

Penns Neck Area EIS
Route 1 Section 2S and 3J

**West Windsor Township,
Mercer County, New Jersey
and
Plainsboro Township,
Middlesex County, New Jersey**



**FINAL
ENVIRONMENTAL
IMPACT STATEMENT/
SECTION 4(F)
EVALUATION**

**U.S. Department of Transportation
Federal Highway Administration
and
New Jersey Department of Transportation**

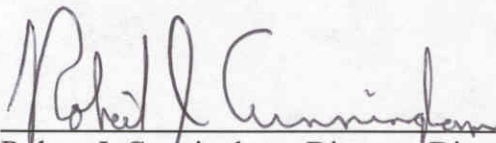
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Penns Neck Area EIS
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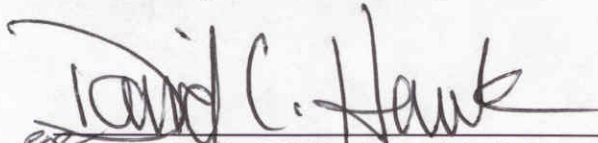
FINAL
ENVIRONMENTAL IMPACT
STATEMENT/
SECTION 4(F) EVALUATION

U.S. Department of Transportation
Federal Highway Administration
and
New Jersey Department of Transportation



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Executive Summary

EXECUTIVE SUMMARY

INTRODUCTION

The Federal Highway Administration (FHWA), in cooperation with the New Jersey Department of Transportation (NJDOT), proposes to make transportation improvements to address traffic congestion, mobility constraints and safety concerns on Route 1 and east-west cross streets in the Penns Neck area of West Windsor Township, Mercer County, New Jersey and its environs. This Environmental Impact Statement (EIS) was prepared to investigate and document potential impact that may result from the action and No-Action Alternatives under consideration. The EIS was prepared in accordance with the implementing regulations of the National Environmental Policy Act (NEPA) of 1969 (42 United States Code (USC) 4321 et seq.), Section 4(f) of the Department of Transportation Act of 1966 (23 USC 138 and 49 USC 303), and the FHWA Guidance for Preparing and Processing Environmental and Section 4(f) Documents (Technical Advisory T 6640.8A, 1987).

PROJECT HISTORY AND BACKGROUND

In 1986, NJDOT completed the Route 1 Corridor Transportation Study. The study examined growth trends and future infrastructure needs along the 19-mile segment of Route 1 between Trenton and New Brunswick. The study identified a variety of corridor needs and highlighted a number of important policies regarding the future of the Route 1 corridor in Mercer and Middlesex Counties. Consistent with this policy direction, NJDOT, in the mid-1980s, initiated a number of projects intended to implement the corridor study recommendations by developing improvement plans for each of the priority intersections. NJDOT issued an Environmental Assessment (EA) of this corridor improvement plan in March 1991.

Improvement plans in the Penns Neck area included five alternative alignment schemes for eliminating the Penns Neck area traffic signals at Washington Road (CR571), Fisher Place and Harrison Street and replacing them with a single grade-separated interchange in the vicinity of Washington Road and Harrison Street. In 1994, NJDOT conducted project-related studies, including an alternatives analysis, interim improvement studies, an environmental constraints study and a hazardous waste screening.

In 1998, the NJDOT, in partnership with the Delaware Valley Regional Planning Commission (DVRPC), performed a Congestion Management System (CMS) study related to increasing roadway lane capacity in the Penns Neck area (Final Version adopted March 26, 1998). The CMS study examined travel demand management (TDM) strategies to determine if a reasonable program of TDM strategies could be implemented that would eliminate the need for the roadway capacity increase. According to the study, to achieve acceptable operating conditions through the project area, a trip reduction of approximately 50% would be needed. The analysis determined that, even if all of the strategies were to be combined, the resulting total would not meet the required trip reduction threshold warranted to eliminate the need for a capacity increase. The results of the analysis are summarized in Chapter 2.

NJDOT issued a Draft EA for the Route U.S. 1/Penns Neck Area Improvements in September 2000. The Draft EA met with significant opposition from some local officials as well as various community and environmental groups. In November 2000, then Governor Christine Todd Whitman ordered that a full EIS be prepared. In March 2001, NJDOT initiated this EIS process to reassess and redefine the problem of mobility in the Penns Neck Area and its environs and to examine a full range of possible actions and alternatives to address Penns Neck area traffic congestion and mobility constraints.

PUBLIC INVOLVEMENT OVERVIEW

The agency coordination and public involvement program for the Penns Neck Area EIS, which was comprehensive and extensive, was implemented throughout the 24-month scoping and EIS process. It was developed in full compliance with federal public involvement regulations and significantly exceeded NEPA requirements for preparation of an EIS. It was specifically designed as an open and ongoing process aimed at establishing and maintaining effective dialogue between interested and involved constituencies, stakeholders and public agencies.

The program's principal objective was to facilitate open lines of communication and information-sharing, active engagement, and maximum participation of the public throughout the scoping, strategy screening, alternatives evaluation, and impact analysis phases of the EIS process. This was achieved through a multi-faceted cooperative approach that involved municipal, state, regional and federal agencies, as well as a broad spectrum of interested publics.

Specific program elements included: stakeholder interviews, small group listening sessions/meetings, large group forums, project website and six document repositories. A central element of the program involved the convening of the Partners' Roundtable Advisory Committee. The Roundtable, which met 35 times during preparation of the Draft EIS, was composed of community partners from the public, private and nonprofit sectors. Its 32 members represented citizens groups, business organizations and stakeholders; the governments of West Windsor Township, Princeton Township, Princeton Borough, Plainsboro Township, Mercer County and Middlesex County; transportation advocacy groups; FHWA; DVRPC; NJDOT; and other State agencies. All Roundtable meetings were open to the public and, at most meetings, members of the public participated fully in discussions.

The Roundtable engaged in extended dialogue and document review related to all aspects of EIS development, including delineation of the project study area; preparation of a Purpose and Need Statement, Working Problem Statement, definition of project Goals and Objectives, and review of actions and alternatives that were considered for detailed analysis in the Draft EIS. The final two meetings involved the Partners' Roundtable in a synthesis of the DEIS findings. Summary reports of the final two meetings are included in Appendix E.

Information related to the EIS process and public involvement activities were communicated on the project website and in the case of large group forums, display ads

were placed in a variety of local and regional newspapers. In addition, notifications were mailed to more than 400 persons included on the EIS mailing list. All project-related data, reports, documents, and presentations were made available on the project website and in six document repositories.

STUDY AREA

The study area for the Penns Neck Area EIS has been structured into overlapping regions, including: the *primary study area* (PSA) which is composed of the municipalities of Plainsboro Township, Princeton Borough, Princeton Township and West Windsor Township; and the *secondary study area* (SSA), which is composed of twenty municipalities in Mercer, Middlesex and Somerset counties. In addition, a *core study area* was defined for considering transportation impacts and several *resource-specific study areas* were defined for the purpose of considering other areas of potential impact from the alternatives.

PROJECT PURPOSE AND NEED

Project Purpose

The purpose of the project is to address traffic congestion, mobility constraints and safety concerns on U.S. Route 1 and the east-west cross streets in the Penns Neck area of West Windsor Township, Mercer County, New Jersey and its environs.

Past growth trends and existing travel conditions

The PSA, for the past 20 years, has seen robust growth in both employment and population. According to the July 2002 *Local Area Land Use Inventory and Forecast Study* (Urbitran, 2002) prepared for this EIS, between 1980 and 2000 the number of jobs located in the PSA grew from an estimated 29,800 to 57,700. This represents a 94% increase. Over the past two decades, West Windsor and Plainsboro Townships have emerged as significant employment centers in the region. Approximately 46,300 jobs, or 80% of the PSA's employment, are located in these two townships, much of it concentrated between Route 1 and the Northeast Corridor (NEC) rail line. Residential growth in the PSA has also been robust. Between 1980 and 2000, population grew from 39,900 to 72,400, an 81% increase. Figures 1-3, 1-4 and 1-5 in Chapter 1 show the location of existing population and employment in the PSA. Figures 3-2 through 3-6 in Chapter 3 demonstrate the important role West Windsor and Plainsboro worksites play in shaping local traffic patterns.

With the exception of Princeton Borough, the land use pattern in the PSA is decentralized and auto-oriented. The dominant land use pattern is single-use office and retail development, built at low density, adjacent to highways with free parking and beyond walking distance from major transit facilities. Residential subdivisions are designed in isolation from one another and other uses and have been built at relatively low densities. These growth trends and land use and traffic generation patterns are projected to continue, against the backdrop of a constrained regional and local transportation infrastructure system.

The transportation facilities that lie at the focal point of this employment and residential growth have severe limitations in their ability to handle growing travel demand. The congested roadway network is marred by discontinuous roads, the absence of a robust grid pattern and absence of grade separations. Existing public transportation services and facilities serving external destinations are well-used but limited in trip purpose, and others serving local travel are not particularly effective in serving the low-density land use pattern of employment sites. The area's bicycle and pedestrian network is not well developed. The utility of these modes is also limited by the area's single-use, low-density land use pattern.

To document existing traffic conditions in the PSA, substantial new data was collected. These data collection efforts included the development of a comprehensive traffic count database, an east-west origin and destination survey and aerial reconnaissance to document existing traffic congestion. This information was used to verify the accuracy of the EIS travel demand forecasting model described in Chapter 4.

The major roads traversing the Penns Neck area include the following:

- *Route 1* is the area's major north-south highway artery. It consists of three travel lanes in each direction with no shoulders. This toll-free road functions both as an inter-regional auto and truck corridor and as a local land access road for properties fronting the highway, including major employment destinations. Approximately 82,700 vehicles per day use Route 1 between Washington Road and Harrison Street.
- *East-west cross streets* in the Penns Neck area include: Alexander Road, CR 571/Washington Road, Fisher Place and Harrison Street. Alexander Road crosses Route 1 on an overpass and varies between two and four lanes. Washington Road is a 2-lane road, which crosses Route 1 at a signal-controlled intersection. Fisher Place, which is located just north of Washington Road, is a residential local street east of Route 1 that also crosses Route 1 at a signal-controlled intersection. Fisher Place is used by many motorists seeking to avoid congestion at the Route 1/Washington Road intersection. Harrison Street is a 2-lane roadway that intersects with Route 1 north of Fisher Place at a signal-controlled intersection opposite the Sarnoff Corporation driveway.

Route 1 traffic through the Penns Neck area is controlled by the three closely-spaced traffic signals at Washington Road, Fisher Place and Harrison Street. Because of the high volume of traffic using Route 1, through movement of traffic on Route 1 is given signal priority over east-west traffic seeking to enter or cross Route 1 at these locations. The combination of high traffic volumes on both Route 1 and signal priority for Route 1 traffic result in significant travel delays on Route 1 and east-west cross-streets in the Penns Neck area that contributes to commuter and resident frustration.

According to travel simulation data from the EIS travel demand forecasting model, average travel time on the 2.4 mile segment of Route 1 between Carnegie Center

Boulevard in West Windsor Township and Scudders Mill Road in Plainsboro Township today ranges from 4 to 5 minutes in the AM peak hour and 4 to 6 minutes in the PM peak hour.

- There are significant delays at the Washington Road and Harrison Street intersections with Route 1 with wide variability in the delay encountered by motorists. Average AM peak hour intersection delays on Washington Road approaching Route 1 are 4 minutes in the eastbound direction and 2 minutes traveling westbound. In the PM peak hour, delays approaching Route 1 on Washington Road average 5 minutes in the eastbound direction and 2.4 minutes traveling westbound. AM peak hour delays on Harrison Street approaching Route 1 in the eastbound direction are 8.2 minutes. In the PM peak hour, delays on Harrison Street approaching Route 1 are 6.2 minutes in the eastbound direction. The variability of delays under typical conditions is broad: the minimum and maximum observed delays varied widely from 0.7 to 11.2 minutes on Washington Road and 0.4 to 11.8 minutes on Harrison Street.
- A measure of mobility in the PSA is east-west travel time. Average east-west travel times between Clarksville Road in West Windsor Township and Nassau Street in the vicinity of Alexander Road, Washington Road and Harrison Street, in Princeton Borough – an average travel distance of 3.6 miles – range from 10 to 13 minutes.

In addition, congested conditions and intersection geometry contribute to high accident rates at the Penns Neck Circle (the Route 1/Washington Road intersection). These congested conditions are perceived by many local officials and residents to impede the ability of emergency personnel to respond effectively.

Growth forecasts and future travel conditions

Growth trends in the PSA, especially for employment, are expected to continue into the foreseeable future. According to the *Local Area Land Use Inventory and Forecast Study* (Urbitran, 2002), an estimated 39,000 new jobs and 8,900 new residents are expected in the PSA by the year 2028, the planning horizon year for the EIS. (See Table ES-1.) The study forecasts that 97% of the PSA's population and employment growth will occur in West Windsor and Plainsboro Townships, where employment is projected to grow 131% and 49%, respectively. Given current zoning regulations and the fact that there is 12,750,000 square feet of additional single-use, low-density, campus-style office space already approved by local planning boards in the PSA, it is reasonable to assume that this pattern of development will continue as well. These trends are expected to worsen travel conditions in the Penns Neck area.

**Table ES-1
Study Area Population, Households, and Employment 2001-2028**

	2001	2028	Absolute Change 2001 -2028	Percent Change 2001-2028
POPULATION				
Plainsboro Twp.	21,865	23,070	1,205	6%
Princeton Borough	15,054	15,137	83	1%
Princeton Twp.	16,947	17,143	196	1%
West Windsor Twp.	22,911	30,343	7,432	32%
Study Area Total	76,777	85,693	8,916	12%
EMPLOYMENT				
Plainsboro Twp.	27,266	40,530	13,264	49%
Princeton Borough	5,561	5,680	119	2%
Princeton Twp.	5,854	6,917	1,063	18%
West Windsor Twp.	18,991	43,915	24,924	131%
Study Area Total	57,672	97,042	39,370	68%

Source: *Local Area Land Use Inventory and Forecast Study* (Urbitran, 2002)

This projected demographic growth principally related to employment, would significantly increase AM peak hour traffic demand on all of the PSA's principal roadways under the No-Action Alternative. On Route 1 northbound, AM peak hour traffic, the currently stronger directional flow, is estimated to increase by approximately 25%. On Route 1 southbound AM peak hour traffic is projected to increase 33%. The greatest AM peak hour increases on east-west roads are forecast for Alexander Road eastbound east of Route 1 (+102%), Washington Road eastbound west of Route 1 (+157%); Washington Road westbound east of Route 1 (+75%); and Harrison Street eastbound Route 1 (+87%).

As a consequence of these projected traffic increases, travel conditions on Route 1 are expected to worsen noticeably by 2028. Average intersection delays on Route 1 at the Washington Road traffic signal would increase from the existing 0.4 to 2.1 minutes to 3.0 to 5.9 minutes in 2028. Route 1 delays at the Harrison Street traffic signal would increase from the existing 0.8 to 1.9 minutes to 3.0 to 7.8 minutes in 2028. Travel time on Route 1 between Carnegie Center Boulevard in West Windsor Township and Scudders Mill Road in Plainsboro Township would exceed 15 minutes in the peak direction of travel in both the AM (northbound) and PM (southbound) peak hour, up from between four to six minutes today.

In addition, severe delays are anticipated at the intersections of east-west routes crossing Route 1 in the Penns Neck area. Travel delays crossing Route 1 at Washington Road would increase from the existing 2.4 to 5.0 minutes to more than 16 minutes in 2028. Travel delays on Harrison Street approaching Route 1 would increase from the existing 1.4 to 8.2 minutes to more than 16 minutes in 2028. These conditions would adversely affect east-west mobility. Average east-west travel times between Clarksville Road in

West Windsor Township and Nassau Street in the vicinity of Alexander Road, Washington Road and Harrison Street in Princeton Borough would range from 18 to more than 21 minutes, up from 10 to 13 minutes today.

A more detailed description of the project purpose and need is presented in Chapter 1.

PROJECT GOALS

The following goals were developed based on public input received during the EIS scoping process and with significant input from the Partners' Roundtable Advisory Committee:

- For all modes of transportation, improve access, mobility and safety and reduce congestion.
- Protect and enhance the environment and natural resources.
- Protect and enhance natural areas, parks and open space.
- Protect and enhance historic and archeological resources.
- Protect and enhance the integrity of residential neighborhoods.
- Maintain the viability of institutional and business communities
- Recognize the interrelationships between land use and transportation.
- Provide an open, inclusive, transparent and responsive EIS process.
- Provide a proactive, comprehensive and ongoing public participation program.

A complete list of project goals and objectives is presented in Chapter 1.

ACTIONS CONSIDERED

The Penns Neck Area EIS considered a wide range of potential actions to meet the project purpose and address the project goals and objectives. This section describes the range of actions considered and indicates which actions were advanced for analysis in the EIS. Table ES-2 summarizes the actions considered and the disposition of each action. A complete summary of the actions considered appears in Chapter 2.

Table ES-2
Summary of Actions Considered in EIS

Action Considered	Disposition
No-Action	As required by the National Environmental Policy Act (NEPA), the Penns Neck Area EIS includes consideration of a No-Action Alternative. This “do-nothing alternative” is included as the benchmark alternative against which all “action” alternatives will be compared.
Travel Demand Management	A variety of TDM strategies were advanced as complementary strategies included in the proposed EIS Commute Options package incorporated as a part of each action alternative (see Chapter 2, Section 2.4).
Transit – Creation of a Light Rail Transit or Bus Rapid Transit system	This action was examined as part of a concurrent planning study conducted by the Delaware Valley Regional Planning Commission for the Central Jersey Transportation Forum (CJTF) and in partnership with NJ TRANSIT. The study determined that construction of a LRT/BRT system would not significantly improve traffic congestion in the Penns Neck area. This action was eliminated from further analysis in the Penns Neck Area EIS, but study of a BRT system has been advanced separately.
Transit – Changes to the NJ TRANSIT rail service	A variety of rail service changes were considered, including more frequent reverse peak service to Princeton Junction station; new rail stations in Plainsboro and/or South Brunswick; additional Amtrak commuter rail service to the Hamilton station; and changes to the Dinky service between Princeton Junction and Princeton Borough. Based on input from NJ TRANSIT, it was determined that these actions were either under investigation as part of other concurrent studies or the project purpose could be more efficiently addressed through enhanced/expanded use of shuttles/jitneys.
Transit – Modification to existing bus services and the creation of a comprehensive jitney/shuttle system	These actions were advanced as complementary strategies included in the proposed EIS Commute Options package incorporated as a part of each action alternative.
Various road-based capacity improvements	A variety of road-based actions were advanced for further consideration in the alternatives development process. In most cases, individual road-based actions were combined into the alternatives considered in the EIS. Chapter 2 provides a complete description of the alternatives development process.

DESCRIPTION OF ALTERNATIVES EXAMINED IN DEIS

Nineteen action alternatives and the no-action alternative are considered in the EIS. The alternatives are presented in seven groupings, lettered A-G, and are best understood based on the components included in each. A narrative description and comparative matrix (Table ES-3) of the major components and distinguishing features of each alternative is presented below. Chapter 2 includes maps and detailed descriptions of the physical and circulation characteristics of the 19 alternatives.

Major Components and Distinguishing Features

Route 1 at-grade

This component would maintain Route 1 at its existing grade in the Penns Neck area with three travel lanes in each direction and safety shoulders. Under some alternatives, Route 1 would remain on its existing alignment. In others, the alignment of Route 1 would shift slightly to the west. Under most alternatives, the Penns Neck area traffic signals would be removed. Finally, under all of the alternatives that include this component, the Route 1 bridge over the Millstone River would be replaced.

Route 1 in-a-cut

This component would place Route 1 below grade at Washington Road and shift its alignment slightly to the west. Washington Road would remain at its existing grade and remain open to east-west traffic. Route 1 would consist of three travel lanes in each direction, auxiliary lanes, as needed, and safety shoulders. In addition, the Route 1 bridge over the Millstone River would be replaced under all of the alternatives that include this component.

Frontage Roads

This component would include the construction of either two one-way frontage roads running parallel to Route 1 between Harrison Street and Washington Road on the east and west sides of Route 1, or one two-way frontage road running parallel to Route 1 on the west side. The frontage roads would collect traffic from the local roadway network and filter it onto the highway with Route 1 at-grade or in-a-cut.

East-side Connector (ESC) Road

This component would include the construction of a connector road east of Route 1 between CR 571 in Princeton Junction and a new grade-separated interchange on Route 1 located between Harrison Street and Fisher Place. The connector road would traverse the Sarnoff property. There are three potential ESC road alignments:

- **ESC 1** – This alignment would run along the northerly edge of the Sarnoff property adjacent to the Millstone River.
- **ESC 2** – This alignment would run parallel to but south of ESC 1 in the vicinity of the northerly circulation road included on the approved Sarnoff General Development Plan.

- **ESC 3** – This alignment would run along the southerly edge of the Sarnoff property in the vicinity of the southerly circulation road included on the approved Sarnoff General Development Plan. This alignment is adjacent to the Penns Neck neighborhood.

For the purpose of environmental and traffic analyses, the ESC road was analyzed as a 4-lane roadway that includes two 11-foot travel lanes in each direction, a 5-foot shoulder striped as a bicycle lane, and a 10-foot landscaped median. This cross-section represents a “worst-case” environmental footprint.

West-side Connector (WSC) Road

This component would include the construction of a connector road west of Route 1 between a new grade-separated interchange on Route 1 and Harrison Street, Washington Road or both. Some alternatives would also provide a connector road between Washington Road and Alexander Road on an alignment that connects with Canal Pointe Boulevard. All WSC roads would include one 11-foot travel lane with a 4-foot shoulder striped as a bicycle lane in each direction.

Vaughn Drive Connector (VDC) Road

This component would extend existing Vaughn Drive north from its current terminus in the Princeton Junction train station parking lot to Washington Road (County Route 571) in the vicinity of the NEC rail line bridge in Princeton Junction. The road would include one 11-foot travel lane and an eight-foot shoulder striped as a bicycle lane in each direction and a 10-foot landscaped median in some segments. There are three potential VDC road alignments:

- **VDC 1** - This easternmost alignment would parallel the NEC rail line and use the right-of-way of existing Station Drive and parking lot circulation roads. It would require a new at-grade crossing of the Dinky rail line or reconfiguration of the Princeton Junction/Dinky station operations.
- **VDC 2** – This alignment would be located just west of the Princeton Junction Train Station and would traverse a small office complex adjacent to Station Drive and station parking lots before connecting with existing Vaughn Drive. The alignment would utilize the existing at-grade crossing of the Dinky rail line, which connects station area parking lots.
- **VDC 3** – Located west of VDC 2, this alignment would use an existing driveway between two small office complexes and would travel through station parking lots before connecting with existing Vaughn Drive. This alignment would utilize the existing at-grade crossing of the Dinky rail line, which connects station area parking lots.

**Table ES-3
Components of Alternatives**

	Route 1 in-cut	Route 1 at-grade	Eastern frontage road	Western frontage road	East-side connector road	West-side connector road to Harrison St (Direct)	West-side connector road to Harrison St (Indirect)	Loop-type interchange (vicinity of Harrison)	Diamond interchange (vicinity of Harrison)	Vaughn Drive connector road
Alternative A	■				ESC1					■
A.1	■	■	■		ESC1					■
A.2	■		■		ESC1					■
A.3	■	■	■		ESC1					■
A.4	■	■	■		ESC1					■
Alternative B		■			ESC1	■				
B.1		■			ESC1	■				■
B.2		■			ESC1	■				■
Alternative C		■								
C.1		■			2-way					■
Alternative D	■		■		ESC2					■
D.1	■		■		ESC2					■
D.2	■		■							■
Alternative E	■		■		ESC3					■
Alternative F	■				ESC1				■	■
F.1	■		■		ESC1					■
Alternative G		■								
G.1		■								
G.2		■								

Key: 2-way – frontage road accommodates two-way traffic.

ESC1 – northern alignment of the east-side connector road adjacent to Millstone River

ESC2 – central alignment of the east-side connector road

ESC3 – southern alignment of the east-side connector road adjacent to Penns Neck neighborhood

PREFERRED ALTERNATIVE

Process of Selecting a Preferred Alternative

As described above, 19 action alternatives were examined in the DEIS. However, as permitted under NEPA and its implementing regulations, the DEIS did not identify a Preferred Alternative. The Preferred Alternative was selected after the NJDOT considered all of the data and information presented in the DEIS and the public input received throughout the DEIS process, including agency comments and the numerous comments received from the public on the DEIS during the public comment period.

Of those providing comments on the DEIS, the vast majority expressed support or opposition for a specific alternative or series of alternatives and included reasons for the stated position. The D-series alternatives, and specifically Alternative D.2, received the most support from the public and various state and federal agencies that commented on the DEIS. In addition, many of those providing comments expressed support or opposition for particular components of the alternatives (e.g., Route 1 in-a-cut, ESC road or VDC road).

Based on a comprehensive review of the data on all 19 of the action alternatives and the No-Action Alternative and the nature and extent of the agency and public comment received on the alternatives and potential impacts, consideration was narrowed to two action alternatives, Alternatives D which included an ESC road and D.2 which did not. Once the field of action alternatives was narrowed to two and based on the comments received on the DEIS, additional, more detailed, engineering and traffic simulation modeling studies were completed to facilitate the process of selecting a Preferred Alternative. These studies are briefly described below and further documented in Chapter 2 of the EIS and its appendices.

Traffic simulation modeling

In order to further refine the design elements of Alternatives D and D.2 and to better understand the operational characteristics of each, additional traffic modeling was performed using *Paramics* traffic simulation software. This traffic simulation model provides a detailed mechanism to evaluate the actual traffic flow characteristics of vehicles moving through a roadway network. These flow characteristics include vehicle acceleration and deceleration as well as weaving and merging movements and achieve more precise estimates of traffic flow, delay and queuing at intersections. The software provides a visual depiction of roadway network and traffic conditions using a graphical user interface. Based on traffic projections and roadway network characteristics, the program simulates predicted route choice, lane changing, car following distance and turning behavior for each individual vehicle using the roadway network. A complete description of the simulation model development and calibration process is presented in Appendix D of the FEIS.

For comparative purposes, the Paramics simulation model was used to simulate 2028 AM peak hour traffic conditions under the No-Action Alternative. The results of this exercise confirmed the results of other traffic and circulation analyses performed using the Penns

Neck Area EIS Travel Demand Forecasting Model (forecast model) and documented in the DEIS and the traffic studies report.

Simulation of Alternative D

Alternative D was modeled assuming a two lane (one travel lane in each direction) ESC road. This assumption was consistent with concurrent design engineering studies being conducted in an effort to further minimize potential impacts attributable to the location and configuration of the ESC road through the Sarnoff property (see section 2.1.2 of the FEIS for additional detail). As mentioned earlier, the primary purposes of the simulation modeling was to help evaluate detailed traffic flow characteristics and refine design elements of Alternatives D and D.2 as needed to respond to forecast traffic flow conditions, especially at intersections and interchanges.

The Paramics simulation modeling revealed operational deficiencies related to the conventional diamond interchange originally envisioned for the Harrison Street interchange at Route 1. The more detailed data provided by the simulation model showed unacceptable vehicle queues on the southbound frontage road and at the Route 1 northbound and southbound exit ramps at Harrison Street. As a result, the conventional diamond interchange at this location was replaced with a single point interchange. A single point interchange treats the entire interchange as a single intersection rather than two separate intersections as is typical with conventional diamond interchanges (see section 2.1.2 below for additional detail).

This new interchange design significantly improved operational conditions at the interchange and was used in the final simulation for Alternative D. Once again, the results of the simulation exercise confirmed the results of other traffic and circulation analyses performed using the forecast model and documented in the DEIS. Compared to the No-Action Alternative:

- Traffic flow along Route 1 would be significantly improved. This is primarily due to the elimination of the Penns Neck area traffic signals and grade separation of traffic at both Harrison Street and Washington Road.
- Traffic flow conditions on Washington Road through the Penns Neck neighborhood would be significantly improved. This is primarily due to a significant reduction in overall traffic volume using Washington Road through Penns Neck as traffic is diverted to the ESC road.

Simulation of Alternative D.2

As was the case with Alternative D, the Paramics simulation exercise for Alternative D.2 revealed operational deficiencies related to the diamond interchange design originally envisioned for the Harrison Street interchange with Route 1. Again, the more detailed data provided by the simulation model showed unacceptable vehicle queues on the southbound frontage road and at the Route 1 northbound and southbound exit ramps at Harrison Street. In addition, the simulation revealed that the diamond interchange design envisioned for Washington Road at Route 1 performed poorly. Significant queuing occurred at the Route 1 northbound exit ramp to Washington Road, sometimes backing

up on to Route 1. Unacceptable queues also occurred along the southbound frontage road approaching Washington Road. Finally, unacceptable queues occurred on Washington Road westbound approaching Route 1, sometimes extending beyond Fairview Avenue in the Penns Neck neighborhood.

Consequently, for the purposes of the simulation modeling, the diamond interchanges at both Washington Road and Harrison Street were replaced with single point urban interchanges at both locations. The new interchange design at these locations significantly improved the operation of the interchanges and was used in the final simulation for Alternative D.2. The following is a summary of conditions forecast to occur under Alternative D.2 during the 2028 AM peak hour.

- As was the case under Alternative D, compared to the No-Action Alternative, traffic flow along Route 1 would be significantly improved. This is primarily due to the elimination of the Penns Neck area traffic signals and grade separation of traffic at the both Harrison Street and Washington Road.
- Modification of the interchange design for both Harrison Street and Washington Road to include a single point interchange instead of a conventional diamond interchange would provide an acceptable LOS at both locations, even without the ESC road.
- Although the overall volume of traffic using Washington Road through the Penns Neck neighborhood would be somewhat reduced under Alternative D.2 (a 9% reduction or approximately 225 fewer vehicles during the AM peak hour compared to the No-Action Alternative), Washington Road would still carry heavy volumes of traffic (more than 2,400 vehicles/hour) and experience some congestion and queuing especially on Washington Road westbound approaching Route 1.

Additional engineering studies

Throughout the engineering design process for each of the Action Alternatives, a concerted effort was made to avoid and minimize adverse impacts resulting from the physical location and characteristics of the alternatives relative to various environmental, community and cultural resources. However, as documented in the DEIS, all of the alternatives except the No-Action Alternative, resulted in at least minor physical impacts to some resources. As stated above, based on the data presented in the DEIS and public comment, the field of Action Alternatives under final consideration was narrowed to Alternatives D and D.2. As part of the process undertaken to select a Preferred Alternative, additional engineering studies were completed to determine if concept designs for the alternatives could be refined to avoid and/or further minimize physical impacts and improve traffic flow conditions.

Design of the east-side connector road

As documented in the DEIS, many of the potential impacts associated with Alternative D resulted from the inclusion of an ESC road. The following potential impacts associated with the ESC road were of particular concern to those reviewing and commenting on the DEIS:

- impacts to archeological sites located proximate to the Little Bear Brook and Millstone River on the Sarnoff property;
- water quality, wetland, floodplain and other stream corridor and natural area impacts resulting from a new stream crossing of the Little Bear Brook and construction of a new roadway proximate to the Little Bear Brook and Millstone River; and
- impacts to long-eared owl habitat located in the upland areas adjacent to the Little Bear Brook and Millstone River on the Sarnoff property.

Given the number and nature of the impacts associated with the ESC road, most of the additional engineering design studies focused on the location and cross-section of the ESC road and its crossing of the Little Bear Brook. The key findings of the engineering design studies related to the ESC road were as follows:

- Although the cross-section of the ESC road could be made smaller (i.e., downsized from two travel lanes in each direction with shoulders to one 11 foot travel lane with a 8 foot shoulder in each direction) to minimize its impact on some resources, many impacts would still occur by virtue of introducing a new roadway where one currently does not exist.
- If an ESC road were constructed, impacts to wetlands and floodplains associated with the Little Bear Brook stream crossing cannot be avoided.
- The crossing angle used for the concept plans (the same angle is used for each of the Action Alternatives) minimizes wetland and floodplain impacts to the maximum extent feasible. However, the crossing angle, when combined with other design parameters such as design speed, results in impacts to archeological sites 28ME23 or 28ME86 located adjacent to the Little Bear Brook to the east and west.
- If the location and angle of the ESC road crossing of the Little Bear Brook were changed to avoid or further minimize impacts to archeological sites 28ME23 or 28ME86, greater impacts to floodplains and wetlands would occur.
- If an ESC road were constructed, impacts to long-eared owl habitat cannot be avoided.

Location of the Vaughn Drive Connector Road

The Vaughn Drive connector (VDC) road, which was a component of most of the Action Alternatives examined in the DEIS, received significant support throughout the EIS process, including from those providing comments on the DEIS. As described above, the DEIS examined three alternative alignments for the VDC road. Each would extend existing Vaughn Drive north from its current terminus in the Princeton Junction train

station parking lot to Washington Road (County Route 571) in the vicinity of the NEC rail line bridge in Princeton Junction:

As part of agency outreach efforts conducted in support of the DEIS and the Partners' Roundtable synthesis workshop process, consensus emerged on a preferred location for a VDC road that balanced circulation needs, potential impacts to area resources and parking and pedestrian safety needs expressed by NJ TRANSIT officials and the public.

The preferred location for the VDC road would involve a minor modification to the VDC 2 alignment, which shifts the alignment slightly to the east. Additional design engineering studies revealed that this modification was feasible and would allow for the consolidation of commuter parking lots east of the new road and to increase the distance between the new road and the David S. Voorhees House, located on Station Drive. As such, it was adopted as the VDC road alignment for the Preferred Alternative.

Detailed Description of the Preferred Alternative

Agency and public comments and the findings of these additional traffic and engineering studies helped to inform the selection of D.2 as the Preferred Alternative. The Preferred Alternative, which is referred to in the FEIS as Alternative D.2.A (Figure ES-1), is substantially similar to Alternative D.2, with several minor engineering refinements and includes the following major components:

- Route 1 in-a-cut at Washington Road with Washington Road crossing over Route 1 at its existing grade and a new single-point interchange at Washington Road (Figure ES-2);
- A new grade-separated single-point interchange in the vicinity of Harrison Street, located south of the PSE&G substation (Figure ES-3);
- A new westside connector road running parallel to Lower Harrison Street, connecting the new Harrison Street interchange with existing Harrison Street in the vicinity of the D&R Canal crossing;
- A one way frontage road system on both sides of Route 1 between Washington Road and the new Harrison Street interchange, with two travel lanes in each direction; and
- A Vaughn Drive connector road located west of existing Station Drive, connecting Washington Road and existing Vaughn Drive (Figure ES-4).

In addition, the intersections of Fisher Place, Varsity Avenue, Lower Harrison Street and Eden Way with Route 1 would be modified to include a cul-de-sac at Route 1. Finally, the driveway providing access to the Sarnoff property at existing Harrison Street would be relocated to the south to connect with the new Harrison Street interchange. Finally, the covered area or plaza included in Alternative D.2 was eliminated both to facilitate the use of a single point interchange design at Washington Road and because the limited community benefits derived from its inclusion did not justify its high cost.

Route 1 Access at Harrison Street

The Preferred Alternative would provide direct access to and from Route 1 via the westside connector road and new Harrison Street interchange.

Route 1 Access at Washington Road

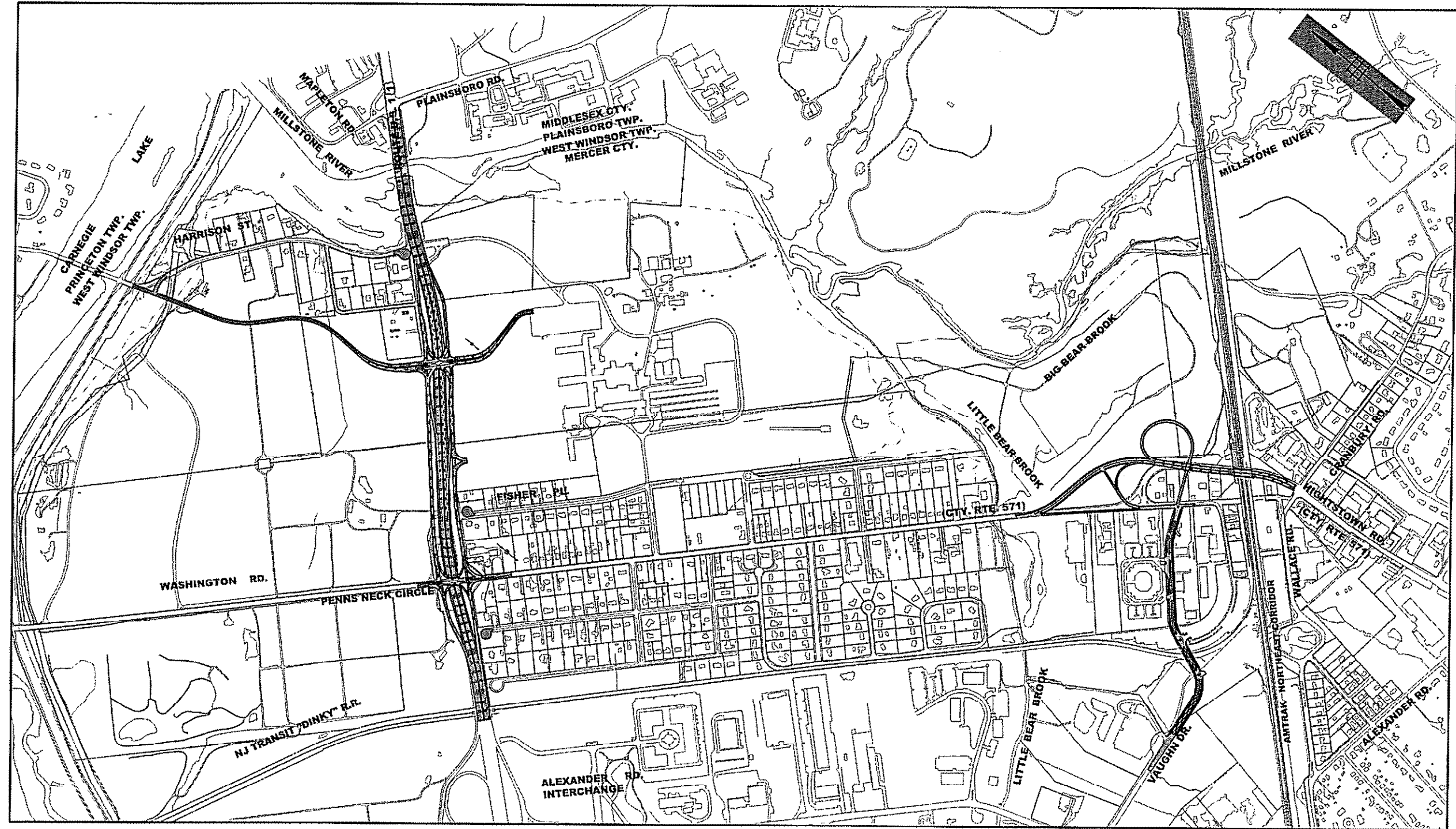
The Preferred Alternative would provide direct access to Route 1 southbound and from Route 1 northbound. Indirect access to Route 1 northbound would be provided via the eastern frontage road and the new Harrison Street interchange. Indirect access from Route 1 southbound to Washington Road would be provided via the new Harrison Street interchange and the western road.

Environmentally Preferable Alternative





Section 1505.2(b) of the Council on Environmental Quality (CEQ) regulations on implementing the National Environmental Policy Act (NEPA) requires the agency preparing an EIS to identify an “environmentally preferable alternative.” As defined in the regulations, the “environmentally preferable alternative” is the alternative that “will promote the national environmental policy” expressed in NEPA’s section 101. CEQ guidance documents state that “ordinarily this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources.”

Once again, agency and public comments and the findings of the EIS technical studies documented in the DEIS informed the selection of the Preferred Alternative (D.2.A) as the “environmentally preferable alternative.” As detailed in the FEIS, and consistent with the project goals and objectives, the Preferred Alternative would provide a reasonable level of transportation benefit, while avoiding and minimizing impacts to the biological and physical environment. Specifically, the Preferred Alternative would:

- Provide system-wide congestion relief in the core study area as measured by vehicle hours traveled, vehicle hours traveled under congested conditions and vehicle miles traveled under congested conditions;
- Improve the flow of traffic on Route 1, resulting in shorter travel times in both the north and southbound directions;
- Improve the flow of traffic on east-west routes, resulting in shorter east-west travel times and significantly reducing traffic delays on east-west routes crossing Route 1 from more than 16 minutes under the No-Action Alternative to one minute or less under the Preferred Alternative;
- Maintain an equitable balance of traffic on east-west routes, on both sides of Route 1, substantially consistent with the distribution of traffic that exists today;
- Reduce traffic on residential streets in most parts of the core study area;
- Minimize potential wetland and floodplain impacts;
- Minimize habitat fragmentation and avoid disturbance of potential habitat for the threatened long-eared owl, located adjacent to the Little Bear Brook on the Sarnoff property;
- Minimize impacts to parks and natural areas, including the D&R Canal State Park, Little Bear Brook and the Millstone River corridor;
- Reduce potential pollutant impacts on the Millstone River from new road surfaces;



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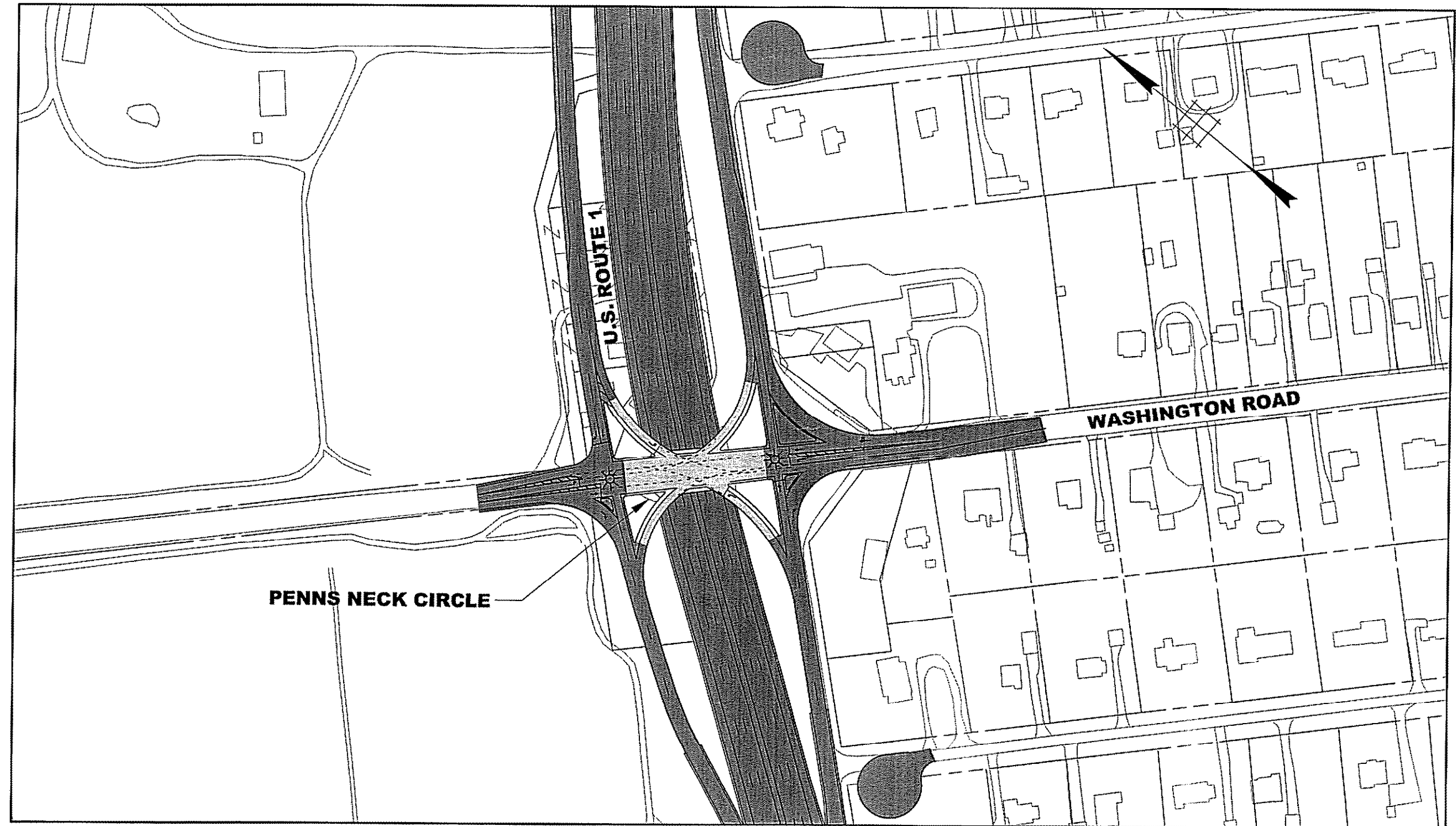
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NEW JERSEY DEPARTMENT OF TRANSPORTATION





PENNS NECK AREA
ENVIRONMENTAL IMPACT STATEMENT
PREFERRED ALTERNATIVE
ALTERNATIVE D2A

DATE: AUG. 2004
SCALE: N.T.S.

FIGURE: ES-1

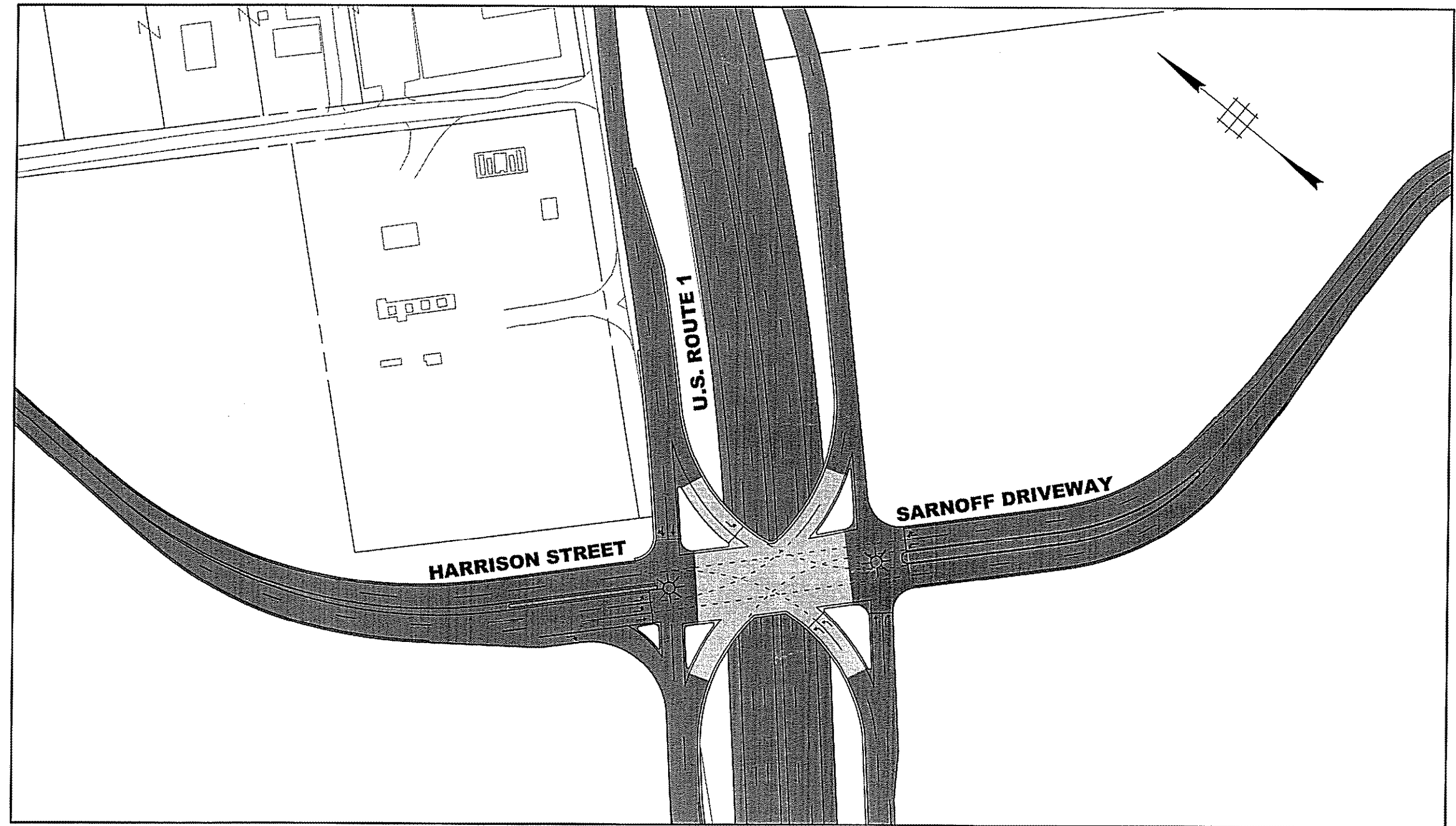


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

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PENNS NECK AREA ENVIRONMENTAL IMPACT STATEMENT SINGLE POINT INTERCHANGE AT WASHINGTON ROAD	
DATE: AUG. 2004	FIGURE: ES-2
SCALE: N.T.S.	

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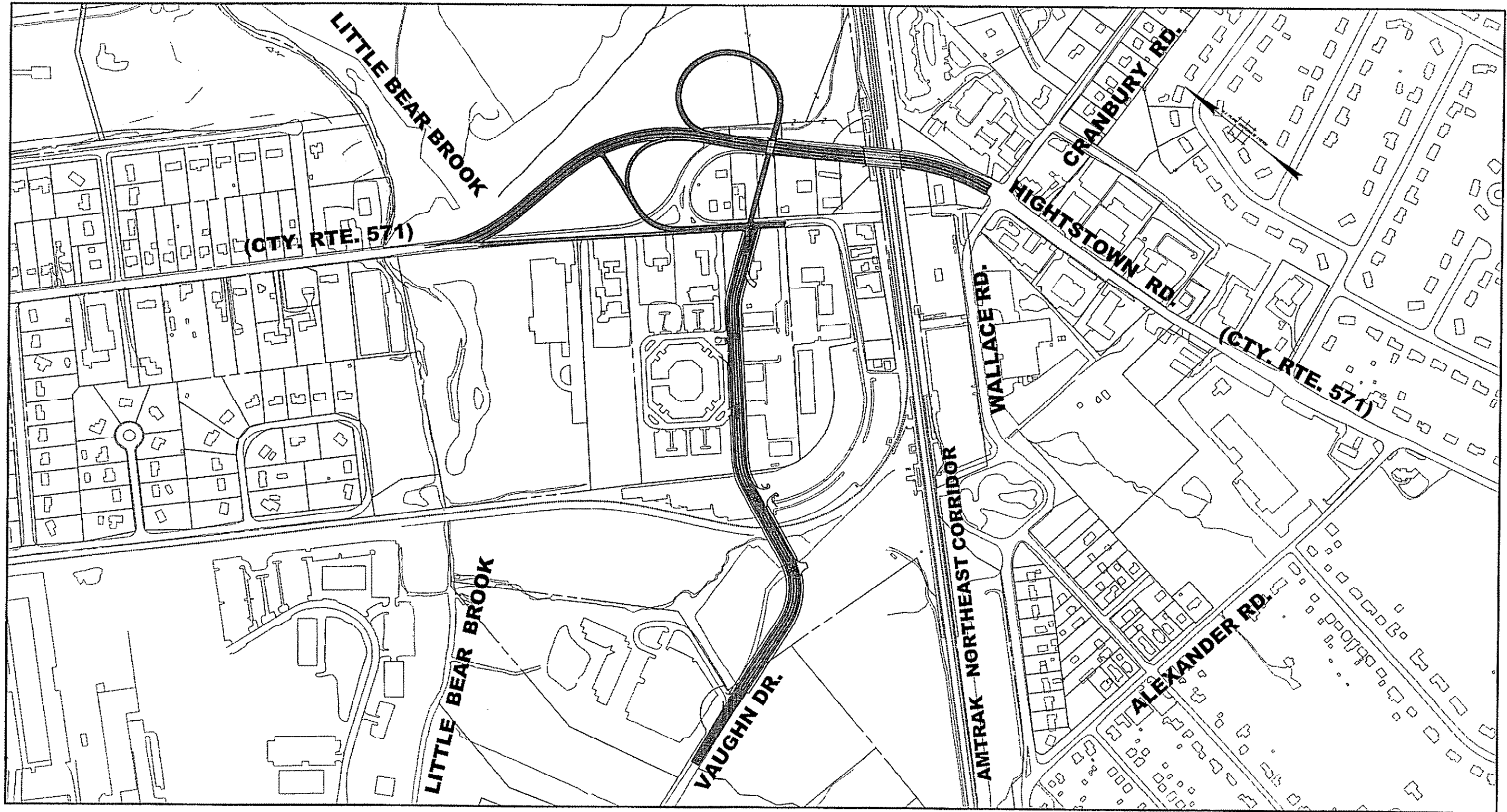


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


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NEW JERSEY DEPARTMENT OF TRANSPORTATION	
PENNS NECK AREA ENVIRONMENTAL IMPACT STATEMENT SINGLE POINT INTERCHANGE AT HARRISON STREET	
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-  PROPOSED IMPROVEMENTS
-  EXISTING CONDITIONS

NEW JERSEY DEPARTMENT OF TRANSPORTATION	
PENNS NECK AREA ENVIRONMENTAL IMPACT STATEMENT VAUGHN DRIVE ACTION ALIGNMENT D2A	
DATE: AUG. 2004	FIGURE: ES-4
SCALE: N.T.S.	

- Avoid disturbance to National Register eligible archeological sites located adjacent to the Little Bear Brook and Millstone River;
- Minimize disturbance to other National Register listed and eligible historic resources;
- Avoid residential displacements and, subject to the caveat below, minimize adverse impacts to residential neighborhoods;
- Enhance vehicular, bicycle and pedestrian access and safety to schools and other community facilities located within the core study area; and
- Minimize business displacements and enhance vehicular, bicycle and pedestrian access and safety to institutions and businesses in the study area.

It is acknowledged that the Preferred Alternative does not provide the same measure of traffic relief on Washington Road through the Penns Neck neighborhood as Alternative D. Although the number of vehicles traversing Washington Road through the Penns Neck neighborhood will only be somewhat reduced (a 9% reduction or approximately 225 fewer vehicles during the AM peak hour compared to the No-Action Alternative), congested conditions will be improved.

POTENTIAL TRAFFIC AND CIRCULATION IMPACTS

This section provides an overview of potential impacts to traffic and circulation patterns from the Preferred and No-Action Alternatives. Detail regarding all of the performance measures and data used in the traffic analyses is presented in Chapter 4, section 4.1. A detailed evaluation of the Preferred and No-Action Alternatives in relation to the project purpose and project goals and objectives is presented in Chapter 5.

The alternatives were assessed based on a variety of transportation performance measures, using a planning horizon year of 2028. Unless otherwise noted, future (2028) traffic conditions under the Preferred Alternative are compared to future (2028) conditions under the No-Action Alternative. In most cases, the period of comparison is the AM peak hour. The study area for the traffic analyses is generally bounded by Plainsboro Road and Mapleton Road to the north, Alexander Road to the south, Clarksville Road to the east and Nassau Street to the west.

Summary of conditions under the No-Action Alternative

By 2028, traffic on Route 1 is expected to grow significantly, with the largest growth destined for West Windsor and Plainsboro and points north of the Penns Neck area. AM peak hour traffic on Route 1 between Harrison Street and Washington Road is expected to grow 25% in the northbound peak direction and 33% in the southbound direction. The directional flow of traffic on several segments of east-west roads is also noteworthy. Disproportionate growth in AM peak hour traffic will occur on Alexander Road east of Route 1 in the eastbound direction (+103%), Alexander Road west of Route 1 in the westbound direction (+54%), Washington Road west of Route 1 in the eastbound direction (+157%), and Harrison Street in the eastbound direction (+88%). These changes in directional flow underscore the enlarged role that residential areas located outside of the PSA will play as future labor markets for jobs located in and near the core study area.

System-wide traffic congestion, as measured by Vehicle Hours Traveled (VHT), VHT under congested conditions and Vehicle Miles Traveled (VMT) under congested conditions would increase significantly compared to the base year. VHT on study area roadways would increase from approximately 7,390 in the base year to 18,060 in 2028, an increase of approximately 145%. VHT under congested conditions would increase from approximately 3,070 to 16,840 an increase of 450%, and VMT under congested conditions would increase from a low base of approximately 1,930 to 31,220, an increase of 1500%.

Travel conditions in the PSA would deteriorate substantially under the No-Action Alternative according to a number of measures. AM peak hour travel time northbound (peak direction) on the 2.4 mile segment of Route 1 through the study area would increase from an existing average travel time of 5 minutes to greater than 15 minutes. AM peak hour travel time southbound would increase from an existing 4 minutes to approximately 7 minutes. Average intersection delays crossing Route 1 at Washington Road and Harrison Street would increase from an existing 3 to 4 minutes to more than 16 minutes in 2028. Average east-west travel times between the intersection of CR571 and Clarksville Road in West Windsor Township and Nassau Street in Princeton Borough, an average distance of approximately 3.6 miles, would increase from an existing 10 to 13 minutes to between 18 and 21 minutes by 2028. This represents an 80% increase.

Under the No-Action Alternative, the distribution of two-way traffic on Alexander Road, Washington Road and Harrison Street west of Faculty Road will shift from Alexander Road and Harrison Street to Washington Road. At the same time, the distribution of two-way traffic between the NEC rail line and Route 1 would shift from Alexander Road to Washington Road. Traffic volumes on virtually all core area roadways would increase significantly.

The proportion of heavy trucks using Alexander Road as a percentage of total daily traffic would increase from 3% under existing conditions to 5.4% under the No-Action Alternative. The proportion of heavy trucks using Washington Road would increase from 2.1% under existing conditions to 3.9%, and the proportion of heavy trucks using Harrison Street would increase from 4.2% under existing conditions to 6.6% of total daily traffic under the No-Action Alternative.

Travel delay and growth in congestion

The Preferred Alternative would provide for uninterrupted flow of traffic along Route 1 and two grade-separated interchanges north of Alexander Road for east-west access in the Penns Neck area. Compared to the No-Action Alternative, the Preferred Alternative would provide significant public benefit in terms of system-wide congestion relief in the study area. VHT would be reduced 27%; VHT under congested conditions would be reduced 29%; and VMT under congested conditions would be reduced 10%.

North-south travel time

The elimination of the Route 1 Penns Neck area traffic signals would provide unrestricted flow of traffic on Route 1 between Carnegie Center Boulevard in West Windsor Township to Independence Way in Plainsboro Township, which reduces north-south travel time. Compared to the No-Action Alternative, the Preferred Alternative would reduce north-south travel time in the AM peak hour, especially in the non-peak southbound direction. Northbound travel time in the AM peak hour would be reduced 20% from 15 minutes to 12 minutes; and southbound (non-peak direction) travel time in the AM peak hour would be reduced 34% from 7 minutes to 5 minutes. This finding is consistent with the previous finding related to reduction in system-wide congestion measures.

East-west travel time

Compared to the No-Action Alternative, the Preferred Alternative with grade separated crossings of Route 1 at Washington Road and Harrison Street would reduce east-west travel time in the AM peak hour from 13-27% between the intersection of CR571 and Clarksville Road in West Windsor and Nassau Street in the vicinity of Alexander Road, Washington Road and Harrison Street in Princeton Borough.

Intersection delays crossing Route 1

The most marked benefit of the Preferred Alternative is its ability to significantly reduce intersection delays on Washington Road and Harrison Street approaching Route 1. Delays under future No-Action conditions are estimated to exceed 16 minutes. Under the Preferred Alternative, which includes grade-separated through movement of east-west traffic across Route 1 at Washington Road and Harrison Street, delays would be reduced to 1 minute or less. As was the case with all of the action alternatives considered in the DEIS, intersection delays on Alexander Road approaching Route 1 were largely unaffected by the alternatives.

Accident and safety conditions

The Preferred Alternative would include the widening of Route 1 to include a shoulder and/or auxiliary lanes in both the northbound and southbound directions. This shoulder area would provide a location for disabled vehicles to get out of the traffic stream and await assistance. Roadways similar to Route 1 that have shoulders exhibit accident rates approximately 40% lower than those without shoulders. Additionally, the Preferred Alternative would remove the traffic signals from Route 1 at Washington Road, Fisher Place and Harrison Street and provide grade-separation to facilitate east-west movements across Route 1. As noted in Chapter 3, section 3.1.4.3, approximately 72% of the accidents occurring along this segment of Route 1 were rear end type, occurring in proximity to the intersections. This high percentage of accidents was attributed to congested conditions and the stop and go traffic caused by the Penns Neck area traffic signals. Removal of the traffic signals along Route 1 would reduce the potential for vehicular conflicts, thereby creating an improved operating and safety condition.

Balance of traffic on east-west routes

The distribution of traffic on east-west routes on both sides of Route 1 was considered at two locations. It is important to note that the distribution of traffic will change over time, with or without improvements in the Penns Neck area. The Preferred Alternative would improve access to/from Route 1 at Harrison Street. As such, it would enhance the function of Harrison Street as an attractive east-west travel corridor. As shown in Table ES-4, under the Preferred Alternative, the balance of traffic on Alexander Road, Washington Road and Harrison Street west of Faculty Road (Location 1) would shift from Washington Road to Harrison Street.

Because the Preferred Alternative would not include an ESC road, traffic volumes on Washington Road would only be slightly reduced when compared to traffic volumes under the No-Action Alternative. The distribution of two-way traffic between the NEC rail line and Route 1 (Location 2) would shift from Washington Road to Alexander Road.

Table ES-4
Distribution of Traffic on East West Routes

	<u>Base Year</u>		<u>No-Action Alt.</u>		<u>Preferred Alt.</u>	
	Volume	%	Volume	%	Volume	%
<u>Location 1 (west of Faculty Rd)</u>						
-Alexander Rd	1,736	45%	2,229	40%	2,113	40%
-Washington Rd	1,222	32%	2,058	37%	1,715	32%
-Harrison St	899	23%	1,231	22%	1,504	28%
<u>Location 2 (Between NEC & Route 1)</u>						
-Alexander Rd	2,301	59%	2,631	49%	3,054	56%
-Washington Rd	1,607	41%	2,670	51%	2,436	44%

Change in local traffic patterns (residential and mixed use streets)

Change in local traffic patterns was assessed based on the degree to which traffic increased or decreased in comparison to the No-Action Alternative. For comparison purposes, key roadway segments were selected and grouped into three generalized geographic areas: a) the core area between the D&R Canal and the NEC rail line; b) west of the D&R Canal; and c) the vicinity of the NEC rail line. For the purposes of this summary, traffic changes on mixed use and residential streets located in the core study area are summarized below.

Core area between D&R Canal and NEC rail line:

- The Preferred Alternative would decrease traffic on **Lower Harrison Street** between Route 1 and the Canal more than 95%.
- The Preferred Alternative would decrease traffic on **Washington Road in Penns Neck** 9%.

- Fisher Place under the No-Action and Preferred Alternatives would become a cul-de-sac. Consequently, through traffic on **Fisher Place between Fairview Ave and Route 1** under both alternatives would be zero.

West of the D&R Canal:

- The Preferred Alternative would decrease traffic on **Alexander Road between Faculty Road and Mercer Street** 5%.
- The Preferred Alternative would increase traffic on **Upper Harrison Street** between Faculty Road and Nassau Street 22%.

Vicinity of the NEC rail line

- The Preferred Alternative would decrease traffic on **Alexander Road east of the NEC rail line** 26%.
- The Preferred Alternative would decrease traffic on **Wallace Road** 29%.
- The Preferred Alternative would decrease traffic on **North Post Road** 13%.
- The Preferred Alternative would have little or no effect on traffic using **Clarksville Road between North Post Road and CR571**.
- The Preferred Alternative would have little or no effect on traffic using **Bear Brook Road**.

Truck traffic on east-west streets

Compared to the No-Action Alternative, the Preferred Alternative would not affect the percentage of heavy trucks using east-west roads. As was the case with all of the alternatives considered in the DEIS, in the future, heavy trucks would represent less than 7% of total 2-way traffic using east-west roads in the Penns Neck area.

Non-auto travel modes

The Preferred Alternative would be accompanied by concurrent implementation of a "Commuter Options" package which would include complementary travel demand management strategies, transit service enhancements and pedestrian and bicycle improvements. A detailed description of the proposed Commuter Options package is presented in Chapter 2.

Access Management

The Preferred Alternative would manage access and safety better along Route 1 in the Penns Neck area by eliminating all curb-cuts along Route 1 between Harrison Street and Alexander Road. In addition, it would use a system of frontage roads which would separate regional and local traffic.

POTENTIAL IMPACTS TO THE NATURAL ENVIRONMENT

This section provides an overview of potential impacts to the natural environment. Detail regarding all of the performance measures and data used in the assessment of impacts is presented in Chapter 4. A detailed evaluation of the Preferred Alternative in relation to the project purpose and all of the project goals and objectives is presented in Chapter 5.

A variety of objectives/performance measures were used to assess potential impacts to the natural environment. Only direct impacts resulting from the Preferred Alternative are considered in this section. In most cases, the impacts relate to permanent physical disturbances. Potential secondary and cumulative effects are summarized in a separate section below.

Wetlands, floodplains and groundwater recharge

Wetlands, floodplains and groundwater recharge in the project area would be affected to a limited degree by the Preferred Alternative. As shown in Table ES-5, the Preferred Alternative would permanently impact 0.18 acres of wetlands. This represents a very small percentage of the total 245 acres of wetlands located within the project area. There are approximately 820 acres of floodplains located in the project area. As shown in Table ES-5, the Preferred Alternative would result in the permanent disturbance of 1.22 acres of floodplains. This represents a 0.14% reduction in project area floodplains. The Preferred Alternative would also introduce approximately 28.21 acres of new road-related impervious surface to the project area. This new impervious surface would reduce the capacity of the project area to recharge groundwater by approximately 1.25%.

**Table ES-5
Potential Wetland, Floodplain and Groundwater Recharge Impacts**

Area of Potential Impact	Preferred Alternative
Permanent wetland disturbance (acres)	0.18
<i>Percent reduction in study area wetlands</i>	0.03%
Permanent floodplain disturbance (acres)	1.22
<i>Percent reduction in study area floodplains</i>	0.14%
Increase in impervious surface (acres)	28.21
<i>Percent reduction in study area groundwater recharge potential</i>	1.25%

Habitat fragmentation

The Preferred Alternative, which would not include an ESC road, is not likely to result in the fragmentation of high quality wildlife habitat.

Threatened and endangered species

In accordance with federal procedures for the preparation of EIS documents, the US Fish and Wildlife Service, New Jersey Department of Environmental Protection – Endangered and Nongame Species Program and the NJ Audubon Society were consulted to determine if any Federal or State threatened and endangered species were known to be located in the project area. According to the US Fish and Wildlife Service, "...except for an occasional transient Bald Eagle, no other federally listed or proposed endangered or threatened species are known to occur within the vicinity of the proposed project site."

In addition, a biological assessment of the study area for specific species is being undertaken by the NJDOT in cooperation with the NJDEP Endangered Non-Game Species Program as part of the Penns Neck Area EIS. The biological assessment identified the following species in or near the study area.

The presence of a nesting pair of Bald Eagles in the vicinity of Carnegie Lake just north of the study area was confirmed by the NJ Department of Environmental Protection Threatened and Non-game Species program subsequent to DEIS publication.

During the course of this study, a long-eared owl was reported and documented as present in the forested area of the Sarnoff property adjacent to the Little Bear Brook. The long-eared owl is on the State threatened species list. Because the Preferred Alternative would not include an ESC road, impacts to the habitat of the long-eared owl would be avoided.

A State-threatened triangle floater freshwater mussel was found in the sediments near the Route 1 Millstone River bridge.

The extent to which the Preferred Alternative may impact the eagles, the owl, the triangle floater, and their habitats is currently under investigation and will be confirmed as part of the final design and permitting process for the Preferred Alternative.

Water quality

The Preferred Alternative does not include an ESC road. As such, it avoids longitudinal impacts to the Millstone River or Little Bear Brook stream corridors. In addition, because the Preferred Alternative does not include an ESC road, it also avoids a new crossing of the Little Bear Brook and its associated water quality impacts.

With the exception of the Route 1/Alexander Road interchange, presently, there are no man-made stormwater management facilities in place to control the quality of stormwater runoff from existing Alexander Road, Washington Road and Harrison Street. Because there is a relationship between the level of traffic using a road and the level of pollutants in stormwater runoff from a road, change in traffic on these streets was examined as a means of considering potential pollution impacts from existing roads. The Preferred Alternative would reduce traffic on a number of existing streets, including Lower Harrison Street between Route 1 and the D&R Canal and Washington Road in Penns Neck. Therefore, the Preferred Alternative would provide an opportunity to reduce the level of pollutants in runoff from existing roads.

Future pollutant levels in stormwater runoff from new roads were estimated using procedures prescribed by the Federal Highway Administration. Based on this analysis, it appears that the Preferred Alternative would result in post-discharge pollutant concentrations that meet State Surface Water Quality Standards for *Suspended Solids, Total Nitrate, Chloride, Lead, Cadmium, and Chromium*. The Preferred Alternative would result in pollutant concentrations that approach or exceed standards for *Total Phosphorous*. Although this analysis indicates that a potential exceedence of water quality standards for phosphorus may occur, it should also be noted that construction of any of the action alternatives would be subject to a permitting process governed by

statutes and regulations intended to protect water quality and to prevent potential violations of water quality standards. This would include construction of stormwater management facilities that would further treat roadway runoff prior to discharge to receiving waterbodies.

Air quality

Potential localized air quality impacts from the Preferred and No-Action Alternatives were analyzed in accordance with Federal Highway Administration and USEPA guidance and regulations. An intersection “hot spot” analysis for carbon monoxide was conducted. The analyses indicated that both the No-Action and Preferred Alternatives would comply with the federal air quality standard for Carbon Monoxide.

Underlying geology

The Preferred Alternative would include Route 1 in-a-cut at Washington Road. As such, it would require the excavation and removal of approximately 48,000 cubic yards of rock material. Preliminary geotechnical borings along Route 1 suggest that rock conditions would not require blasting. Rock removal can be undertaken for Route 1 in-a-cut using typical excavation methods.

POTENTIAL IMPACTS TO THE BUILT ENVIRONMENT

This section provides an overview of potential impacts to the built environment. Detail regarding all of the performance measures and data used in the assessment of impacts is presented in Chapter 4. A detailed evaluation of the Preferred and No-Action Alternatives in relation to the project purpose and all of the project goals and objectives is presented in Chapter 5.

A variety of objectives/performance measures were used to assess potential impacts to the built environment. In most cases, both direct and indirect impacts resulting from the proposed alternatives are considered in this section. Potential secondary and cumulative effects are summarized in a separate section below.

Cultural Resources

For the purposes of the EIS, potential impacts to archeological and historic architectural resources that are listed or eligible for listing on the National Register of Historic Places were assessed. There are 4 archeological sites and 12¹ historic architectural resources located in the project area that qualify under this category.

¹ The DEIS listed the D&R Canal Bridge as an additional historic resource. During Section 106 consultation, it was determined that the bridge is a contributing element to the Pennsylvania Railroad Historic District which is also located within the study area. In this FEIS, the bridge was combined with and included as part of the Historic District.

Archeological Sites

There are four National Register Listed or eligible archeological resources located in the project area:

- 28ME2 – This site is located in the vicinity of the Harrison St/Route 1 intersection on the east side of Route 1. It contains artifacts indicating prehistoric occupations dating to the Late Archaic, Terminal Archaic and Woodland periods.
- 28ME23 – This site is located in the vicinity of the proposed east-side connector road crossing of the Little Bear Brook on the east side of the brook. It contains artifacts indicating prehistoric occupations dating to the Late Archaic and Late Woodland periods.
- 28ME86 – This site is located in the vicinity of the proposed east-side connector road crossing of the Little Bear Brook on the west side of the brook. It contains artifacts indicating prehistoric occupations dating to the Late Archaic, Middle Woodland and Late Woodland periods.
- 28ME291 – This site is located in the vicinity of the Vaughn Drive connector road interchange with CR571/Washington Rd. It is a small but intact deposit dating to the Early Woodland period.

The No-Action and Preferred Alternatives would result in no impact to these archeological resources.

Historic Architectural Resources

There are 12 historic architectural resources located in the project area that are listed or eligible for listing on the National Register. Potential impacts to these resources are as follows:

Aqueduct Mills Historic District

Under the No-Action Alternative, increased traffic on Mapleton Road and Route 1 in the vicinity of Mapleton Road would cause increased auditory and visual intrusion on the district. As a result, the No-Action Alternative would have some negative impact on this resource. The Preferred Alternative would include widening of Route 1 to accommodate safety shoulders and auxiliary lanes as needed for acceleration and deceleration of traffic merging on and off of Route 1. Widening Route 1 would require acquisition of a portion of District property at the intersection of Mapleton Road and Route 1, and impact a dry-laid stone wall that is a contributing element to the District. This impact would be negative. The Preferred Alternative would reduce traffic on Mapleton Road. This would result in a positive impact on the district.

Aqueduct Mills Historic District Extension

Under the No-Action Alternative, traffic on Lower Harrison Street would increase over existing conditions. This would cause increased auditory and visual intrusion on the district. As a result, the No-Action Alternative would have some negative impact on this resource. The Preferred Alternative would include a WSC road that diverts traffic away from Lower Harrison Street. As a result, compared to the No-Action

Alternative, traffic on Lower Harrison Street would be significantly reduced. Given the location of the proposed interchange and west-side connector road, no visual intrusion on the district would occur. The impact of the Preferred Alternative is expected to be positive.

Covenhoven-Logan-Silvers House

The No-Action Alternative would result in no impact to this resource. The Preferred Alternative, which includes a WSC road adjacent to the property, would result in increased traffic proximate to the resource. This increase in traffic would introduce visual and auditory intrusion not currently present, resulting in some negative impact.

Delaware & Raritan Canal Historic District

Under the No-Action Alternative traffic crossing the D&R Canal State Park at Alexander Road, Washington Road and Harrison Street would increase. This increase in traffic would increase visual intrusion and increase auditory intrusion in excess of noise abatement criteria at the Alexander Road, Washington Road and Harrison Street crossings. This would result in some negative impact.

Like the No-Action Alternative, the Preferred Alternative would increase total traffic crossing the D&R Canal State Park in the project area. While total traffic increases overall under the Preferred Alternative, traffic at the Alexander Road and Washington Road crossings would decrease compared to the No-Action Alternative. This would result in comparatively less visual and auditory intrusion on the district in the vicinity of Alexander Road and Washington Road; however, noise levels would still approach or exceed noise abatement criteria at these locations.

Traffic at the Harrison Street crossing would increase compared to the No-Action Alternative. This would result in increased visual intrusion and increased auditory intrusion that approaches or exceeds noise abatement criteria in the vicinity of the Harrison Street crossing. Although the decrease in traffic crossing the district in the vicinity of Alexander Road and Washington Road would have some positive impact, similar to conditions under the No-Action Alternative, future noise levels at all three canal crossings are expected to approach or exceed noise abatement criteria under these alternatives. The net effect of these changes is expected to result in some negative impact.

The Preferred Alternative would improve sight distance at the Harrison Street crossing of the canal. With appropriate design, this could enhance safety for park users crossing Harrison Street.

Lake Carnegie Historic District

The No-Action and Preferred Alternatives would result in no impact to this resource.

Penns Neck Baptist Church (a.k.a. – Princeton Baptist Church at Penns Neck)

Under the No-Action Alternative traffic would increase on Route 1 and Washington Road proximate to the resource. While this increased traffic may result in increased

visual and auditory intrusion, the increase in noise would not exceed noise abatement criteria for worsening an existing adverse condition. In addition, because the setting of the property does not represent a significant characteristic of its historic eligibility, the visual intrusion of increased traffic is also not expected to affect this resource negatively. Consequently, the impact of the No-Action Alternative would be neutral relative to this resource.

The Preferred Alternative, which includes Route 1 in-a-cut, would result in decreased traffic on Route 1 and Washington Road proximate to and/or at the same grade as the resource. This decrease in traffic would result in less permanent visual and noise intrusion on the resource. While there may be temporary noise impacts related to constructing Route 1 in-a-cut, the net impact of these alternatives is expected to be positive.

Penns Neck Cemetery

The No-Action and Preferred Alternatives would result in no impact to this resource.

Pennsylvania Railroad Historic District

The No-Action Alternative would result in no impact to this resource. The Preferred Alternative includes both a VDC road that would be constructed proximate to the district and rehabilitation of the CR571 bridge crossing the NEC rail line. This bridge is a contributing resource to the district. Construction activities associated with the VDC road and bridge rehabilitation activities may result in some impact to the district.

Princeton Operating Station (a.k.a. – Eden Institute)

The No-Action and Preferred Alternatives would result in no impact to this resource.

Sarnoff Corporation (formerly RCA Laboratories – David Sarnoff Research Center)

The No-Action Alternative would result in no impact to this resource. The Preferred Alternative would require acquisition of property frontage along Route 1 and realignment of the existing main entrance to the Sarnoff property. These changes may have some negative impact on the district.

David S. Voorhees House

The No-Action Alternative would result in no impact to this resource. The large tract of land on which the house sits would be acquired to implement the Preferred Alternative. The house and its immediate environs would be retained with the current use allowed to continue. The office buildings, parking areas, and roads on the remainder of the parcel, which are not related to the house, would be demolished and replaced with surface parking for the Princeton Junction Railroad Station. The provision for Station parking is compensation for unavoidable isolation of an existing parking lot by the new Vaughn Drive Connector road. These changes would have some impact on the house.

Washington Road Elm Allée

The No-Action Alternative would result in increased auditory and visual intrusion on this resource due to increased traffic on Washington Road between Route 1 and the D&R Canal. Consequently, the No-Action Alternative would result in some negative impact on this resource. The Preferred Alternative would result in decreased traffic on Washington Road between Route 1 and the D&R Canal. This decreased traffic would result in less visual and auditory intrusion on the resource, resulting in a positive impact. The Preferred Alternative may require acquisition of narrow slivers of land on either side of Washington Road near Route 1 and the frontage roads, and construction activities proximate to the allée. This impact would be negative.

A detailed description of potential impacts to cultural resources is presented in Chapter 4.

Distinctive neighborhoods

The No-Action Alternative would result in no physical fragmentation of neighborhoods or residential displacement; however, under the No-Action Alternative, traffic on existing roadways is expected to increase substantially throughout the study area. A number of neighborhoods may experience increased visual and auditory intrusion resulting from increases in traffic. Notably, AM peak hour traffic on Washington Road bisecting the Penns Neck neighborhood would increase from approximately 1610 vehicles today to 2670 in 2028, an increase of 66%. AM peak hour traffic on Alexander Road bisecting the Berrien City neighborhood would increase from approximately 610 vehicles today to 1565 vehicles in 2028, a 157% increase.

The Preferred Alternative would avoid physical fragmentation of residential neighborhoods; however, as noted below, a number of neighborhoods may experience increased visual and auditory intrusion resulting from increase traffic. As noted in Chapter 3, a number of distinctive mixed use areas and residential neighborhoods were identified within and adjacent to the study area. These include:

West Windsor Township

- Penns Neck;
- Princeton Junction, a mixed use, pedestrian-scaled area that includes the Princeton Junction business/shopping area, West Windsor's municipal complex, and the Berrien City, Sherbrooke Estates, Benford Estates, Clarksville Road, and Wellington Estates neighborhoods;
- Lower Harrison Street;
- Alexander Road (west of Route 1);
- Canal Pointe; and
- Old Bear Brook Road and Windsor Haven.

Princeton Borough & Township

- Central District, a mixed use, pedestrian-scaled area that includes the Princeton Borough CBD and the Bank Street historic district;
- Mercer Hill; and
- Upper Harrison Street, which includes the Jugtown historic district.

The Preferred Alternative would result in the following traffic-related impacts to neighborhoods:

- The Preferred Alternative would reduce traffic on Washington Road between the NEC rail line and Route 1 by 9% or approximately 225 vehicles/hour in the AM peak hour. Traffic would move more freely than under the No-Action Alternative where significant queuing would occur on Washington Road westbound approaching Route 1. This would have some positive impact on the **Penns Neck neighborhood**.
- The Preferred Alternative would reduce traffic on Alexander Road between Route 1 and the D&R Canal. This would have a positive impact on the **residences and neighborhoods located along this segment of Alexander Road**.
- The Preferred Alternative would not significantly affect the level of traffic on Bear Brook Road. As such, its impact would be neutral on **residences located along Bear Brook Road and the Windsor Haven neighborhood**.
- The Preferred Alternative would reduce traffic on North Post Road. This would have a positive impact on the **Benford Estates neighborhood**.
- The Preferred Alternative would reduce traffic on Alexander Road between the NEC rail line and CR571 and on Wallace Road. This would have a positive impact on the **Berrien City neighborhood**.
- The Preferred Alternative would reduce traffic on Canal Pointe Boulevard. This would have a positive impact on the **Canal Pointe neighborhood**.
- The Preferred Alternative would not significantly affect the level of traffic on Clarksville Road between North Post Road and CR571. As such, its impact would be neutral on **residences located along Clarksville Road and the Wellington Estates neighborhood**.
- The Preferred Alternative would significantly reduce traffic on Lower Harrison Street between Route 1 and the D&R Canal. This would have a positive impact on the **Lower Harrison Street neighborhood**.
- The Preferred Alternative would reduce traffic on CR571 between Clarksville Road and the NEC rail line. This would have a positive impact on the **Sherbrooke Estates neighborhood** and the **Princeton Junction mixed use business district**.
- The Preferred Alternative would increase traffic on Upper Harrison Street between Faculty Road and Nassau Street. This would have a negative effect on the **Upper Harrison Street neighborhood**, which includes the **Jugtown Historic District**.
- The Preferred Alternative would not significantly affect the level of traffic on Alexander Road between University Place and Mercer Street. As such, its impact would be neutral on the **Mercer Hill Historic District**.
- The Preferred Alternative would reduce traffic on Nassau Street between Mercer Street and Washington Road. This would have a positive effect on **Princeton**.

Borough's Central District south of Washington Road, including the Bank Street Historic District.

- The Preferred Alternative would reduce traffic on Nassau Street between Washington Road and Harrison Street. This would have a positive effect on **Princeton Borough's Central District north of Washington Road.**

Residential displacements

The Preferred Alternative would result in no residential displacements.

Schools and community facilities

The Preferred Alternative would partially enhance vehicular, bicycle and pedestrian access and safety to West Windsor's Maurice Hawk School and the West Windsor-Plainsboro High School (South Campus) located on Clarksville Road in West Windsor Township. The Preferred Alternative would also enhance vehicular, bicycle and pedestrian access and safety to community facilities located within the West Windsor Township municipal complex.

Business and institutional communities

The No-Action Alternative would result in no business displacements or fragmentation of lands reserved for campus development; however, under the No-Action Alternative, area-wide congestion would result in lengthy north-south and east-west travel times, thereby limiting access to area businesses and institutions. The Preferred Alternative would result in multiple business displacements, including Larry's Sunoco located at the corner of Route 1 and Harrison Street; the Gulf and Exxon gas stations located west of the Route 1/Washington Road intersection; and a small office complex located at 14 Washington Road adjacent to the Princeton Junction train station.

The Preferred Alternative which includes a WSC road in the northern quadrant of Princeton University-owned land west of Route 1 minimizes adverse impacts to future campus development on this site. In addition, the Preferred Alternative would reduce area-wide congestion and shorten north-south and east-west travel times compared to the No-Action Alternative. This would enhance vehicular access and safety to area businesses and institutions; however, it limits direct access to Route 1 for businesses fronting on Route 1 in the Penns Neck area. Finally, the Preferred Alternative would include concurrent implementation of the Commute Options package which is intended to enhance transit, bicycle and pedestrian access to area businesses and institutions.

Parks, Recreational Facilities and Natural Areas

The No-Action Alternative would result in no physical changes that would affect natural areas, parks and recreational facilities; however, under the No-Action Alternative, increased traffic at the three crossings of the D&R Canal State Park would result in increased noise and visual intrusion on the park. The No-Action Alternative would result in no physical changes that would affect natural areas, parks and recreational facilities; however, under the No-Action Alternative, traffic on existing roadways is expected to increase substantially throughout the study area. Increased traffic at the three crossings

of the D&R Canal State Park would result in increased auditory and visual intrusion at these locations. This would have a negative impact on the park.

The Preferred Alternative would avoid physical taking of lands designated as parks or permanently preserved open space and avoids impacts to the Millstone River and Little Bear Brook stream corridor areas and recreational facilities located on the Sarnoff property and Princeton University-owned land west of Route 1. In addition, the Preferred Alternative reduces traffic crossing the D&R Canal at Alexander Road and Washington Road. This would have a positive impact on the D&R Canal State Park at these locations.

However, the Preferred Alternative would increase traffic-related visual and auditory intrusion on the D&R Canal State Park in the vicinity of the Harrison Street crossing. Although this impact is associated with an existing perpendicular crossing of the park, it would still have a negative impact. Finally, the Preferred Alternative provides an opportunity to enhance access and safety for motorists and park users at the Harrison Street crossing of the D&R Canal State Park by improving sight distance at the crossing.

Contaminated materials sites

The No-Action Alternative would result in no disturbance of contaminated materials sites. As shown in Table ES-6, the Preferred Alternative would result in the potential disturbance of multiple contaminated materials sites, including sites of higher concern, such as existing and former gas stations along Route 1, and sites of moderate to lower concern, such as the Princeton-Windsor News building on Washington Road and one or more office buildings located at 14 Washington Road. Those sites that are disturbed would require clean-up and remediation in accordance with federal and state regulations.

**Table ES-6
Potential Impacts to Contaminated Materials Sites**

<i>Sites of highest concern</i>	
Larry's Sunoco	YES
Princeton Circle Exxon	YES
Pits/Cumberland Gulf Station	YES
Princeton Getty Station	YES
Century 21 Realty Office (former gas station)	YES
Sarnoff - chlorinated compounds release site, former USTs and processing systems	NO
<i>Sites of Moderate to lower concern</i>	
Sarnoff - former lab equipment dump site	NO
Sarnoff - former low level radiation dump site	NO
Roadway Fuel Oil Releases (dates: 4/96 & 7/96)	YES
Eden Institute	NO
Farmland - west of Rte 1 (potential pesticides/herbicides)	YES
Princeton Station Garage	NO
Princeton-Windsor News	YES
14 Washington Road - office building	YES

PRELIMINARY CONSTRUCTION COST ESTIMATES

Preliminary construction cost estimates were developed for each of the action alternatives. These cost estimates were based on NJDOT's *Construction Cost Estimation Preparation Manual for Preliminary Design*, July 2002. The construction cost estimate formulas are based on historical construction cost data for a range of project types. The estimation procedures incorporate the following elements of roadway construction:

1. Earthwork
2. Pavement
3. Culverts & bridges
4. Drainage
5. Utility relocation
6. Landscaping
7. General and incidental items.

Costs related to engineering design, contaminated materials remediation and other environmental mitigation costs are not included because of the project-specific nature of these items. The preliminary cost estimate for the Preferred Alternative is \$70,000,000 and \$21,500,000 in right-of-way costs.

ENVIRONMENTAL JUSTICE

The Preferred Alternative would not have a disproportionately adverse effect on minority or low income residents living in the study area. Racial and ethnic minorities in the PSA and SSA comprise 31.5 percent and 27.3 percent, respectively. These are lower percentages than New Jersey's 34 percent, Mercer County's 35.8 percent, and Middlesex County's 38.1 percent. Within the PSA, Plainsboro had a higher percentage of minority persons than the state and study area counties, at 44.5 percent. In the PSA and SSA, Asian/Pacific Islander was the largest category of minority, followed by African Americans and Hispanics.

The minority and low-income populations represented in all but two of the Census Block Groups located within the core study area do not exceed fifty percent of the total population and are not materially greater than the proportion of minority or low-income populations represented in the PSA municipalities, surrounding counties, or New Jersey. The minority and low-income populations represented in Census Tract 41 – Block Group 2 located along Alexander Road in Princeton Borough, are 57% and 0%, respectively. Although the minority population of this Block Group exceeds 50%, persons living in this Block Group are not expected to be disproportionately impacted. Compared to the No-Action Alternative, the Preferred Alternative would reduce traffic on Alexander Road adjacent to this area.

The minority and low-income populations represented in Census Tract 42.04 – Block Group 3, located in Princeton Township along Upper Harrison Street, are 30% and 12%, respectively. Although the low-income population represented in this Block Group is comparatively higher than other areas, adverse impacts would not be disproportionately borne by low-income persons living in this Block Group. Potential impacts from increased traffic on Upper Harrison Street under the Preferred Alternative would not be

more adverse to these persons than to non-low-income populations affected by the Preferred Alternative.

SECONDARY AND CUMULATIVE EFFECTS

Potential secondary and cumulative effects on the environment were assessed for the Preferred Alternative. As required by the National Environmental Policy Act (NEPA) (40 CFR Part 1508.7), past, present and reasonably foreseeable future actions have been included in this secondary and cumulative effects analysis (SCEA). The SCEA was performed pursuant to 23 CFR Part 771 and the Council on Environmental Quality's guidelines contained in the document entitled *Considering Cumulative Effects under the National Environmental Policy Act*, January 1997.

Secondary Effects

Secondary effects consist of the impacts that would occur as a result of growth induced by an Action Alternative. For instance, if a sewer line were proposed through land that is currently vacant, the impact of building a home that is now feasible due to installation of that sewer line would be considered a secondary effect. The home is dependent upon the sewer line. For the purposes of the secondary effects analysis conducted for this EIS, if an alternative would enhance access to a particular undeveloped site (i.e., the Sarnoff property), thus enabling development of that site beyond that which would otherwise be permitted under local ordinances and approvals, the development of the site after road construction would be considered a secondary effect.

The time frame of the secondary effects analysis is from estimated time of completion for the Preferred Alternative (ETC) 2008 through Design Year 2028. This 20-year period is the design life of the project, which means the time period during which the project has been designed to be effective in terms of its purpose and need. The EIS employment projections for this time frame assume that, if an ESC road is not present, development on the Sarnoff site would be constrained to Phase I development which includes a total of 1.2 million square feet of office/research space. Because the Preferred Alternative would not include an ESC road, it would not result in secondary effects as defined by NEPA and CEQ guidance documents.

Cumulative effects

Cumulative effects are defined by the Council on Environmental Quality's (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) as:

"the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.7)."

In other words, cumulative effects look beyond the direct effects and secondary effects to account for general changes and developments in the study area. Cumulative effects are not caused by the action. Rather, cumulative effects attempt to describe the context in

which any action would exist. Thus, they provide an additional perspective for evaluating proposed action alternatives.

Traffic, Air Quality and Noise

Regional growth in traffic and its consequent air quality and noise impacts is largely determined by demographic changes in any given region. The magnitude of population and employment growth and patterns of development determine what impact growth will have on communities and the environment. The greater the growth and the more dispersed the land pattern, the greater the impact traffic will have.

Between 1980 and 2000, the Cumulative Effect Assessment (CEA) region added approximately 86,000 persons and 65,500 jobs. This represents a 64% increase in population and a 98% increase in employment. As shown in Table ES-7, the regional and local population and employment forecasts prepared for the EIS and incorporated into the EIS travel demand forecasting model project a 42% increase in population and a 76% increase in employment within the CEA region by 2028. The cumulative effects of this growth and development in terms of increased traffic and its consequent air quality and noise impacts are presented in the EIS as part of the analysis of the action and No-Action Alternatives.

The air quality and noise impact analyses conducted as part of the EIS appropriately utilized these cumulative traffic forecasts. The results of the air analysis indicate that the Preferred Alternative would not cause a violation of the National Ambient Air Quality Standards in the core study area. Thus, the cumulative impact with the Preferred Alternative would not be adverse.

The results of the noise analysis indicate that existing conditions, as well as conditions under the No-Action and Preferred Alternatives at some locations, violate federal noise standards. Consequently, overall, the Preferred Alternative was determined to have an incremental noise impact due to cumulative traffic in the core study area.

Table ES-7
CEA Region Population & Employment Forecasts

	Base year *	2028	Absolute Change	Percent Change
Population	217,000	307,000	90,000	42%
Employment	143,000	251,000	108,000	76%

* Base year = 1999, 2000, or 2001 depending on data source.

Sources: US Census Bureau, DVRPC, NJTPA, NJDOL, Urbitran Associates

Wetlands

Of the total 23,696 acres of wetlands within the CEA study area, 236.61 acres would be impacted by Design Year 2028. Of this total, 159.59 acres are anticipated to occur over the next 25 years, representing 0.67% of the total wetlands present in the CEA study area. Of the 236.61 acres of cumulative wetland impact, 0.18 acres or 0.08% is attributable to

the potential implementation of the Preferred Alternative. This 0.18 acres of wetland impact represents 0.00075% of the 23,696 acres of existing wetlands within the CEA study area. Based on this information, and with proper adherence to and enforcement of state and federal wetland regulations, the portion of cumulative wetland impacts in the CEA study area would be negligible. Table ES-8 below provides a summary of potential cumulative wetland impacts in the CEA region.

**Table ES-8
Summary of Past, Present & Reasonably Foreseeable
Wetland Impacts in CEA Study Area**

<i>TIME FRAME</i>	Wetland Impacts (acres)	% of Cumulative Wetland Impacts	% of Total Wetlands in CEA Study Area
Past (1988-2001)	76.84	32.48%	0.32%
Present & Reasonably Foreseeable (2001– 2028)	159.59	67.45%	0.67%
Estimated Time of Completion (2008) – Preferred Alternative	0.18	0.08%	0.00075%
<i>TOTALS</i>	236.61	100%	1.0%

Impervious Surface

Given past trends and future forecasts for growth in population and employment, it is reasonable to assume that developed land in the CEA could increase at a rate similar to that of the past 25 years. Assuming a 3% annual increase in developed land through the year 2028, this consumption would yield an additional 38,400 acres of developed land in the CEA. Assuming a similar proportion of impervious surface will be present in the future, this growth rate would yield an estimated 10,400 acres of additional impervious surface by 2028. As shown in Table ES-9, the Preferred Alternative would contribute less than half of one percent to the cumulative impervious cover effects that can be anticipated in the CEA.

**Table ES-9
Summary of Past, Present and Reasonably Foreseeable
Impervious Surface in CEA Study Area**

Timeframe	Pavement (acres)	Percent of Cumulative Paved Surfaces
1996	10,700	50.64%
1996-2028	10,400	49.22%
Preferred Alternative	28.21	0.13%
<i>CUMULATIVE TOTAL</i>	21,128	100%

Floodplains

Flood-prone areas within the CEA study area total approximately 16,989 acres or 26.55 square miles. The NJDEP regulates development affecting floodplains under the Flood Hazard Area Control Act N.J.A.C. 7:13. These regulations provide protections for floodplains from physical disturbance, as well as control the discharge of runoff from paved surfaces to floodplains and water bodies. Under these regulations, a stream encroachment permit must be obtained for development that would either directly impact a floodplain or discharge stormwater to a regulated floodplain. Private development must also include stormwater management measures to comply with municipal drainage requirements.

As previously noted, a total of approximately 21,100 acres of impervious surfaces may cover the CEA study area by 2028. The additional impervious surface which would result from the Preferred Alternative brings this total to approximately 21,128 acres. The project portion of cumulative impervious surfaces in the CEA would be negligible as compared to cumulative impacts overall.

Surface Water Quality

Development in the CEA study area has and will continue to cumulatively impact surface water quality. As land is developed, temporary soil erosion/sedimentation impacts could result from clearing and grading sites. As described above, the amount of impervious surface in the CEA region is expected to grow as a result of the conversion of open land to development. Non-point source pollution contained in runoff from impervious surfaces would be expected to contribute nutrients and sediment, as well as deicing salts, heavy metals, oils and greases, and other contaminants to the waterbodies.

Although future development can be expected to continue to adversely affect surface water resources in the CEA study area, adherence to stringent NJDEP and D&RCC stormwater management regulations will partially mitigate impacts to surface water features during and after construction. The project contribution in the context of overall water quality in the CEA study area is incremental.

Groundwater Recharge

The NJDEP recently enacted new design and performance standards that focus on water quality protection and recharge enhancement. These regulations, established new guidelines for the development of municipal and regional stormwater management plans. It is anticipated that the Preferred Alternative, and other projects in the CEA, would be subject to these more stringent regulations. Thus, regulatory requirements that encourage groundwater recharge and land preservation efforts will provide some compensation. Strong local, county and state initiatives to preserve parklands and open space will help to offset reduced groundwater recharge resulting from increased impervious surfaces in the CEA.

Historic and Archeological Resources

A variety of historic architectural and archaeological resources are located within the project study area. These include historic districts, structures, cemeteries, bridges,

archaeological and other sites. Potential impacts to cultural resources in the CEA study area are significant due to on-going development pressure. Federal and state funded projects are required to recognize and assess impacts on cultural resources. This regulatory requirement provides some measure of protection. Protection of cultural resources threatened by private development is the purview of municipalities. Some municipal governments enact historic preservation ordinances; however, ordinances are often weak in terms of requiring property owners and developers to identify and protect cultural resources. The CEA study area communities are fortunate to have active historical organizations and interested individuals. These entities provide some protective benefit by alerting agencies to threatened resources, and pressing for their protection.

As previously described, the Preferred Alternative would potentially impact a variety of cultural resources located in the study area. Although this would be a relatively small number of resources in the context of the much larger number of resources in the CEA study area, it is a notable number considering the small size of the study area and the nature of the Preferred Alternative. As with the other NEPA issues, selection and development of the Preferred Alternative must consider means to avoid, or at least minimize adverse cultural resource impacts, and must provide appropriate mitigation to overcome adverse impacts.

Open Space Resources

Growth in the PSA and CEA through Design Year 2028 is expected to consume a significant part of remaining undeveloped lands. The pressures to preserve land for parks and open space in the CEA study area are great due to on-going development. Mercer and Middlesex counties both have active land preservation programs and many of the CEA region municipalities have dedicated sources of local revenue to purchase open space. Over the past two decades, these programs have been successful in permanently preserving a significant amount of open space in the CEA region. The Preferred Alternative would not physically impact dedicated parks or open space. Although the Preferred Alternative may cause some localized auditory or visual intrusion due to changes in traffic volumes on existing roads in the study area, in the cumulative context, it would have a negligible adverse impact on the open space resources in the CEA.

In summary, throughout the 2028 SCEA timeframe, residential, research/development and office development is expected to continue to occur throughout the CEA study area. This growth and development is likely to result in impacts to most of the resources identified in the SCEA. As explained above, regulations have been and are expected to be enacted specifically to protect many of these resources. These regulations require that project sponsors make all reasonable efforts to avoid impacts, minimize unavoidable impacts, and, as appropriate, implement compensatory mitigation for unavoidable resource impacts.

CONSTRUCTION IMPACTS

Construction impacts are consequences of activities undertaken during the construction phase of a project. These impacts are considered to be temporary, and are distinct from permanent impacts presented in other sections of the EIS. As is common in the

preparation of an EIS, because of the conceptual nature of the alternatives, the consideration of potential construction impacts is necessarily general in nature. Developing a detailed construction approach typically occurs during the design phase of a project, when specific alignments are known. Development of a construction approach during the design phase of project development ensures that the project can be built while avoiding or minimizing to the greatest extent possible adverse temporary effects on the natural and built environments.

Natural Resources Protection

The NJDEP regulatory framework specifies strategies that would have to be used during construction of the Preferred Alternative to avoid or minimize impacts to natural resources. The Flood Hazard Control Regulations (NJAC 7:13-1.1 et seq), the NJDEP's *Technical Manual for Stream Encroachment*, the Freshwater Wetlands Protection Act Rules (NJAC 7:7A), and *Regulations for the Review Zone of the Delaware and Raritan Canal State Park* (NJAC 7:45-1.1 et seq) mandate that areas of temporary disturbance be minimized during construction; disturbance areas be delineated and fenced; and, ultimately, temporarily disturbed areas be restored at the end of the construction period.

Maintenance and Protection of Traffic

Construction of the Preferred Alternative would occur in stages over approximately a 3-year period. A project construction phasing plan and appropriate traffic control plan would be developed during final design to coordinate construction activities and minimize disruption of traffic movements. Public awareness programs to inform residents and motorists about potential construction delays and patterns would be implemented by the NJDOT. Every effort would be made to avoid, or at least minimize, traffic impacts. During final design, a detailed construction phasing plan would be developed for the Preferred Alternative, including not only Route 1 but also the Northeast Corridor bridge crossing, Washington Road, Vaughn Drive and the east- and west-side connectors, as they apply. The overall phasing plan must also consider activities external to the project, such as the Alexander Road Bridge replacement project. Special attention would be paid to ensuring that the construction phasing and traffic control plans of multiple projects work together to minimize traffic impacts. In addition, a traffic control plan would be developed to accommodate traffic movements that existed on roadways immediately prior to the construction period to the greatest extent practicable.

Community Protection

Construction activities can have adverse visual and auditory impacts on the community in which they occur. In some cases, impacts can be avoided by carefully locating material stockpile and equipment storage areas away from places where people live. More than likely, however, some impacts are unavoidable, and best efforts must be used to minimize the adverse impacts of construction. A key component in community protection is keeping the community apprised of activities during construction. Community awareness minimizes surprises and allows the community to prepare for activities that may impact them. To the greatest extent possible, the community would be kept informed of the elements of each construction stage that have the potential to affect them: traffic management, unavoidable noisy operations and activity durations, for example. Other

efforts include physical protections. The placement and maintenance of fencing around the work area would contain the work activity and protect the community from potential construction hazards.

Construction may result in short-term impacts to local air quality resulting from construction equipment activities, temporary changes in traffic operations and distribution, and soil exposure. NJDOT *Standard Specification, 107.28 Environmental Protection, Section 2 – Control of Noise and Air Pollution*, would be followed during construction periods to minimize construction related air quality impacts. An appropriate traffic control plan, previously described, may limit localized emissions during construction. Soil erosion control measures on the worksite would minimize airborne dust: vegetative stabilization of soils and/or wetting of soils within the construction zone, and transport of topsoil in tarpaulin-covered trucks, among other techniques.

The area adjacent to the construction right-of-way for the Preferred Alternative would experience an increase in noise levels during construction. Generally, roadway construction involves land clearing and grading, placing of structures, and paving. As previously described, the Preferred Alternative would include the construction of Route 1 in-a-cut. Preliminary geotechnical borings along Route 1 suggest that rock removal can be undertaken for Route 1 in-a-cut using typical excavation methods. NJDOT's standard construction noise mitigation measures would be included in the specifications for the Preferred Alternative to minimize noise impacts during construction. To minimize the duration of high noise levels, noisy operations should be scheduled concurrently as the combined noise level would not be significantly greater than the level produced if the operations were done separately, and the duration of the activities would be less.

PERMITS AND APPROVALS

Various permits at the federal, state, and local levels would be required to construct the Preferred Alternative. Permit applicability would be re-evaluated during design through agency coordination and would involve examining the current regulations at the time. A description of these permits is given below, including the jurisdiction and requirements of the different regulatory agencies.

- **Delaware and Raritan Canal Commission Approval**
- **New Jersey Department of Environmental Protection**
 - Freshwater Wetlands Permit
 - New Jersey Pollution Discharge Elimination System (PDES) – Statewide General Permit
 - Stream Encroachment Permit (SEP)
 - Section 401 Water Quality Certificate (WQC)
 - New Jersey No Net Loss Reforestation Act Compliance

