awaiting planned development.

The Maryland Historical Trust concurred that the project, if built along the Original CCT Alignment, will have an adverse effect on this resource. The proposed S1 alignment through Crown Farm would also have an adverse effect on this resource if built, therefore a use under Section 4(f) would occur.

Section 4(f) Use from Alignment Modifications and O&M Sites on the Above-Listed Resources

Table V-1 below indicates the potential impact of the proposed alignment modifications on Crown and Belward Farms, and Muddy Branch Stream Valley Park.

Table V-1: Section 4(f) Use of Proposed Alignment Modifications

RESOURCE	POTENTIAL USE
Muddy Branch Stream Valley Park	S3 – 0.02 acre
Crown Farm	S1 – 4.42 acres
Belward Farm	S2 – 9.85acres S2c – 9.85 acres

Muddy Branch Stream Valley Park

Both the Original CCT Alignment and the S3 alignment run alongside Great Seneca Highway (the former on the north/east side of the travel lanes, and the latter on the south/west side). Great Seneca Highway runs through Muddy Branch Stream Valley Park, so an expansion to either side would impact the park. The S3 alignment would impact an estimated 0.02 acres of the park. This would be a strip taking in an area of the park that is not actively used by the public because it is adjacent to a major road.

Crown Farm

As reported in the 2009 AA/EA, the Original CCT Alignment would impact 3.6 acres of this property, and cut diagonally across the full expanse of the property and the smaller National Register eligible historic boundary. The S1 alignment would use 4.42 acres of the property from the National Register eligible historic boundary, which would be utilized for a transitway, as well as for a station. The S1 alignment would pass slightly closer to the farm buildings that are part of this site.

The Maryland Transit Administration (MTA) has consulted with the property owners of Crown Farm and the City of Gaithersburg on the historic eligibility of the property and the need to identify and study alternatives that would avoid impacts to the property. Redevelopment of Crown Farm appears in the recently updated City of Gaithersburg Master Plan, which is still in draft form. (**See Chapter I** for a description of this document.) The owners of the property have plans to redevelop the farmland into four distinct "neighborhoods," including a mixed-use Main Street that features the CCT running in an extended Decoverly Drive. The property is currently being prepared for the development and its continued eligibility for the National Register and/or the possible effects of the various CCT alignments will be re-examined in the future as appropriate.

Belward Farm

As reported in the **2009 AA/EA**, the Original CCT Alignment would impact the wooded northeast corner of the National Register eligible boundary of Belward Farm. The impact area of 0.64 acres was to be used for constructing a parking structure and hiker/biker trail. At the time, the plan for these components of the CCT was in line with the development plans for the area.

The S2 and S2c alignments would use 9.85 acres of this property, which would be utilized for transitway, as well as for a station. Both of these alignments would run much closer to the farm buildings on this site than the Original CCT Alignment.

The MTA has engaged in consultation with Montgomery County and the owners of Belward Farm on the historic eligibility of the property and the need to identify and study alternatives that would avoid use of the property per Section 4(f). The owner intends to redevelop the farmland into a transit and pedestrian oriented biotechnology research "community" featuring laboratory and office space, educational facilities, retail, recreational and other uses. The property is currently approved for 1,411,350 square feet of additional development and its continued eligibility for the National Register and/or the possible effects of the various CCT alignments will be re-examined in the future as appropriate. Montgomery County has incorporated these plans into their recently adopted *Great Seneca Science Corridor Master Plan* (discussed in **Chapter I** of this document), which includes the realigned CCT operating through the center of Belward Farm as described above. The site of the original homestead and farm buildings would be preserved and integrated into the fabric of the planned research campus.

Description of the Avoidance Alignments

Because of the potential Section 4(f) use of the National Register eligible Crown Farm and Belward Farm that would result from the S1, S2, and S2c alignment modifications (as well as the Original CCT Alignment), a number of avoidance alignments were developed for further examination if avoidance of these sites is feasible and prudent. The avoidance alignments are described below and depicted in **Figure V-1** with the Original CCT Alignment, the proposed alignment modifications, and the historic resources. It should be noted that the lines in **Figure V-1** denoting the various alignments are conceptual and do not indicate the full "limits of disturbance" that these alignments could have. Actual Section 4(f) use, which is conservatively estimated at this point in the design stage, would include stations, possible park-and-ride lots, and the proposed hiker/biker trail. While some of these impacts are not visually evident in **Figure V-1**, the potential Section 4(f) use is accurately indicated in the tables and text of this chapter. More detailed graphics are available in the plan sheets in **Appendix A**.

As stated in the 2009 AA/EA, the No-Build and the Transportation Systems Management/Travel Demand Management (TSM/TDM) Alternative would completely avoid impacts to the potentially-impacted resources but they are not feasible and prudent because they do not meet the project purpose and need.

The prior study documents, including the 2009 Section 4(f) Evaluation, also concluded that avoidance options regarding Crown Farm and Belward Farm were not prudent or feasible, and that further impact minimization, footprint reduction and other techniques would be examined in later stages of design. The concept-level engineering described below is intended to examine in greater detail the feasibility of avoiding these Section 4(f) resources. This was done to better inform a future LPA decision, as well as ongoing and future coordination with the owners and regulatory agencies associated with these properties.

S1a – Crown Farm Full Avoidance Alignment

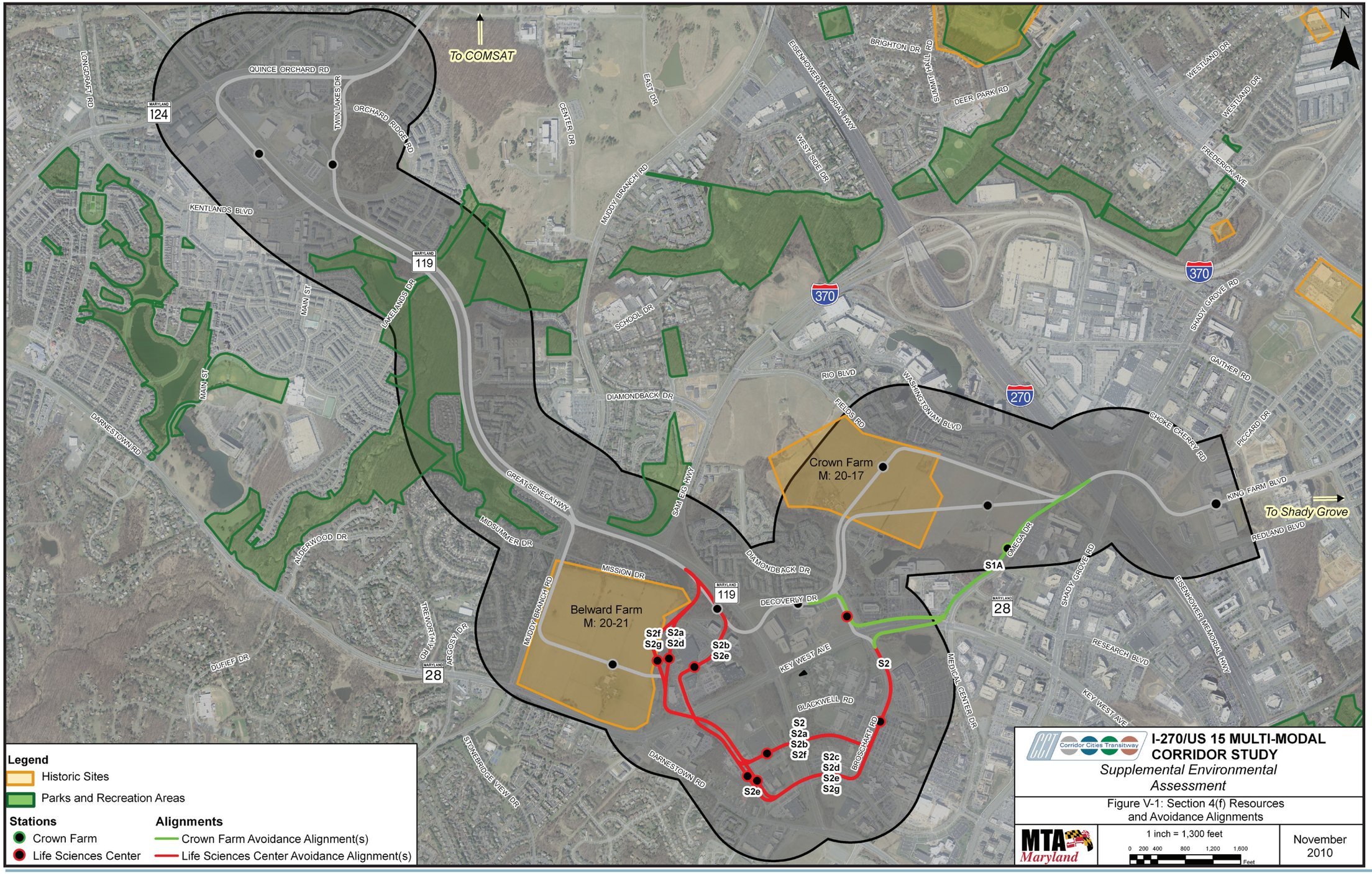
This alignment modification would completely avoid the Crown Farm property by following the Original CCT Alignment until just after the I-270 crossing where it turns left to run along Omega Drive. The alignment turns right along Key West Avenue and would either turn northbound along Diamondback Drive to rejoin the Original CCT Alignment at the intersection of Diamondback Drive and Decoverly Drive or continue south to connect with S2, S2c, or the other LSC alignments described below.

This alignment includes a station located along Omega Drive.

S2a – Belward Farm Minimization Alignment (East) Skirting the Historic Property

From Crown Farm, this alignment runs along Diamondback Drive through a tunnel under Key West

Figure V-1: Avoidance Alternative Alignments



Avenue and continues along Broschart Road. The alignment turns right to travel west through a currently wooded area between the planned extension of Blackwell Road and Medical Center Drive with a bridge over Great Seneca Highway. The alignment then continues along the north side of a future extended Johns Hopkins Drive where it continues through a tunnel under Key West Avenue. From Key West Avenue, the alignment continues along the eastern edge of the Belward Farm property along the border between the currently undeveloped farm and the existing developed property. The alignment rejoins the Original CCT Alignment at Great Seneca Highway. The segment of Great Seneca Highway immediately to the west includes planned, grade-separated interchanges at Sam Eig Highway and Muddy Branch Road. Although not analyzed in this document, construction of those planned interchanges may force a shift to the CCT alignment and may result in additional impacts on natural resources and developed properties. These potential impacts will be examined in the future.

S2a has three stations, two are the same locations as proposed for S2, with the third station (the one shown near the Belward Farm buildings) relocated along the edge of the undeveloped portion of the farm.

S2b – Belward Farm Full Avoidance Using Belward Campus Drive

From Crown Farm, this alignment would run along Diamondback Drive through a tunnel under Key West Avenue to Broschart Road turning right, then traveling west through a currently wooded area between the planned extension of Blackwell Road and Medical Center Drive and bridge over Great Seneca Highway. The alignment will continue along the median of a future extended Johns Hopkins Drive where it will continue to either a tunnel or an at-grade crossing of Key West Avenue. The alignment would turn right to follow the median of Belward Campus Drive where it rejoins the Original CCT Alignment along Great Seneca Highway.

S2b has three stations, two are the same locations as proposed for S2, with the third station (the one shown near the Belward Farm buildings) relocated along Belward Campus Drive.

S2d – Belward Farm Minimization Alignment (East) via Medical Center Drive Skirting the Historic Property

This alignment is similar to S2a, but runs along Medical Center Drive instead of through a currently wooded area between the planned extension of Blackwell Road and Medical Center Drive.

From Crown Farm, this alignment runs along Diamondback Drive through a tunnel under Key West Avenue to travel west along Medical Center Drive with an at-grade crossing of Great Seneca Highway. The alignment then continues along the north side of a future extended Johns Hopkins Drive where it continues through a tunnel under Key West Avenue along the eastern edge of the Belward Farm property along the border between the currently undeveloped farm and the existing developed property. It rejoins the Original CCT Alignment at Great Seneca Highway.

S2d has three stations, two are the same locations as proposed for S2c, with the third station (the one shown near the Belward Farm buildings) relocated along the edge of the undeveloped portion of the farm.

S2e – Belward Farm Avoidance Alternative via Medical Center Drive Using Belward Campus Drive

This alignment is similar to S2b, but runs along Medical Center Drive instead of through a currently wooded area between the planned extension of Blackwell Road and Medical Center Drive.

From Crown Farm, this alignment runs along Diamondback Drive through a tunnel under Key West Avenue and continues along Broschart Road turning right to travel west along Medical Center Drive with an at-grade crossing of Great Seneca Highway. The alignment would then continue along the median of a future extended Johns Hopkins Drive where it continues either in a tunnel or on an at-grade crossing of Key West Avenue, turning right to the median of Belward Campus Drive where it would rejoin the Original CCT Alignment along Great Seneca Highway.

S2e has three stations, two are the same locations as proposed for S2c, with the third station (the one shown near the Belward Farm buildings) relocated along Belward Campus Drive

S2f – Belward Farm Minimization Alignment (West) Skirting the Historic Property

From Crown Farm, this alignment runs along Diamondback Drive through a tunnel under Key West Avenue and continues along Broschart Road. The alignment turns right to then travel west through a currently wooded area between the planned extension of Blackwell Road and Medical Center Drive with a bridge over Great Seneca Highway. The alignment then continues along the north side of a future extended Johns Hopkins Drive where it continues through a tunnel under Key West Avenue. From Key West Avenue, the alignment continues along the eastern edge of the Belward Farm property, similar to alignment S2c. The alignment curves farther west onto the Belward Farm property to permit a station closer to the interior of the property and proposed development therein. The alignment would then rejoin the Original CCT Alignment at Great Seneca Highway.

S2f has three stations, two are the same locations as proposed for S2, with the third station (the one shown near the Belward Farm buildings) relocated to the eastern edge of the undeveloped portion of Belward Farm.

S2g – Belward Farm Minimization Alignment (West) via Medical Center Drive Skirting the Historic Property Using Belward Campus Drive

This alignment is similar to S2f, but runs along Medical Center Drive instead of through a currently wooded area between the planned extension of Blackwell Road and Medical Center Drive.

From Crown Farm, this alignment runs along Diamondback Drive through a tunnel under Key West Avenue to travel west along Medical Center Drive with an at-grade crossing of Great Seneca Highway. The alignment then continues along the north side of a future extended Johns Hopkins Drive where it continues to a tunnel under Key West Avenue along the eastern edge of the Belward Farm property, similar to the S2c alignment. The alignment curves farther west onto the Belward Farm property to permit a station closer to the interior of the property and proposed development therein. The alignment would then rejoin the Original CCT Alignment at Great Seneca Highway.

S2g has three stations, two are the same locations as proposed for S2c, with the third station (the one shown near the Belward Farm buildings) relocated to the eastern edge of the undeveloped portion of Belward Farm.

Section 4(f) Use of Avoidance Alignments on Crown and Belward Farms

The physical impacts of the avoidance alignments on the two historic sites are shown in **Table V-2**.

Table V-2: Section 4(f) Use of Avoidance Alignments on Crown and Belward Farms

ALIGNMENT	SECTION 4(f) PROPERTY	USE
S1a	Crown Farm	No impact
S2a	Belward Farm	1.56 acres
S2b	Belward Farm	No impact
S2d	Belward Farm	1.56 acres
S2e	Belward Farm	No impact
S2f	Belward Farm	3.53 acres
S2g	Belward Farm	3.53 acres

Section 4(f) Use of Avoidance Alignments on Other Resources

While the avoidance alignments minimize or avoid Section 4(f) use of the two specified historic resources, these avoidance alignments will alter the transportation impacts of the project, as well as impact other natural and social resources as described below. Note that only the impacts on these resources are described in this chapter – information on existing conditions, regulatory environment and other background, as well as possible mitigation, is provided in **Chapter IV**.

Land Use, Zoning and Future Development

Effects on Land Use

Direct impacts to land use were evaluated based on the effect that the avoidance alignments would have on compatibility of land uses, land use patterns, and access to land.

While the Section 4(f) avoidance alignments (S1a, S2a, S2b, S2d, S2e, S2f and S2g) will significantly reduce the impacts to Crown Farm and the Belward Farm, they will result in direct impacts to land uses within the study corridor for the following reasons:

- The CCT, on these avoidance alignments, would not be consistent with local land use plans, as currently written and approved.
- On these avoidance alignments, the CCT will not facilitate the achievement of the future land use visions included in the local land use plans. As such, parcels will not be able to be developed as currently planned.
- The avoidance alignments do not support state and local-level smart growth policies as densities will not be concentrated near transit stations.

Consistency with Area Master Plans

Four master plans described in this document, as well as in the 2009 AA/EA provide a vision for the area in which the Section 4(f) avoidance alignment modifications are proposed:

- The *Shady Grove Sector Plan* (described in the 2009 AA/EA)
- The *Great Seneca Science Corridor Master Plan* (described in Chapter IV)
- The *City of Gaithersburg Master Plan* (described in the 2009 AA/EA)
- The *Clarksburg Master Plan* (described in the 2002 DEIS)

Based on the information provided in **Chapter IV** of this document and the 2009 AA/EA regarding the goals of these plans, Alignments S1a, S2a, S2b, S2d, S2e, S2f and S2g are not consistent with approved local plans as they do not support the future land use plans and visions for the region.

In particular, these alignments conflict with an interchange at Sam Eig Highway and Great Seneca Highway included in the recently approved *Great Seneca Science Corridor Master Plan*. This interchange has been proposed by Montgomery County, but it is not currently undergoing project development by the Maryland State Highway Administration or the Montgomery County Department of Transportation, nor is it programmed for funding in the State or regional Transportation Improvement Programs. Nevertheless, both the proposed interchange and the proposed avoidance alignments could not likely be built in the limited right-of-way available and could result in substantial impacts to adjacent property and costly design and implementation.

Social Environment

Chapter IV covers impacts to the following resources related to the project area's social environment:

- Neighborhoods and Communities
- Community Facilities and Services
- Parks and Recreational Facilities
- Displacements and Relocations
- Environmental Justice

Neighborhoods and Communities

Impacts to neighborhoods and communities would be the same as described in **Chapter IV**, with the accessibility benefits of the project (regardless of alignment) resulting in greater mobility for residents, including greater access to employment centers, public service providers and facilities, including health care and recreational resources. By better integrating with planned future neighborhoods and employment centers, the alignment modifications (S1, S2, S2c and S3) are expected to have greater positive impacts, and lower negative impacts on ongoing and future planned development in the Crown Farm, Belward Farm, and Kentlands areas compared to the Section 4(f) avoidance alternatives.

Community Facilities and Services

Direct impacts to community facilities and services identified in **Chapter IV** are not expected from the Section 4(f) avoidance alignments (S1a, S2a, S2b, S2d, S2e, S2f and S2g). It should be noted that S3, which

is not an avoidance alternative, would impact Muddy Branch SVP as described earlier in this chapter.

Parks and Recreational Facilities

There are no parks located in the vicinity of the Section 4(f) avoidance alignments, so no impacts are expected.

Displacements and Relocations

Displacements are expected only under the following Section 4(f) avoidance alignments: S2a, S2b and S2f. With each of these alignments, there would be one displacement – a business located along Broschart Road. This property would also be displaced under S2.

The other displacement mentioned for S2 and S2c, located at Mission Drive and Muddy Branch Road, would not be required under the Section 4(f) avoidance alignments.

Information on the relocation process and compliance with Title VI requirements in this regard, is presented in **Chapter IV**.

Environmental Justice

Because the Section 4(f) avoidance alignments are so physically close to the alignment modifications described in previous chapters, the impacts related to Environmental Justice (EJ) would be the same as described in **Chapter IV**. Specifically, a benefit is expected from the increased mobility and access to employment, and there is no indication that the project, if built along the Section 4(f) avoidance alignments, would have a "disproportionate impact" on EJ areas.

Economic Environment

The impacts of the Section 4(f) avoidance alignments on the overall economic environment would be generally the same as those described for the alignment modifications in **Chapter IV**. Overall, the CCT build alternatives on any alignment will create relatively small positive economic development effects when compared with the large amount of economic growth that is forecasted to occur in the project area, with or without the project. The positive effects could be lower with the Section 4(f) avoidance alignments compared to the alignment modifications, as the Section 4(f) avoidance alignments are located farther away from major planned job and residential destinations, which would decrease the positive benefits expected to result from increased accessibility.

Cultural Resources

Impacts to Crown Farm and Belward Farm are discussed on the previous pages. No other historical resources have been identified either in the vicinity of the alignment modifications or in the vicinity of the proposed O&M sites.

As noted for the alignment modifications in **Chapter IV**, it is possible that as-yet-unidentified archaeological resources may be impacted by the Section 4(f) avoidance alignments. Because the Section 4(f) avoidance alignments were developed to avoid less-disturbed land (that is, the fallow farmland of Crown Farm and Belward Farm, versus currently developed former farmland), the likelihood of archaeological resources being impacted by the Section 4(f) avoidance alignments is likely to be lower than under the alignment modifications (S1, S2, and S2c).

The alignment of the LPA would require additional research and review with respect to archaeological resources.

Natural Environment

Topography, Geology and Soils

Topography

Topographic impacts from each of the Section 4(f) avoidance alignments would be the same as those for the alignment modifications (S1, S2, and S2c). As described in **Chapter IV**, the impacts on topography are expected to be minimal. The alignments will either maintain the existing topography, as some of them occur within existing roadways or, in most cases, parallel the roadway or require grading that would amount to a relatively small incremental change to the existing topography. Changes to topography would occur primarily from reconfiguring existing roadways to support aerial crossings and tunnel options, as well as widening some existing roadways to accommodate the CCT.

S1a has the fewest constructed elements making it the alignment that would have the least effect on topography. The LSC alignments would have the greatest effect on topography due to the tunnel options, which would be constructed using the "cut and cover" method with possibly blasting if rock is encountered.

Geology

Effects on study area geology would be the same for the Section 4(f) avoidance alignments as for the alignment modifications (S1, S2, and S2c). The LSC alignments would have the greatest impact (compared to S1a) due to the tunnel options. All of the tunnel options could affect the geologic resources in the corridor, although these changes would be limited to the tunnel section itself where rock would be excavated and removed for construction of the tunnel.

Detailed geotechnical investigations will be undertaken in later phases of the project to determine the specific nature of the geologic formations within the tunnel sections. This information will be used for design of the tunnel sections and for development of construction techniques tailored to the specific geologic conditions in the corridor.

Soils

Effects on study area soils would generally be the same for the Section 4(f) avoidance alignments as for the alignment modifications (S1, S2, and S2c). The same is true for potential changes to drainage patterns within or adjacent to the right-of-way. These effects should be minimal and would be reduced by required stormwater management (SWM) facilities.

As noted in **Chapter IV**, soil types and their limitations for construction would be evaluated in detail during later phases of the project. Detailed geotechnical investigations would be conducted to determine specific soil characteristics along the selected alignment so that construction techniques and environmental safeguards can be developed to address any limitations. To minimize potential effects from soil disturbances, proper slope and soil stabilization techniques would be used in work areas, both during and after construction, to prevent potential sedimentation of nearby waterways. Sediment and erosion controls and SWM facilities would be implemented in the project area in accordance with the Maryland Department of Environment *2000 Maryland Stormwater Design Manual, Volumes I & II.*

Prime Farmland Soils and Farmland of Statewide or Local Importance

A majority of the areas of all the avoidance alignments that are designated as potential prime farmland soils and farmland of statewide and local importance are already developed. When developed, these soils are no longer considered prime farmland and farmland of statewide or local importance.

Impacts to both categories of farmland are shown in **Table V-3** and discussed below. Information on the alignment modifications (S1, S2, and S2c) is provided for comparison.

Crown Farm Alignment Options (S1 and S1a)

The Crown Farm alignments could impact between 2.13 and 6.21 acres of prime farmland soils and between zero and 1.81 acres of farmland soils of statewide and local importance. A majority of these impacts would occur within the Crown Farm. As shown in **Table V-3**, there are four potential Crown Farm alignments, as S1 and S1a can each connect to the LSC options on two ways. Of the four, the S1 to LSC alignment option would have the most impact to prime farmland soils as it traverses the entire width of the farm. The S1a to LSC alignment option would have the greatest effect on farmland soils of statewide or local importance.

LSC Alignment Options (S2 and S2a-S2g)

The LSC alignments could impact between 0.72 and 8.75 acres of prime farmland soils and between 0.14 and 1.05 acres of farmland soils of statewide or local importance. The S2c alignment option could have the greatest effect on prime farmland soils as it traverses the entire width of the Belward Farm. The S2 alignment is very similar in design, impacting slightly less than the S2c alignment option, with 8.43 acres of impact. The S2 and S2c alignment options would have the greatest effect on farmland soils of statewide or local importance soils with an equal impact of 1.05 acres.

The impact of the avoidance alternatives would be much less than for the alignment modifications in this area. This is not unexpected as these avoidance alignments were specifically designed to avoid impacts to Belward Farm. Impacts of the avoidance alternatives on prime farmland soils range from 0.72 acres for S2a, S2b and S2f, to 1.04 acres for S2d and S2e. Impacts of the avoidance alternatives on farmland soils of statewide or local importance range from 0.14 acres for S2f to 0.56 acres for S2b (with the tunnel option) and S2e (with the tunnel option).

The impacts associated with the alignments are not anticipated to interrupt viable farm operations, as both Crown Farm and Belward Farm are not being actively

Table V-3: Impacts to Prime Farmland Soils and Farmland Soils of Statewide or Local Importance

ALIGNMENT	SEGMENT	PRIME FARMLAND SOILS (acres)	FARMLAND SOILS OF STATEWIDE OR LOCAL IMPORTANCE (acres)
Crown Farm Alignments	S1 to LSC	6.21	1.63
	S1 to Original CCT Alignment	5.20	0.29
	S1a to LSC	2.13	1.81
	S1a to Original CCT Alignment	3.63	0.0
Range of Impacts for Crown Farm Alignments		2.13-6.21	0-1.81
Life Sciences Center Alignments	S2	8.43	1.05
	S2c	8.75	1.05
	S2a	0.72	0.43
	S2b (at-grade)[1]	0.72	0.42
	S2b (tunnel option)[1]	0.72	0.56
	S2d	1.04	0.43
	S2e (at-grade)[1]	1.04	0.42
	S2e (tunnel option)[1]	1.04	0.56
	S2f	0.72	0.14
	S2g	1.04	0.43
Range of Impacts for LSC Alignments		0.72-8.75	0.14-1.05

[1] *S2b and S2e have the option of crossing over Key West, near the future extended Johns Hopkins Drive, either at-grade, or below grade, using a cut-and-cover tunneling method.*

farmed. Master plan documents for Montgomery County show that both of these areas in their entirety are planned for development.

A Farmland Conversion Impact Rating form, in accordance with the Farmland Policy Act (FPPA), will be completed for this project and submitted to the Natural Resources Conservation Service for Montgomery County.

Groundwater

The Section 4(f) avoidance alignments, like the primary alignment modifications, are not expected to substantially affect groundwater within the project areas. These alignments would be largely constructed on the ground surface and only minor changes to the movements of the shallow groundwater table are likely during grading and construction. Any runoff would be treated in accordance with Maryland Department of Environment guidelines for SWM and released to surface waters.

The LSC alignments could affect groundwater as a result of the tunnel component. Tunneling could intercept groundwater resources in the shallow aquifers of the Piedmont. Tunnel excavation in the Piedmont would likely intercept the rock fractures that are typical of this physiographic province, potentially causing a minor change in localized groundwater paths. These minor changes, however, are not expected to affect overall groundwater flows or quantities.

During the geotechnical investigations that would occur in later phases of the project, a groundwater

testing program would be undertaken to identify any potential groundwater or soil contaminants that could be encountered during tunnel construction.

Surface Waters

Crown Farm Alignments

Like S1, S1a would not impact palustrine open water, intermittent streams or ephemeral channels (**Table V-4**). Perennial streams do exist along these alignments, and it is estimated that S1 could impact 88 linear feet of these streams, while the S1a avoidance alternative would impact 68 linear feet.

In the 2009 AA/EA, the Original CCT Alignment showed a larger impact to the same stream system that will potentially be impacted by S1 and S1a. However, since the publication of the 2009 AA/EA, Decoverly Drive was extended and the stream was placed in a twin box culvert, reducing the original impact to this stream system.

LSC Alignments

The Section 4(f) avoidance alignments would have very different impacts than S2 and S2c. Depending upon which option is chosen, the LSC alignment could impact between 51 and 303 linear feet of perennial streams and 0 and 68 linear feet of intermittent streams. Impacts to ephemeral channels range between zero and 146 linear feet. Impacts to open water areas, mainly SWM ponds, could range between zero and 0.03 acres depending on which option is chosen. Specific impacts for each potential alignment are shown in **Table V-4**.

Scenic and Wild Rivers

There are no scenic and wild rivers within the alignment modifications or the Section 4(f) avoidance alignments.

Waters of the US including Wetlands

The impacts to palustrine forested (PFO), scrub-shrub (PSS), and emergent wetlands (PEM) areas are minimal with any combination of alignment options

Table V-4: Waterway Impacts

ALIGNMENT	SEGMENT	PERENNIAL STREAMS (linear feet)	INTERMITTENT STREAMS (linear feet)	EPHEMERAL CHANNELS (linear feet)	PALUSTRINE OPEN WATER SQUARE FEET (acres)
Crown Farm Alignments	S1	88	0	0	0
	S1a	68	0	0	0
Range of Impacts for Crown Farm Alignments		68-88	0	0	0
Life Sciences Center Alignments	S2	51	68	146	0
	S2c	51	0	78	0
	S2a	167	68	67	1236.75 (0.03)
	S2b	303	68	67	973.65 (0.02)
	S2d	167	0.2	0	1236.78 (0.03)
	S2e	303	0.2	0	973.68 (0.02)
	S2f	162	68	67	1231.59 (0.03)
	S2g	162	0.2	0	1231.59 (0.03)
Range of Impacts for Life Sciences Center Alignments		51-303	0-68	0-146	0-0.03

chosen totaling less than one acre of impact to vegetated wetlands as shown in **Table V-5**.

Crown Farm Alignments

Depending on which options are chosen, the Crown Farm Alignment could potentially impact between zero and 0.004 acre of emergent wetlands. These impacts are associated with the S1 option under this alignment, while the S1a (Section 4(f) avoidance) option would have no impact to wetlands. Impacts to forested and scrub-shrub wetlands are not anticipated as part of this alignment.

The Original CCT Alignment showed a larger impact to the same wetland area that will potentially be impacted by the Crown Farm alignment modification. The Original CCT Alignment would impact 0.31 acres of emergent wetlands and 0.03 acres of forested wetlands. However, since the publication of the 2009 AA/EA, the development of this area has decreased the forested and emergent wetland areas that once existed in this location.

LSC Alignments

The LSC alignment could potentially impact between 0.02 and 0.47 acres of emergent wetlands, while impacts to scrub-shrub wetlands would range from zero to 0.32 acres. Depending on which options are chosen, impacts to forested wetlands could range between zero and 0.10 acres.

The Original CCT Alignment would impact 0.33 acres of emergent wetlands with no scrub-shrub or forested wetland impacts. S2e (with the tunnel option) impacts fewer wetlands than the Original CCT Alignment and all other options being considered as part of the LSC alignment configuration.

Non-Tidal Wetlands of Special State Concern

There are no Non-tidal Wetlands of Special State Concern within the new alignments of the CCT project area.

Floodplains

Any construction within the 100-year floodplain will require a Waterway Construction Permit from the Maryland Department of Environment. The placement of substantial amounts of fill in floodplain areas is not anticipated for the at-grade components of the alignment options. However, fill may be placed in the 100-year floodplain in areas where the existing road berm may need to be extended to support the placement

Table V-5: Impacts to Waters of the US, Including Wetlands

ALIGNMENT	SEGMENT	PEM SQUARE FEET (acres)	PSS SQUARE FEET (acres)	PFO SQUARE FEET (acres)
Crown Farm Alignments	S1	158.16 (0.004)	0	0
	S1a	0	0	0
Total Impacts for Crown Farm Alignment		0-0.004	0	0
Life Sciences Center Alignments	S2	3,398.06 (0.08)	12,276.13 (0.28)	4,414.50 (0.10)
	S2c	702.82 (0.02)	0	4,413.06 (0.10)
	S2a	18,008.04 (0.41)	13,771.54 (0.32)	1.44 (0.0)
	S2b	9,577.63 (0.22)	12,460.32 (0.29)	1.44 (0.0)
	S2d	15,312.82 (0.35)	1,495.42 (0.03)	0
	S2e	6,882.40 (0.16)	184.19 (0.004)	0
	S2f	20,626.21 (0.47)	13,758.61 (0.31)	1.44 (0.00)
	S2g	17,930.98 (0.41)	1,482.49 (0.03)	0
Range of Impacts for LSC Alignments		0.02-0.47	0-0.32	0-0.10

of aerial structures, which includes widening of existing bridges such as the one over the mainstem of Muddy Branch, and the construction of grade separations.

Crown Farm Alignments

The Crown Farm Section 4(f) avoidance alignment (S1a), like the S1 alignment modification, is not anticipated to impact any 100-year floodplains.

LSC Alignment

The LSC alignments could potentially impact between 0.29 and 0.74 acres of the 100-year floodplain associated with an unnamed tributary of Muddy Branch (**Table V-6**). The S2 and S2c options would have the least amount of floodplain impact at 0.29 acres, while the Section 4(f) avoidance alternatives would each have 0.74 acres.

Terrestrial Vegetation

Impacts to forested habitats and non-forested habitats, such as managed lawns, landscaped areas, agricultural land and old field habitat would result from all alignment options. These impacts, however, should be relatively minor as the alignments would generally follow within or along existing roadways. In general, impacts to plant communities include direct losses from clearing within rights-of-way and changes in plant community structure and composition. Effects to terrestrial resources will involve the conversion of habitat to impervious road, rail or other associated facilities. In many locations, managed lawns and landscaped areas would likely be restored following construction. Effects could also result from the introduction of invasive non-native plant species into undisturbed habitat adjacent to newly impacted sites, however, the majority of the impacts will be occurring in areas which are already disturbed and dominated by invasive species. Forested habitat impacts resulting from the Section 4(f) avoidance alignments, as well as S1, S2, and S2c, are shown in **Table V-7**.

Table V-6: 100-Year Floodplain Impacts

ALIGNMENT	SEGMENT	FLOODPLAIN IMPACT (acres)
Crown Farm Alignments	S1	0
	S1a	0
Impacts for Crown Farm Alignments		0
Life Sciences Center Alignments	S2	0.29
	S2c	0.29
	S2a	0.74
	S2b	0.74
	S2d	0.74
	S2e	0.74
	S2f	0.74
	S2g	0.74
Range of Impacts for LSC Alignments		0.29-0.74

Table V-7: Forest Impacts

ALIGNMENT	SEGMENT	FOREST IMPACTS (acres)
Crown Farm Alignments	S1 to LSC	0.27
	S1 to Original CCT Alignment	0.38
	S1 to LSC	1.83
	S1a to Original CCT Alignment	2.21
Range of Impacts for Crown Farm Alignments		0.27-2.21
Life Sciences Center Alignments	S2	3.43
	S2c	2.19
	S2a	6.44
	S2b (at-grade)	3.73
	S2b (tunnel option)	3.82
	S2d	5.19
	S2e (at-grade)	2.49
	S2e (tunnel option)	2.58
	S2f	6.09
	S2g	4.85
Range of Impacts for Life Sciences Center Alignments		2.19-6.44

Crown Farm Alignments

The Crown Farm alignments could potentially impact between 0.27 and 2.21 acres of forest, with the Section 4(f) avoidance alternatives impacting less than the S1 alignments. These impacts occur in forest patches already disturbed due to their adjacency to existing roadways or along the edges of the Crown Farm where the forest has been previously impacted by development.

LSC Alignment

The LSC alignments could potentially impact between 2.19 and 6.44 acres of forest. The majority of these impacts will occur within forested areas that are less disturbed due to their connectivity to wetlands and the floodplain along Great Seneca Highway. Additional impacts will occur to the forests that surround Belward Farm. The S2a and S2f options would have the greatest impact to forests with 6.44 and 6.09 acres, respectively. The S2c option has the least amount of forest impacts (2.19 acres), due to the fact that it parallels existing roadways, except for where it cuts across Belward Farm.

Terrestrial Wildlife

The impact of the Section 4(f) avoidance alignments on wildlife resources is anticipated to be minor because the alignment changes mostly follow existing roadway alignments and because existing wildlife corridors would be maintained. Impacts to Forest Interior Dwelling Species (FIDS) habitat are also anticipated to be minor for these same reasons.

Aquatic Habitat/Species

Impacts to aquatic biota and water quality from the Section 4(f) avoidance alignments would be the same as for the alignment modifications discussed in **Chapter IV**.

Rare, Threatened, and Endangered Species

As noted in **Chapter IV**, no rare, threatened, or endangered species are known to be located in the area of the Crown Farm and LSC alignment options.

Hazardous Materials

As described in **Chapter IV**, an initial site assessment (ISA) for the I-270/US 15/CCT project area was conducted in 1998 and its findings were presented in the *1999 Preliminary Screening Assessment Report* and the 2002 DEIS. The ISA identified the potential areas of hazardous material on properties that could be impacted by the build alternatives. The ISA included field reconnaissance, a search of the regulatory databases, and a review of public regulatory documents.

The findings from the ISA are described in **Chapter III** of the **2002 DEIS**. No additional research on hazardous materials sites has been done since then.

It is recommended that more detailed environmental assessments should be performed for specific sites of concern and for large property acquisitions following selection of an LPA and prior to right-of-way acquisition.

Air Quality

As described in **Chapter IV**, the predicted impacts of the project on air quality will be the same with or without the alignment modifications, including the Section 4(f) avoidance alignments. Current air quality modeling technology is not sensitive enough to reflect alignment changes of this small a scope.

Noise and Vibration

Noise

A description of the existing noise environment, the methodology used to predict noise impacts, and the regulatory environment regarding noise impacts can be found in **Chapter IV**. **Figure IV-9** in that chapter shows the locations of noise receptor sites with respect to the alignment modifications and the Section 4(f) avoidance alignments.

Predicted impacts for the alignment modifications, as well as the Section 4(f) avoidance alignments are discussed below with separate results for LRT and BRT alternatives as each of these modes has different sound characteristics.

Future Transit Noise Exposure Methodology and Findings

In accordance with FTA impact assessment procedures, existing ambient L_{dn} levels measured at each monitoring location were compared with future noise levels computed from LRT and BRT transit line operations. Following the impact category thresholds in **Table IV-22** in **Chapter IV**, computed future noise exposure levels at each site were compared to the measured existing L_{dn} levels to establish if the project noise would exceed the threshold of "moderate" or "severe" impact.

The noise analysis findings for LRT without horn blowing are provided in **Table V-8**. The noise analysis findings for BRT are summarized in **Table V-9**. The noise analysis findings indicate that under normal operating conditions (no horn blowing) there will be no severe impacts under any proposed LRT or BRT alignments with moderate impacts identified only under the S1+S2+S3 alternatives, as follows:

- Under the LRT and BRT S1+S2+S3 alternatives, a moderate noise impact is expected at one site, R-6, a residential property at 427 Upshire Circle
- Under the BRT S1+S2+S3 alternatives, a moderate noise impact is expected at Site R-18 (9800 Fields Road, in Gaithersburg, near Crown Farm)

Table V-10 provides a summary of the projected noise impacts that are likely to occur under LRT operations at properties located near at-grade crossings if train horn sounding warnings are required. The additional noise impact assessment due to horn blowing was completed at properties which were within 1,000 feet of proposed at-grade crossings where horn noise annoyance could be a noise contributing factor. The analysis findings indicate that moderate or severe noise impacts are projected to occur at Sites R-8, R-15, R-16 and R-17 under all proposed alignment options which pass by these areas. Information on mitigation of train horn noise is available in **Chapter IV**, along with other noise mitigation measures.

Detailed hour-by-hour LRT and BRT noise calculations at each of the noise monitoring sites are contained in the *2010 Corridor Cities Transitway Supplemental Noise and Vibration Technical Memoradum*.

Vibration

A discussion of vibration, including measurement, impacts, and FTA regulations, is contained in **Chapter IV**, with additional detail available in the *2010 Corridor Cities Transitway Supplemental Noise and Vibration Technical Memoradum*.

Vibration Impact Assessment and Mitigation Measures

At all 22 receptor sites evaluated (see **Figure IV-9**), velocity levels stay below the FTA thresholds under both LRT and BRT proposed operations on all alignment variations. Consideration of vibration mitigation measures is therefore not necessary.

Visual Quality

The impact of the Section 4(f) avoidance alignments would be similar to the effects for the S1, S2, S2c, and S3 alignments. As described in **Chapter IV**, at this point in the development of the CCT, it is difficult to assess visual impacts because many design elements are unknown, including mode selection and the design, lighting, and landscaping of stations and park-and-ride lots. Furthermore, the design of some of the surrounding areas will be changing (e.g., the development planned for Belward Farm and Crown Farm). For this reason, it is recommended that additional visual impact analysis be done after further design development is completed.

Construction and Operational Issues

Construction and operational issues resulting from implementation of the Section 4(f) avoidance alignments would be similar to those effects described for the alignment modifications (S1, S2, S2c, and S3). As noted in **Chapter IV**, these impacts are similar to those presented in the 2009 AA/EA.

Indirect and Cumulative Effects (ICE) Analysis

The Section 4(f) avoidance alignments represent relatively small changes to the Original CCT Alignment. With differences in direct impacts to various resources being relatively small, as described in the sections above, the potential for differences in indirect and cumulative impacts to these same resources would be similarly limited.

Therefore, there are no indications that the conclusions reached in the 2002 ICE analysis (for the alternatives with the Original CCT Alignment) would change as a result of the proposed Section 4(f) avoidance alignments.

Energy

Without refined information on materials and rolling stock to be used on the CCT corridor, the direct and indirect energy impacts of the project following one or more of the Section 4(f) avoidance alignments are assumed to be the same as those presented in the 2009 AA/EA. The impacts of one or more of the alignment variations are too minor to impact direct and indirect energy use estimates at this level.

Table V-8: Existing Noise Levels, Projected Future LRT Noise Exposure and Impact Assessment Using FTA Criteria

Site No	Existing Noise Level[1] L_{dn} (dBA)	PROPOSED CCT ALIGNMENT MODIFICATIONS AND SECTION 4(F) AVOIDANCE ALIGNMENTS[2]									
		S1+S2+S3 Alignment	S1a to Master Plan Alignment	S1a to S2 Alignment	S2a Alignment	S2b Alignment	S2c Alignment	S2d Alignment	S2e Alignment	S2f Alignment	S2g Alignment
		Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment
R1	68	56 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R2	61	52 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R3	71	60 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R4	63	52 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R5	65	52 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R6	61	60 Moderate Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R7	66	52 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R8	61	44 No Impact	NA	NA	NA	NA	43 No Impact	54 No Impact	53 No Impact	55 No Impact	54 No Impact
R9	58	52 No Impact	45 No Impact	45 No Impact	NA	NA	45 No Impact	NA	NA	NA	NA
R10	63	NA	NA	NA	52 No Impact	54 No Impact	NA	47 No Impact	52 No Impact	52 No Impact	47 No Impact
R11	55	48 No Impact	NA	NA	NA	NA	47 No Impact	NA	NA	40 No Impact	41 No Impact
R12	58	NA	NA	NA	43 No Impact	41 No Impact	48 No Impact	49 No Impact	49 No Impact	40 No Impact	48 No Impact
R13[3]	64	55 No Impact	NA	NA	55 No Impact	55 No Impact	NA	NA	NA	55 No Impact	NA
R14	63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
R15	58	NA	NA	NA	NA	NA	47 No Impact	47 No Impact	47 No Impact	NA	53 No Impact
R16	59	45 No Impact	39 No Impact	NA	NA	NA	NA	NA	NA	NA	NA
R17	59	53 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R18	61	56 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R19	67	55 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R20	56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] Existing L_{dn} noise levels are derived from 24-hour measurements collected at each location (except Site R13 which is limited to primarily daytime use, and therefore peak hour L_{eq} is provided.

[2] Headways of ten minutes (5 AM to 5:30 AM , 9:30 AM to 4:30 PM & 7:30 PM to 9 PM), 7.5 minutes (5:30 AM to 9:30 AM & 4:30 PM to 7:30 PM) and 12 minutes (9 PM to 1 AM) were used for the impact assessment, with no service from 1 AM to 5 AM.

[3] Peak hour L_{eq} (h) dBA measured and predicted under future line operations at this location because land use is primarily limited to daytime use.

NOTE: NA indicates where the alternative alignment is not in proximity to the receptor site

Table V-9: Existing Noise Levels, Projected Future BRT Noise Exposure and Impact Assessment Using FTA Criteria

Site No	Existing Noise Level[1] L_{dn} (dBA)	PROPOSED CCT ALIGNMENT MODIFICATIONS AND SECTION 4(F) AVOIDANCE ALIGNMENTS[2]									
		S1+S2+S3 Alignment	S1a to Master Plan Alignment	S1a to S2 Alignment	S2a Alignment	S2b Alignment	S2c Alignment	S2d Alignment	S2e Alignment	S2f Alignment	S2g Alignment
		Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment
R1	68	58 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R2	61	55 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R3	71	63 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R4	63	55 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R5	65	55 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R6	61	63 Moderate Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R7	66	55 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R8	61	49 No Impact	NA	NA	NA	NA	47 No Impact	57 No Impact	57 No Impact	58 No Impact	57 No Impact
R9	58	55 No Impact	NA	NA	NA	56 No Impact	55 No Impact	NA	NA	NA	NA
R10	63	NA	NA	NA	NA	56 No Impact	NA	51 No Impact	55 No Impact	55 No Impact	51 No Impact
R11	55	51 No Impact	NA	NA	55 No Impact	NA	50 No Impact	NA	NA	44 No Impact	45 No Impact
R12	58	NA	NA	NA	48 No Impact	45 No Impact	52 No Impact	52 No Impact	52 No Impact	44 No Impact	52 No Impact
R13[3]	64	59 No Impact	NA	NA	59 No Impact	59 No Impact	NA	NA	NA	59 No Impact	NA
R14	63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
R15	58	NA	NA	NA	NA	NA	52 No Impact	52 No Impact	52 No Impact	NA	56 No Impact
R16	59	49 No Impact	45 No Impact	NA	NA	NA	NA	NA	NA	NA	NA
R17	59	57 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R18	61	59 Moderate Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R19	67	58 No Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R20	56	NA	45 No Impact	45 No Impact	NA	NA	NA	NA	NA	NA	NA

[1] Existing L_{dn} noise levels are derived from 24-hour measurements collected at each location (except Site R13 which is limited to primarily daytime use, and therefore peak hour L_{eq} is provided.

[2] Headways of ten minutes (5 AM to 5:30 AM , 9:30 AM to 4:30 PM & 7:30 PM to 9 PM), 7.5 minutes (5:30 AM to 9:30 AM & 4:30 PM to 7:30 PM) and 12 minutes (9 PM to 1 AM) were used for the impact assessment, with no service from 1 AM to 5 AM.

[3] Peak hour L_{eq} (h) dBA measured and predicted under future line operations at this location because land use is primarily limited to daytime use.

NOTE: NA indicates where the alternative alignment is not in proximity to the receptor site

Table V-10: Existing Noise Levels, Projected Future LRT Noise Exposure at Locations Where Horn Noise Soundings Are Required and Impact Assessment Using FTA Criteria

Site No	Existing Noise Level[1] L_{dn} (dBA)	PROPOSED CCT ALIGNMENT MODIFICATIONS AND SECTION 4(F) AVOIDANCE ALIGNMENTS[2]									
		S1+S2+S3 Alignment	S1a to Master Plan Alignment	S1a to S2 Alignment	S2a Alignment	S2b Alignment	S2c Alignment	S2d Alignment	S2e Alignment	S2f Alignment	S2g Alignment
		Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment	Estimated L_{dn} Level FTA Impact Assessment
R8	61	65 Severe Impact	NA	NA	NA	NA	63 Moderate Impact	63 Moderate Impact	63 Moderate Impact	63 Moderate Impact	63 Moderate Impact
R15	58	NA	NA	NA	NA	NA	69 Severe Impact	69 Severe Impact	69 Severe Impact	NA	66 Severe Impact
R16	59	61 Moderate Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA
R17	59	72 Severe Impact	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] Existing L_{dn} noise levels are derived from 24 hour measurements collected at each location.

[2] Headways of 10 minutes (5 AM to 5:30 AM , 9:30 AM to 4:30 PM & 7:30 PM to 9 PM), 7.5 minutes (5:30 AM to 9:30 AM & 4:30 PM to 7:30 PM) and 12 minutes (9 PM to 1 AM) were used for the impact assessment, with no service from 1 AM to 5 AM.

NOTE: NA indicates where the alternative alignment is not in proximity to the receptor site