4.12 Aesthetics

The Federal Highway Administration guidelines specify that impacts to visual resources be evaluated from two perspectives: the appearance of the project from the surrounding areas, and the appearance of the surrounding areas from the project (FHWA, 1988). Viewers from the surrounding areas include residents of the Penns Neck and Lower Harrison Street neighborhoods, customers and employees of the businesses in the area. Other viewers might be users of the Princeton recreation fields and pedestrians along Washington Road or users of the D&R Canal Park. Viewers of the surrounding area from the project include drivers along Route 1, Washington Road, Harrison Street and new roadways contemplated under the Action Alternatives. These drivers would be comprised of local users, including residents of area neighborhoods and customers of area businesses and regional users, including commuters along Route 1 that work in or outside of the study area.

Potential visual impacts could include encroachment of new roadways on existing viewsheds, visual compatibility of a new roadway design with the surroundings, and views created by construction of a new roadway, both from the roadway and of the roadway.

4.12.1 No-Action Alternative, Aesthetics

The No-Action Alternative would preserve existing roadways and travel patterns, and would involve no new construction. The only potential visual impact would be increased traffic on existing roadways. The No-Action Alternative is expected to increase peak period congestion and queues on Washington Road, Harrison Street, and Alexander Road which would have an added visual impact on the D&R Canal Park and elm allee compared to existing conditions.

4.12.2 Action Alternatives, Aesthetics

The components of the Action Alternatives were evaluated in terms of their potential to impact the identified visual resources. A ranking system having the categories negative, neutral, and positive was used to rate the components. The total number of impacts was tallied for each alternative and the percent of each category was reported. The No-Action Alternative is assumed to have a neutral impact.

It should be noted that two of the visual resources, the Sarnoff Corporation lawns and Princeton University fields are to be developed within the design and construction timeframe of this project. As a consequence, impacts to these visual resources have been given a neutral rank.

Route 1 in-a-cut:
Residents and businesses on Route 1 currently have a direct view of Route 1. Residents and businesses on the west side of Route 1 have some view of the fields

across Route 1. It is proposed to shift Route 1 to the west and depress it under Washington Road. For safety reasons, Route 1 would have to be fenced in, potentially by a 6-8 foot fence. A neutral rating for other viewers was selected because although Route 1 in-a-cut would improve views for residents and businesses, fencing would detract from that improved view. If Route 1 is depressed, drivers at this intersection would have no views, a negative impact.

Route 1 in-a-cut, Alternatives D and D.2:
Action Alternatives D and D.2 would provide the opportunity to consider constructing a covered section over a portion of Route 1 in-a-cut. This cover section would not have to be fenced and would have the positive impact of providing the opportunity to create community open space. If Route 1 is in-a-cut, drivers at this intersection would have no views, a negative impact.

Route 1 at-grade:
Route 1 at-grade would not change any views from or of the roadway, thereby having a neutral impact on all viewers. The proposed intersection modifications would be minor for the Action Alternatives, and the visual resources nearest the intersection, the Princeton Baptist Church and Cemetery at Penns Neck, would not be affected.

Western Frontage Road:
Aside from an area south of the PSE&G substation, the view from the west side of Route 1 is primarily wooded. Route 1 in-a-cut would shift Route 1 to the west, and the addition of the frontage road would increase the width of pavement in the vicinity of Route 1 and add a new traffic corridor. These changes are considered to have a neutral visual impact to viewers and drivers.

Eastern Frontage Road:
This frontage road would add new pavement and a travel way alongside Route 1 and would impact the view of the Sarnoff lawns for viewers as well as drivers on Route 1. It should be remembered that the permitted General Development Plan for the Sarnoff Corporation, however, proposes development on much of the lawn on Route 1. Therefore, the views that would be obscured by an eastern frontage road would not be the open sweeping lawns that currently exist. These changes are considered to have a neutral visual impact to viewers and drivers.

East-side connector road (ESC1):
The ESC1 east-side connector road would follow an alignment through the northern part of the Sarnoff Corporation property. The road could create public (driver) views of the Millstone River, and would be a positive impact. Views from the Millstone River of the Sarnoff property would change with the addition of the road. Employee views of the Sarnoff lawns and river fringe from existing roadways would be reduced. It should be remembered that the permitted General Development Plan for the Sarnoff Corporation, however, proposes development on much of the property. These changes are considered to have a neutral visual impact to viewers.

ESC2:
The ESC2 east-side connector road would follow an alignment through the central portion of the Sarnoff facility across the open lawns that front on Route 1 and those on the central part of the property. The road could create public (driver) views of the Millstone River, and would be a positive impact. Employees' views of the Sarnoff lawns and river fringe from existing roadways would be reduced. It should be remembered that the permitted General Development Plan for the Sarnoff Corporation, however, proposes development on much of the property. These changes are considered to have a neutral visual impact to viewers.

ESC3:
The ESC3 east-side connector road would follow an alignment across the southern portion of the property. The road could create public (driver) views of the Sarnoff property, and would be a positive impact. The road would be located adjacent to the Penns Neck neighborhood, and would impact views for residents of Fisher Place. The road would also impact Sarnoff's oak-lined entrance driveway. However, it should be remembered that the approved General Development Plan for the Sarnoff Corporation proposes development on much of the property, including modification of their Fairview driveway that might affect the oaks. For these reasons, the changes are considered to have a negative visual impact to viewers, and neutral impact to drivers.

West-side connector road to Harrison Street: Alternatives A, A.1, A.2, A.3, A.4, D, D.2, F, F.1
Drivers could have a view of the Princeton University fields. It should be remembered that the University intends to develop this property such that the fields may not exist in 2028. Residents and businesses on Harrison Street would have a view of the road. The aggregate ratings for this alternative would be negative to viewers, and neutral to drivers.

Alternative D.1
The west-side connector in this Alternative would impact the view of the Princeton University fields from Eden Way and would change views of Eden Way by residents on that road. It should be remembered that the University intends to develop this property such that the fields may not exist in 2028. Due to the change in the use and appearance of Eden Way, a negative viewer impact would occur and a neutral impact to drivers.

Alternative E
The west-side connector would cut through fields that are not accessible by public roads and views of the Princeton University fields could be created for drivers. It should be remembered that the University intends to develop this property such that the fields may not exist in 2028. Residents on Harrison Street and Eden Way, however, would have a view of the road. The aggregate ratings for this alternative would be negative to viewers, and positive to drivers.

West-side Connector Road to Washington Road:
Alternative B, B.1
The proposed connector to Washington Road would follow an alignment parallel to the D&R Canal Park along an existing private road. This would open the fields to drivers' views. Viewsheds for users of the athletic fields could be impacted by the location of the road. However, it should be remembered that the University intends to develop this property such that the fields may not exist in 2028. Therefore, the rating for both drivers and viewers is neutral in this regard. The road may be visible to Park users in some places, although adequate screening would be provided through coordination with the D&R Canal Commission. The point where the connector road would join Washington Road could require the removal of some trees from the Washington Road Elm Allée. The aggregate ratings of this component would be negative for viewers and neutral for drivers.

Alternative B.2
The B.2 west-side connector alignment would follow and alignment through the Princeton fields partly along an existing internal road, cross Washington Road, and terminate at Alexander Road. This alignment would impact create views of the Princeton University fields for drivers, but would impact views of the fields. However, it should be remembered that the University intends to develop this property such that the fields may not exist in 2028. Therefore, the rating for both drivers and viewers is neutral in this regard. The road would impact some trees at the middle of the Elm Allée. The aggregate ratings of this component would be negative for viewers and neutral for drivers.

West-side connector road between Alexander Road and Washington Road:
Alternative C
This west-side connector road would have visual effects similar to those of Alternative B.2. Because the connector road would cross University fields and impact a part of the allée. The aggregate ratings of this component would be negative for viewers and neutral for drivers.

Loop-type interchange (vicinity of Harrison):
The grade separated loop ramp interchange would change existing views of the Sarnoff lawns. It should be remembered that the approved General Development Plan for the Sarnoff Corporation proposes development on much of the property. The ratings for viewers and drivers are neutral.

Diamond interchange (vicinity of Harrison Street):
The diamond interchange would impact the Sarnoff lawn in a similar way to the loop-type interchange, although the area of impact would be smaller. The ratings for viewers and drivers are neutral.

Diamond interchange (just north of Fisher Place):
The diamond interchange would impact the Sarnoff lawn in a similar way to the loop-type interchange, although the area of impact would be smaller. This component

would impact views of nearby residents on Route 1 north of Fisher Place. The rating for viewers would be negative and neutral for drivers.

Vaughn Drive Connector Road:
Each of the three options would impact a portion of the mature pine trees along Princeton-Hightstown Road. The ratings for viewers and drivers would be negative.

Action Alternatives G, G.1, and G.2:
The G Action Alternatives would focus on intersection improvements that would not impact visually sensitive resources. The ratings for these alternatives are neutral.

Table 4-31 summarizes the visual impacts of each alternative. The visual impacts for each component are listed, for drivers and other viewers and then summed in the table. The table shows that the visual impacts of the Action Alternatives are 50 to 100 percent neutral depending on the alternative. Positive impacts range from 0 to 10 percent, and negative impacts range from 0 to 43 percent. neutral. The G Alternatives would result in no negative visual impacts.

A number of components would have adverse visual impacts, including:

- Route 1 in-a-cut would impact views for drivers.
- The west-side connector road to Harrison Street could impact views for residents and businesses along Harrison Street and Eden Way. The West-side connector road to Washington Road and Alexander Road could impact views of the Elm Allée.
- The east-side connector road (ESC3) that travels along the southern edge of the Sarnoff property would impact views for the residents on Fisher Place.
- The Vaughn Drive Connector would impact views of the pine grove at the corner of the Sarnoff property.

There are potentially positive visual impacts from some of the components including:

- All Action Alternatives would preserve wooded river fringe along the Millstone River. Alternatives that include the east-side connector road closest to the river have the potential to introduce drivers to views of the Millstone River.
- New, optional open space on top of Route 1 in Action Alternative D could be visually enhanced.

Action Alternatives D.1 and E have the highest number of negative visual impacts (5 and 6 respectively). Action Alternatives A, E and F have the highest proportion of negative impacts, compared to their neutral and positive impacts (40, 43 and 40 percent respectively).

Action Alternatives C, C.1, E, G, G.1, and G.2 would have no positive visual impacts, only negative and neutral visual impacts. Action Alternatives G, G.1 and G.2 have only neutral impacts. Action Alternative D is the only Action Alternative with two

potential positive impacts. Alternatives D and D.2 are the only Action Alternatives that would provide the opportunity to consider constructing a covered section over Route 1 in-a-cut that could be landscaped and developed as public open space.

Table 4-31
Summary of Visual Impacts

Alternative	Route 1 in-a-cut		Route 1 at-grade		Eastern frontage road		Western frontage road		East-side connector road		West-side connector road to Harrison Street		West-side connector road to Washington Road		West-side connector road between Alexander Road and Washington Road		Loop-type interchange (vicinity of Harrison)		Diamond interchange (vicinity of Harrison		Diamond interchange (just north of Fisher Place)		Vaughn Drive connector road		Tallies				Percents		
	Viewers	Drivers	Viewers	Drivers	Viewers	Drivers	Viewers	Drivers	Viewers	Drivers	Viewers	Drivers	Viewers	Drivers	Viewers	Drivers	Viewers	Drivers	Viewers	Drivers	Viewers	Drivers	Viewers	Drivers	Positive	Neutral	Negative	Totals	Positive	Neutral	Negative
A	◎	◎							◎	●	◎	◎					◎	◎					◎	◎	1	5	4	10	10	50	40
A.1	●	○			●	●	●	●	●	●	○	●					●	●					○	○	1	9	4	13	8	62	31
A.2	●	○			●	●	●	●	●	●	○	●					●	●					○	○	1	7	4	12	8	58	33
A.3	●	○			●	●	●	●	●	●	○	●							●	●			○	○	1	9	4	14	7	64	29
A.4	●	○			●	●	●	●	●	●	○	●							●	●			○	○	1	9	4	14	7	64	29
B			◎	◎					◎	●			◎	◎			◎	◎					◎	◎	1	6	3	10	10	60	30
B.1			●	●					●	●			○	●			●	●					○	○	1	6	3	10	10	60	30
B.2			●	●					●	●			○	●			●	●					○	○	1	6	3	10	10	60	30
C			◎	◎			◎	◎											◎	◎			◎	◎	0	6	2	8	0	75	25
C.1			●	●			●	●							○	●			●	●			○	○	0	7	3	10	0	70	30
D	●	◎			◎	◎	◎	◎	●	●	◎	◎							◎	◎			◎	◎	2	8	4	14	14	57	29
D.1	●	○			●	●	●	●	○	●	○	●							●	●			○	○	1	8	5	14	7	57	36
D.2	●	○			●	●	●	●			○	●							●	●			○	○	1	7	2	10	10	70	20
E	◎	◎			◎	◎	◎	◎	◎	◎	◎	◎									◎	◎	◎	◎	0	8	6	14	0	57	43
F	◎	◎							◎	●	◎	◎					◎	◎					◎	◎	4	6	4	10	10	50	40
F.1	●	○			●	●	●	●	●	●	○	●					●	●					○	○	1	9	4	14	7	64	29
G			◎	◎																			◎	◎	0	4	0	4	0	100	0
G.1			●	●																			●	●	0	4	0	4	0	100	0
G.2			●	●																					0	2	0	2	0	100	0

Positive	Neutral	Negative
●	◎	○

4.12.3 Mitigation Measures, Aesthetics

Potential visual impacts of the Action Alternatives are being addressed through on-going context sensitive design efforts as part of the EIS process (see Sections 1.6 and 4.4.3.8). Context sensitive design encourages transportation officials to collaborate with community stakeholders to ensure the design of an action reflects the goals of the people who live, work, and travel in the area. Through this collaborative process, the selected Action Alternative is integrated into the existing terrain and environment.

Specific actions could mitigate the potential visual impacts of major construction. Route 1 in-a-cut's negative impact to drivers' views could be mitigated by utilizing concrete form liners for the walls within the drivers' viewsheds, considering under-bridge lighting, or painting the under-bridge area. Additionally, visual impacts for drivers along Washington Road could be mitigated by thoughtful design of safety walls and fencing.

Potential visual impacts on residents and businesses along Harrison Street and Eden Way would be mitigated with an appropriate vegetated, landscaped buffer within the right-of-way.

Although the loss of up to four allee trees could result from an Action Alternative, the opportunity exists to enhance the allee as a mitigation measure. For example, new tree plantings appear to be needed to fill in gaps where mature trees have died and been removed. Supplemental elm tree plantings may also be appropriate to unify the appearance of the allee, particularly at its end points.

Potential tree and shrub replacements along Washington Road would be carefully coordinated with the existing allée, planting the same species (*Elmus americanus*) where possible and logical. Along other proposed right-of-way areas, an emphasis on native plant materials may be appropriate because of their resistance to disease and pests, low maintenance, and support of the local ecological habitat. Alternatively, a program to plant new elm or other tree species corridors adjacent to new roadways could be recommended.

Impacts to the mature pine grove on the Sarnoff property could be mitigated by planting trees which offer the same visual and screening properties as the existing trees. Tree replacement could be done according to a 2:1 ratio, planting the same species where possible and logical, with an emphasis on native plant materials because of their resistance to disease and pests, low maintenance, and support of the local ecological habitat. If guide rail is warranted, rails with wooden posts and cor-ten steel with a W-beam could be recommended and used pending NJDOT approval. Use of cor-ten steel, which rusts to a brown color, and wood posts would minimize the visual impact of these guard rails.

Some visual resources, including the Millstone River and Princeton fields, have the potential to be revealed as new views to users of the proposed roadway network. All Action Alternatives would preserve wooded river fringe along the Millstone River. Alternatives that include the east-side connector road closest to the river have the potential to introduce drivers to views of the Millstone River. As noted, the river is an important visual and natural resource with the potential to link natural and historic resources throughout central New Jersey. If an east-side connector is selected, the feasibility of providing a pedestrian route along the river would be explored as a mitigation strategy.

4.13 Construction Impacts

The following discussion of construction impacts focuses on the Action Alternatives as the No-Action Alternative would involve no construction activity.

4.13.1 Natural Resources Protection

The NJDEP regulatory framework specifies strategies that would have to be used during construction of any Action 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.

During the final design phase of a project, drawings would be submitted to the NJDEP as part of the permit review and approval processes. These drawings must indicate the strategies that would be used to protect natural resources during construction. Strategies likely to be applied to design of an Action Alternative would include minimizing the construction disturbance area to the greatest extent possible, particularly at or near waterways and forested areas, protecting vegetation near watercourses, applying appropriate soil erosion and sediment control strategies, and restoring temporarily disturbed areas at the end of construction.

The NJDOT's *Standards for Soil Erosion and Sediment Control* were developed from the Natural Resource Conservation Service's *Standards for Soil Erosion and Sediment Control in New Jersey*, and contain specific requirements for stabilizing temporarily exposed soils and protecting waterways from the effects of erosion and soil movement. These standards typically require vegetative stabilization of exposed soils, use and proper maintenance of protective silt fencing and other devices to contain soils, temporary drainage systems, and, ultimately, permanent restoration of disturbed areas and permanent vegetative stabilization.

4.13.2 Traffic and Circulation

Construction of an Action 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.

A purpose of a construction phasing plan is to avoid, or at least minimize, traffic impacts. The following conceptual phasing plan for Route 1 in-a-cut demonstrates that traffic movements can be accommodated on Route 1 and east-west cross streets throughout the construction period. During final design, a detailed construction phasing plan would be developed for the entirety of an Action Alternative. The overall phasing plan must also consider activities external to the project, such as the Alexander Road Bridge replacement project and high traffic-generating events at Princeton University. Special attention would be paid to ensuring that the construction phasing and traffic control plans of multiple projects work together to minimize traffic impacts.

A conceptual level plan for staging construction of Route 1 in-a-cut includes four phases:

Stage 1 – The first stage of construction would be to construct a temporary road along the western side of Route 1. This roadway would be three lanes and would accommodate Route 1 southbound traffic. This roadway would be constructed with no impacts to existing traffic. It should be noted, that if an alternative is chosen that includes frontage roads, the construction of the temporary road would utilize this same alignment and become the permanent frontage road at the completion of the project.

Stage 2 – Route 1 southbound traffic would be shifted to the temporary road and the traffic signal at Fisher Place would be removed. Washington Road traffic across Route 1 would be shifted to the north to allow for the construction of the first half of the Washington Road bridge over Route 1. Temporary traffic signals would be constructed at the intersections of northbound and southbound Route 1 and Washington Road. Northbound Route 1 traffic would remain in its current location. Excavation of Route 1 and the construction of retaining walls along Route 1 would begin.

Stage 3 – Washington Road traffic would be shifted to the newly constructed bridge across Route 1. The remaining portion of the Washington Road bridge would be completed. Construction operations described in Stage 2 would continue.

Stage 4 – Once the western portion of Route 1 is completed, northbound traffic would be shifted to this portion of the roadway. Southbound Route 1 traffic would

remain on the temporary roadway as discussed in Stage 1. The Route 1 northbound roadway would be constructed including the necessary excavation and construction of the retaining walls. At the completion of this stage, Route 1 traffic would be shifted to its proper location and the temporary roadway would be removed as necessary.

The purpose of a traffic control plan is to accommodate traffic movements that existed on roadways immediately prior to the construction period to the greatest extent practicable. A traffic control plan would be developed along with a construction phasing plan during final design of an Action Alternative. Using the guidance provided in the *Manual of Uniform Traffic Control Devices*, the traffic control plan would specify where, how and when travel lanes would be maintained, what routes should be provided, when and where closures are necessary, and how signage should be presented to orient motorists.

4.13.3 Community Protection

Construction activities can have adverse 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. 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. Community awareness minimizes surprises and allows the community to prepare for activities that may impact them.

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.

4.13.4 Air Quality

The proposed improvements may result in minor, short-term impacts to local air quality resulting from construction activities and temporary changes in traffic operations and distribution. Vehicle emissions and localized concentrations of CO may also increase as a result of construction. An increase in particulates can also be expected as a result of topsoil disturbance and equipment operation during construction. These impacts would be short-term and can be minimized by standard erosion control strategies, including transport of topsoil through tarpaulin-covered trucks, and selected wetting of soils within the construction zone. 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. Appropriate traffic control plans may also serve to limit localized concentrations of emissions during construction.

4.13.5 Noise

The area adjacent to the construction right-of-way of an Action Alternative would experience an increase in noise levels during construction. Construction would involve clearing, grubbing, rough grading, structures and paving. Equipment such as bulldozers, scrapers, backhoes, graders, loaders, cranes and trucks would be used in the construction process and would be subject to construction noise specifications. Table 4-32 lists typical noise levels for various types of construction equipment.

The measures listed below which are part of the NJDOT's standard construction noise mitigation measures and would be included in the project specifications to minimize noise impacts during construction.

1. All construction equipment powered by an internal combustion engine shall be equipped with a properly maintained muffler.

2. Air compressors shall meet current USEPA noise emission exhaust standards.

3. Air powered equipment shall be fitted with pneumatic exhaust silencers.

4. Stationary equipment powered by an internal combustion engine shall not be operated within 150 feet of noise sensitive sites without portable noise barriers placed between the equipment and the noise sensitive sites. Noise sensitive sites shall include residential buildings, motels, hotels, schools, churches, hospitals, nursing homes, libraries and public recreation areas. Portable noise barriers shall be constructed of plywood or tongue and groove boards with a noise absorbent treatment on the interior surface (facing the equipment).

5. Powered construction equipment shall not be operated before 8 a.m. or after 8 p.m. within 150 feet of a noise sensitive site.

6. To minimize the duration of high noise levels, noisy operations should be scheduled concurrently to take advantage of the phenomena that the resultant noise level will not be significantly greater than the level produced if the operations were done separately, and their duration would be less.

Table 4-32
Noise Level dBA at 50 Feet
for Various Construction Equipment

Equipment (Earth Moving)	Noise Level (dBA)	Stationary	Noise Level (dBA)
Front Loader	79	Pumps	76
Back Hoes	85	Generators	78
Dozers	80	Compressors	81
Tractors	80	**Impact**	
Scrapers	88	Pile Drivers	100
Graders	85	Jackhammers	88
Truck	91	Rock Drills	98
Paver	89	**Other**	
Materials Handling		Saw	78
Concrete Mixer	85	Vibrators	76
Concrete Pump	82		
Crane	83		
Derrick	88		

Preliminary geotechnical borings along Route 1 suggest that rock removal can be undertaken for Route 1 in-a-cut using typical excavation methods. Rock blasting is considered a last resort in the event that solid rock is encountered during construction and no other excavation techniques prove feasible. The community would be informed of the need and schedule for such activities, which would adhere to local governmental requirements and NJDOT procedures.

4.13.6 Protection of Workers on the Construction Site

The community of construction workers on the job site must also be protected during construction activities. Construction specifications for an Action Alternative would include the provision for the development and use of a Health and Safety Plan. The Plan would identify procedures to be followed to ensure a safe working environment for workers on the job site, as well as specific procedures and contractor responsibilities to be followed in the event that a hazardous condition or emergency is encountered on the construction site.

4.13.7 Utilities

Construction of an Action Alternative would likely require the temporary or permanent relocation of utilities in the study area. Coordination of construction activities with local utility officials and implementation of staged construction would insure that continuous utility services are provided to local area residents and businesses.

4.14 Secondary and Cumulative Effects

Potential secondary and cumulative effects on the environment were assessed for the Action 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*" are those that are caused by an action, and are later in time or farther removed in distance, but are still reasonably foreseeable. These may include growth inducing effects, and other effects related to induced changes in the patterns of land use, population density or growth rate, and the related effects on the natural and/or socioeconomic environment (40 CFR 1508.8(b)).

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

> *"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.

Secondary and cumulative effects are, therefore, different and will be discussed independently of one another in this SCEA.

4.14.1 Scope of Study

The first step in conducting the SCEA was to define the scope of analysis in terms of resources analyzed, geographic study area, and timeframe of the study. The following defines the scope of this SCEA and explains the rationale used in identifying resources to be evaluated, the study area boundary, and the timeframe for the study.

4.14.1.1 Key Resources

The universe of resources initially considered for inclusion in this analysis were those resources directly affected by an Action Alternative. Ultimately, the selection of key resources for this study considered not only the local importance of a resource, but

also its importance on a more regional and cumulative level. The key resources selected and evaluated in this SCEA include:

Traffic, Air Quality and Noise
Wetlands
Impervious Surfaces
Floodplains
Surface Water Quality
Groundwater Recharge
Historical and Archaeological Resources
Open Space Resources

4.14.1.2 Geographic Study Areas

Secondary Effects
The study area for secondary effects was determined by answering the question of whether the implementation of a Penns Neck Area EIS Action Alternative would cause other development to occur consistent with the definition of secondary effects. The approved General Development Plan (GDP) for the Sarnoff property located in West Windsor Township provides for up to 3 million square feet of office/research space and associated parking areas at the site. The GDP requires that a roadway functionally equivalent to an east-side connector (ESC) be constructed to accommodate traffic demand generated by development on the site beyond Phase I of the approved GDP. Phase I development would add 600,000 square feet of new office/research space to the existing 600,000 square feet of research space. Development of the site beyond Phase I is directly linked to the construction of a road facility similar to the ESC roads proposed in some of the Action Alternatives. Aside from the Sarnoff property, there are no other development proposals or approvals contingent upon the construction of a Penns Neck area improvement. Therefore, the study area for secondary effect analysis was limited to the Sarnoff property.

Cumulative Effects
Definition of the geographic study area for the cumulative effects analysis (CEA) considered a variety of geographic inputs including the following:

- Project impact zone. The project impact zone is the area that would be affected by any Action Alternative. This area is located in West Windsor Township, Mercer County, and a portion of Plainsboro Township, Middlesex County. The project impact zone is illustrated on Figure 4-75.

- Primary Study Area (PSA). The PSA includes Plainsboro Township, Princeton Borough, Princeton Township, and West Windsor Township. These municipal jurisdictions are also illustrated on Figure 4-75.

- The geographic area occupied by the key resources, within and outside of the project impact zone. Since many of the key resources to be evaluated in the CEA are related to the watershed, the geographic extent of the watershed was evaluated for inclusion in the CEA study area. All Action Alternatives are located within the Millstone River Watershed; Watershed Management Area (WMA) 10 in New Jersey's Raritan Basin. WMA 10 encompasses 24% of the Raritan Basin. The Millstone River WMA is further divided into three sub-watersheds: 1) the Millstone River above Carnegie Lake; 2) the Millstone River below Carnegie Lake; and 3) Stony Brook, which is a tributary to the Millstone River. The proposed action is situated in two of the three sub-watersheds within WMA 10: the Millstone (above Carnegie Lake) and the Stony Brook.[5] WMA 10 and the three sub-watersheds are illustrated on Figure 4-75.

These three geographic inputs were overlaid to form the composite CEA study area illustrated in Figure 4-75. Of the three geographic areas, the project impact zone is the smallest, the PSA is larger, and the watershed is the largest geographic area. The CEA study area totals 104,850 acres or 163.83 square miles of land in Middlesex and Mercer Counties, New Jersey. In summary, the CEA study area can be defined as follows:

CEA Study Area = Project Impact Zone + PSA + Portion of WMA 10

Based on the foregoing decisions, the CEA study area includes the following local jurisdictions:

Mercer County:
- East Windsor (portion within WMA 10)
- Hightstown Borough
- Hopewell Borough
- Hopewell Township (portion within WMA 10)
- Lawrence Township (portion within WMA 10)
- Pennington Borough (portion within WMA 10)
- Princeton Borough (All)
- Princeton Township (All)
- West Windsor (All)

[5] WMA 10 encompasses 285 acres. Each of the Action Alternatives is situated in two of the three sub-watersheds within WMA 10: the Millstone Sub-watershed above Carnegie Lake and the Stony Brook Sub-watershed. These two sub-watersheds were included in the CEA study area, except for small portions of East and West Amwell Townships which are located at the far west end of the Stony Brook sub-watershed, in Hunterdon County.

The third sub-watershed of WMA 10 is the Millstone River (below Carnegie Lake) sub-watershed. This sub-watershed is predominately in Somerset County and includes Montgomery Township, Rocky Hill Borough, Hillsborough Township, Millstone Borough, Franklin Township and Manville Borough. It was determined that since the Action Alternatives do not lie within these municipalities, the portion of the sub-watershed in those municipalities could be excluded from the CEA study area. The portions of the sub-watershed that were retained in the CEA study area include portions of Princeton and Hopewell Townships in Mercer County and South Brunswick and Plainsboro Townships in Middlesex County, due to their close proximity.

Middlesex County:
Cranbury Township
Monroe Township (portion within WMA 10)
Plainsboro Township
South Brunswick Township (portion within WMA 10)

4.14.1.3 Study Time Frame

The implementing regulations for NEPA require that cumulative effects analysis address past, present and reasonably foreseeable actions. A definition of past actions is necessary to define the "start-date" of the analysis. For the Penns Neck Area EIS, it was necessary to look back in planning history to determine what major land use changes indicated the onset of development that has historically taken place throughout this Route 1 corridor.

It was determined that construction of the Princeton Forrestal Center and Quakerbridge Mall in 1978 was an important indicator of the large office complex/residential development that occupies the area today.[6] Therefore, 1978 was selected to be the "start-date" for the cumulative impact analysis. The horizon year of the EIS, 2028, was selected as a reasonable "end-date" for the analysis. This 25-year projection into the future is a time span for which planning projections can be made with a reasonable level of confidence and with the support of state, regional, county, and local planning documents. Therefore, this SCEA spans a 50-year period from 1978 to 2028.

4.14.1.4 Data Resources

This SCEA was performed using existing readily available data. In cases where data was not readily available, such was noted and discussed.

In the assessment of cumulative effects, it is necessary to identify all past, current and reasonably foreseeable projects that have, or will occur within the SCEA study area. With respect to the most unknown of these three, reasonably foreseeable future actions have been based on current municipal planning documents (i.e., county and township master plans) and on Federal, State and local agency plans for future projects, and known private actions.

[6] NJDOT, 1986. Route 1 Corridor Transportation Study.

The "Local Area Land Use Inventory and Forecast"[7] for the Penns Neck Area EIS presented growth trends in West Windsor Township, Princeton Borough, Princeton Township, and Plainsboro Township. These four PSA municipalities have experienced rapid population and employment growth over the last two decades and it is anticipated that this growth will continue at a similar rate. A primary factor in this trend is the availability of vacant land with appropriate zoning and with planning approvals already in place. Virtually all significant residential properties in the study area have some form of General Development Plan (GDP) approval, site plan approval, or are actively engaged in the approval process.

[7] Urbitran, July 29, 2002.

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4-75 Cumulative Effects Analysis (CEA) Study Area

Hunterdon County

Somerset County

Middlesex County

Mercer County

Monmouth County

Princeton

Plainsboro

South Brunswick

West Windsor

East Windsor

Lawrence

New Jersey Turnpike

1

130

31

206

95

295

Legend

WMA 10

- Millstone River (above Carnegie Lake)
- Millstone River (below/incl Carnegie Lake)
- Stony Brook
- WMA 10 Boundary
- Municipal Boundaries
- Project Boundary
- State Boundary
- CEA Study Area
- Roads

N

0 1 2 4 Miles

This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

The growth potential for the PSA was estimated by identifying the building potential of specific properties in each of the four municipalities. This analysis resulted in a comprehensive database that contains an estimate of likely growth potential.

While this growth forecast for the PSA is used in this SCEA, it is important to note that the PSA is smaller than the CEA study area. It includes four municipalities while the CEA study area includes all or portions of 13 municipalities.

Figures 4-76, 4-77, and 4-78 illustrate the future total development for residential, office and research/development land uses in the PSA, respectively.

4.14.2 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. In the case of the actions considered in the EIS, if an Action Alternative enhances access to a particular undeveloped site, thus enabling development of that site, the development of the site after road construction would be considered a secondary effect.

The time frame of the secondary effects analysis is from completion of an Action 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.

For those alternatives that include an ESC road, the EIS employment projections assume that market demand could result in an additional 1.2 million square feet of new office/research space and associated parking on the site by the Design Year 2028. Accordingly, total development on the site would be 1.8 million square feet or approximately 60% of the total space permitted under the GDP approval. The EIS employment projections 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 provision for an ESC road in some Action Alternatives would enable the development of an additional 600,000 square feet of space by 2028 (total of 1.8 million square feet), this increment of development and its associated impacts would be considered secondary effects of those alternatives. Table 4-33 provides a brief summary of development potential on the Sarnoff site and associated traffic and impervious cover effects.

Table 4-33
Summary of Potential Secondary Effects

	Full Build-out	2028 w/o ESC	2028 w/ESC	Secondary Effect
Development (square feet)	3,000,000	1,200,000	1,800,000	600,000
AM peak hour traffic (vehicles)	3,000	1500	2000	500
Impervious surfaces (acres)	78	31	47	16

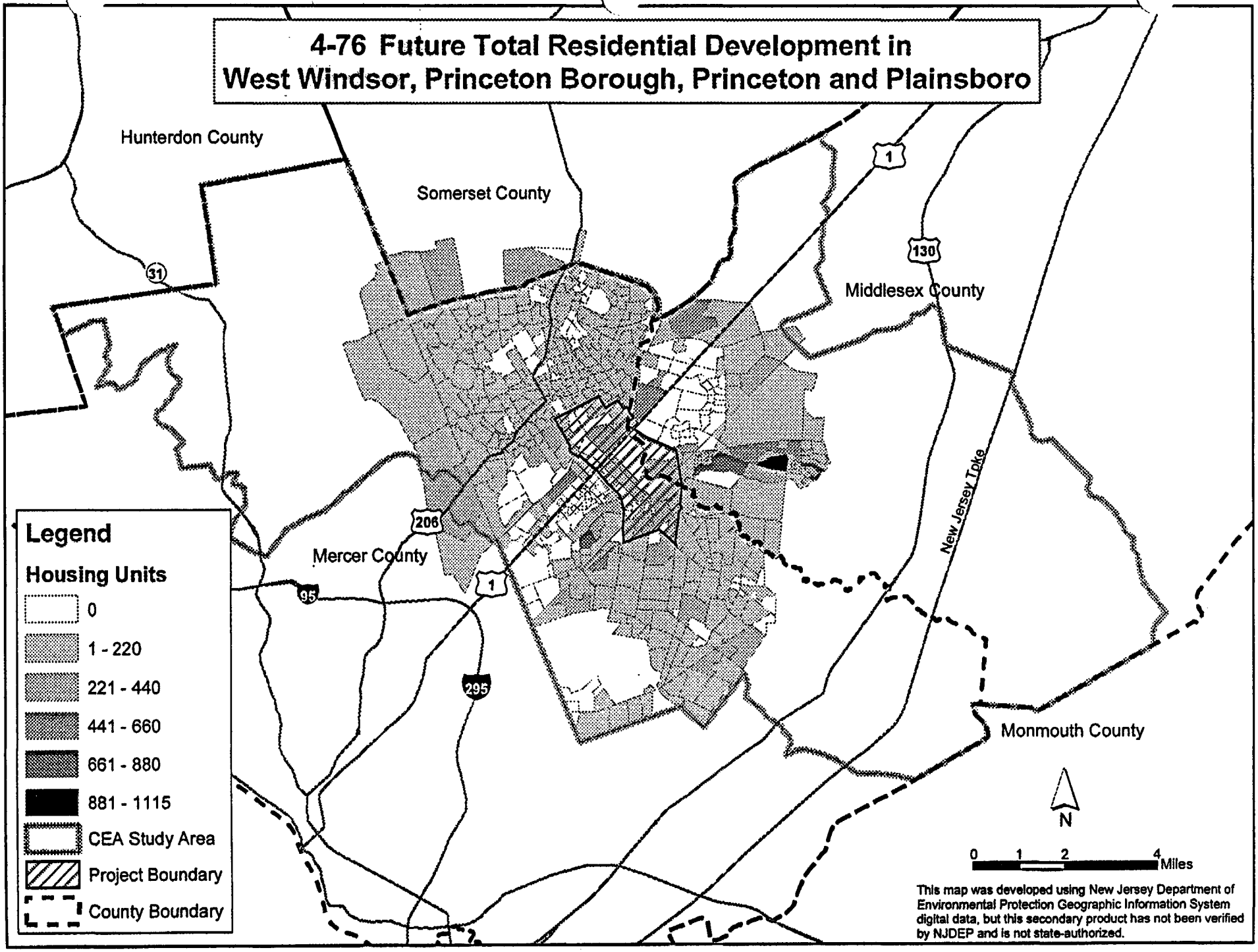
Sources: Approved GDP for the Sarnoff property, Penns Neck Area EIS Travel Demand Forecasting Model.

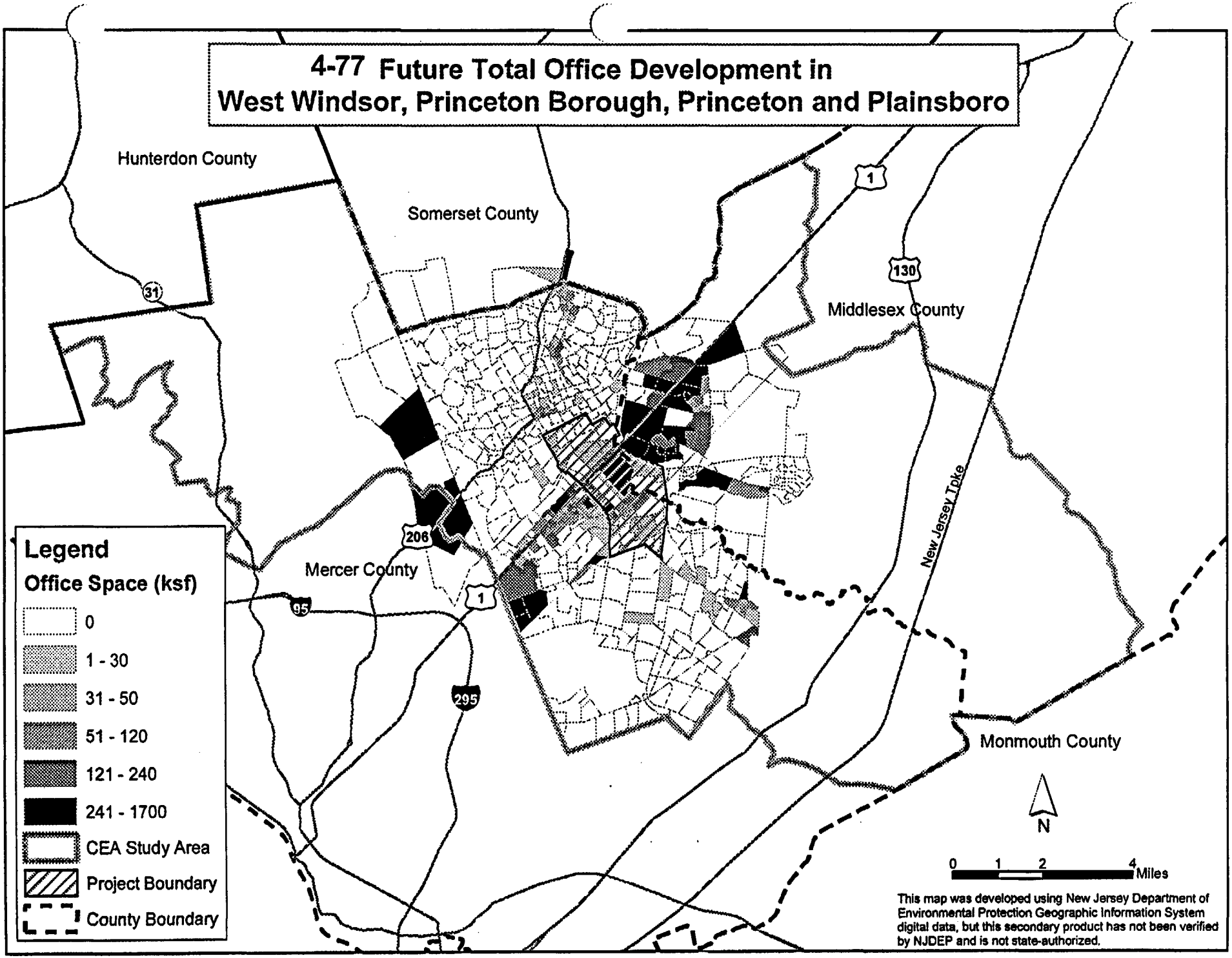
The 600,000 square feet of additional office and research space enabled by construction of the ESC road would generate an estimated additional 500 peak hour trips and result in an additional estimated 16 acres of impervious cover on the Sarnoff site by 2028. Although the timeframe for this analysis is 2028, it is appropriate to note that at full-build out, the ESC road could enable an additional 1.2 million square feet of office/research space, beyond the time-frame of the analysis. This additional development could result in an estimated 1,000 additional AM peak hour trips and 47 additional acres of impervious surface.

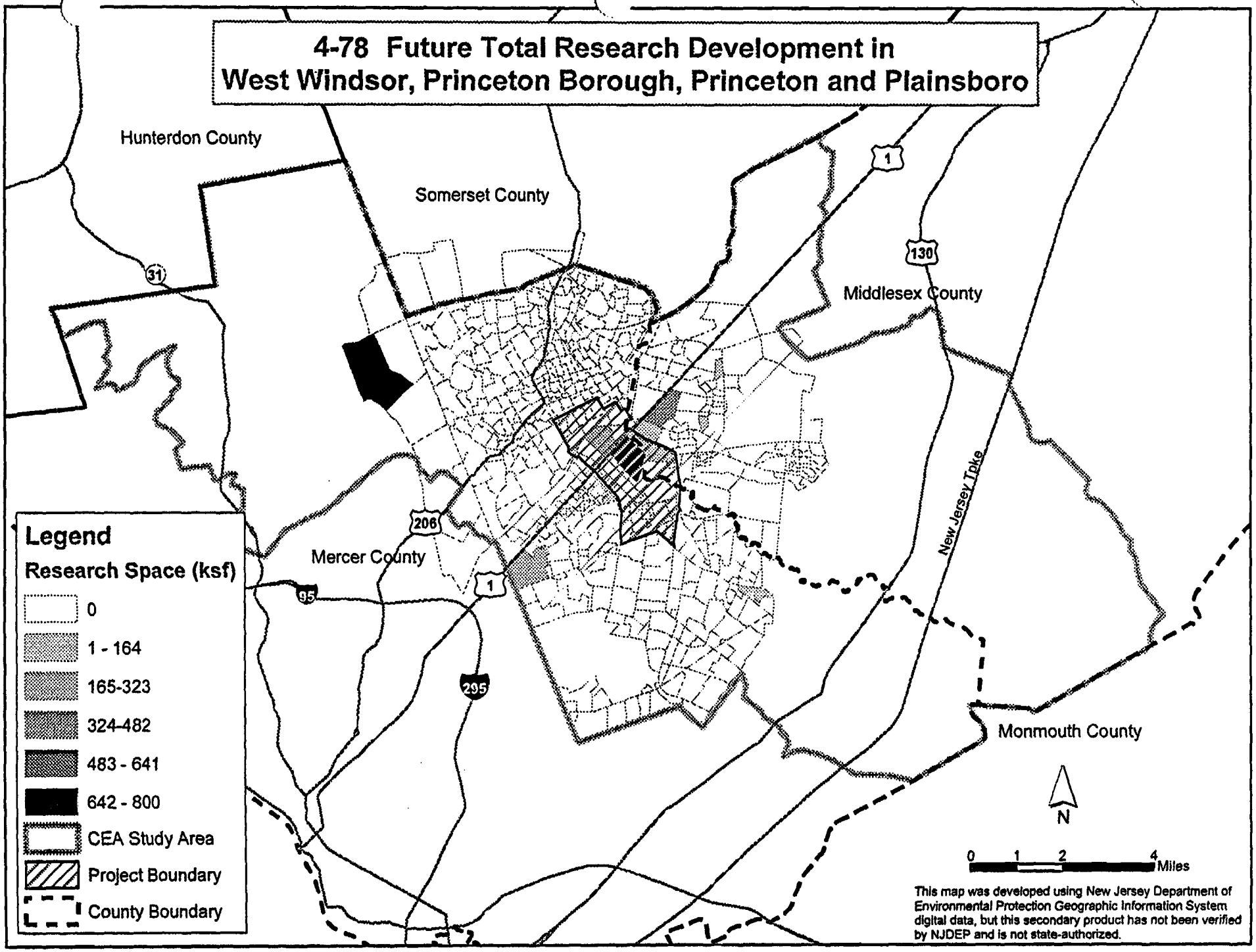
The consequent air quality and noise effects of the additional 500 trips generated by the 600,000 square feet of space have been quantified and incorporated into the analyses of the Action Alternatives that include an ESC road. The direct effects of impervious surface associated with the ESC road have also been quantified and incorporated into the analyses of the Action Alternatives that include an ESC road.

In terms of potential secondary impacts to wetlands, floodplains and water quality, it appears that the Sarnoff GDP was developed with a general knowledge of and respect for the natural resources on the property. In addition, development on the Sarnoff site will be subject to a variety of federal, state and local regulatory processes designed to protect these resources. As such, secondary effects on wetlands, floodplains and water quality should be minimized.

As noted in the EIS, there are a number of cultural resources located on the Sarnoff property and a portion of the Sarnoff Property itself has been deemed eligible for listing on the National Register of Historic Places. Although it is reasonable to assume that development on the Sarnoff site may have an impact on these resources, it is impossible to predict with any certainty what these impacts may be. In addition, it is reasonable to assume that some of these impacts would result without the ESC road. As a private development, it will be the responsibility of the property owner and the municipality to ensure the protection of the natural and built environments as part of the site development process.


4-76 Future Total Residential Development in
West Windsor, Princeton Borough, Princeton and Plainsboro
Hunterdon County
Somerset County
Middlesex County
Mercer County
Monmouth County
New Jersey Toke
31
1
130
206
95
295
Legend
Housing Units
0
1 - 220
221 - 440
441 - 660
661 - 880
881 - 1115
CEA Study Area
Project Boundary
County Boundary
N
0 1 2 4 Miles
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.


4-77 Future Total Office Development in
West Windsor, Princeton Borough, Princeton and Plainsboro
Hunterdon County
Somerset County
Middlesex County
Mercer County
Monmouth County
New Jersey Turke
31
1
130
206
95
295
Legend
Office Space (ksf)
0
1 - 30
31 - 50
51 - 120
121 - 240
241 - 1700
CEA Study Area
Project Boundary
County Boundary
N
0 1 2 4 Miles
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.


4-78 Future Total Research Development in
West Windsor, Princeton Borough, Princeton and Plainsboro
Hunterdon County
Somerset County
Middlesex County
Mercer County
Monmouth County
New Jersey Turke
31
1
130
206
95
295
Legend
Research Space (ksf)
0
1 - 164
165-323
324-482
483 - 641
642 - 800
CEA Study Area
Project Boundary
County Boundary
N
0 1 2 4 Miles
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

4.14.3 Cumulative Effects

This cumulative effects section of the SCEA addresses the cumulative effects of past, present and reasonably foreseeable development in the CEA study area, in the context of the Action Alternatives. This section is organized by key resource. Within each key resource section separate sections on existing conditions and cumulative effects are included. The analysis included in the SCEA is commensurate with the level of available data.

This cumulative effects analysis is applicable to the No-Action Alternative as well as all Action Alternatives, as past, present and reasonably foreseeable development would occur under both conditions (i.e., irrespective of implementation of any of the Penns Neck Action Alternatives).

The methodology used to determine cumulative impacts varies based on the resource being evaluated. Three basic methodologies were used to determine cumulative impacts. For some resources, a combination of these methodologies was used. These methodologies include the following:

Growth/Trends Analysis: When historic information and data was available, this data was used to conduct a growth trends analysis. This approach utilized historic growth factors and resource impact information to estimate future impacts within the designated timeframe.

Impervious-Based Analysis: Several areas of potential impact relate directly to increase in impervious surfaces. In these cases, impacts to a resource were assessed based on estimated increases in impervious surface.

Regulation-Based Analysis: When potential impacts were governed by local, state and federal regulations, regulatory standards were used to discuss impacts. In cases where this methodology was used, the governing regulations are described.

The remainder of this section presents the potential cumulative effect findings for the resources listed above. Table 4-34 presents each studied resource and indicates the methodology used with a shaded cell. In some cases a combination of methodologies were used.

Table 4-34
Methodologies Used in SCEA

Area of Potential Impact	Methodology Used		
	Growth and Trends Analysis	Impervious-Based Analysis	Regulation Based Analysis
Traffic, Air Quality and Noise	■		
Wetlands	■		■
Impervious Surface	■	■	
Floodplains		■	■
Surface Water Quality		■	■
Groundwater Recharge		■	■
Historical/Archaeological Resources			■
Open Space Resources			■

** **Shading indicates use of Methodology**

4.14.3.1 Traffic, Air Quality and Noise

Existing Conditions
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.

As shown in Table 4-35, between 1980 and 2000, the CEA region added approximately 86,000 persons and 65,500 jobs. This represents a 64% increase in population and a 98% increase in employment. 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 effect 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.

Cumulative Effects
The air quality and noise impact analyses conducted as part of the EIS appropriately utilized these cumulative traffic forecasts. As discussed in Section 4.2 of the EIS, the results of the air analysis indicate that none of the Action Alternatives would cause violation of the National Ambient Air Quality Standards in the core study area. Thus, the cumulative impact with an Action Alternative would not be adverse.

The results of the noise analysis indicate that existing conditions, as well as No-Action and Action Alternatives cause or would cause violations of the federal noise standard. Overall, the alternatives were determined to have an incremental noise impact due to cumulative traffic in the core study area.

Table 4-35
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

4.14.3.2 Wetlands

Existing Conditions

Wetlands of the CEA study area consist primarily of palustrine, forested and palustrine emergent wetlands associated with the various non-tidal watercourses including the Millstone River, Little Bear Brook, Stony Brook and Carnegie Lake, and other waterways. The majority of the wetlands within the CEA study area are palustrine, forested, broad-leaved deciduous wetlands (PFO1). Typical wetland plant species in the PFO1 habitats include red maple (*Acer rubrum*), trident red maple (*Acer rubrum trilobum*), American elm (*Ulmus americana*), sweetgum (*Liquidambar styraciflua*), pin oak (*Quercus palustris*), and green ash (*Fraxinus pennsylvanica*).

All scrub-shrub wetlands in the CEA study area are palustrine, broad-leaved deciduous (PSS1). Common PSS1 plant species include red maple and box elder maple (*Acer negundo*) saplings, northern arrowwood (*Viburnum dentatum*) and silky dogwood (*Cornus amomum*). Scrub-shrub wetlands in the CEA study area typically represent successional growth from relatively recent land disturbance. Provided that no further disturbance occurs in these wetlands, successional growth patterns will likely eventually progress into forested wetlands.

Palustrine emergent wetlands (PEM) are present within the CEA study area and the majority are located adjacent to or wholly within existing waterways. PEM wetlands are typically dominated by herbaceous plants and grasses including water arum (*Calla palustris*), arrow arum (*Peltandra virginica*) and common arrowhead (*Sagittaria latifolia*) within the stream channels (i.e. aquatic species). Woolgrass (*Scirpus cyperinus*), soft rush (*Juncus effusus*), tussock sedge (*Carex stricta*), jewelweed (*Impatiens capensis*), skunk cabbage (*Symplocarpus foetidus*), false nettle (*Boehmaria cylindrica*), purple loosestrife (*Lythrum salicaria*), swamp rose mallow (*Hibiscus palustris*), broad-leaved cattail (*Typha latifolia*), and sensitive fern (*Onoclea sensibilis*) are commonly found in or adjacent to the stream channels,

within the CEA study area. PEM wetlands are commonly found in conjunction with the scrub-shrub regimes and adjacent to open waters along the Millstone River and Little Bear Brook stream corridors. PEM wetlands also occur in localized topographical depressions where the water table is close to the surface and a canopy is lacking or broken to allow sunlight to filter in.

The Millstone River and Little Bear Brook support the majority of the forested wetlands within the CEA study area. These watercourses flow through these forested areas, as well as more open areas of scrub-shrub vegetation and emergent species.

Wetlands and waterbodies within the CEA study area are freshwater and as such are regulated by the New Jersey Department of Environmental Protection (NJDEP), Freshwater Wetlands Protection Act (FWPA), as governed by the Freshwater Wetlands Protection Act Rules (NJAC 7:7A-1 et al.). These Rules regulate activities proposed within and adjacent to freshwater wetlands and State open waters. Certain activities are regulated by Statewide General Permits (SGPs), which apply to minor activities that would not result in a significant environmental impact. Impact criteria associated with these activities, including disturbance quantities are regulated by the Rules and require a permit from the NJDEP. In addition, activities proposed in a wetlands transition area or buffer zone would also require a permit from the NJDEP. Transition areas are adjacent to wetlands and are an integral part of the wetlands ecosystem and hence are regulated similarly to wetlands.

Activities in wetlands, waterbodies or transition areas for which there are no associated SGPs or for those that exceed the allowable criteria, would need individual freshwater wetlands permit (IP). All permit activities are subject to review and approval by the NJDEP. For projects requiring an IP, wetland mitigation is required.

Projects within the CEA study area proposing impacts to wetlands, waterbodies and/or transition areas, would be required to comply with the FWPA (the Rules). All activities requiring and obtaining a SGP would by definition "cause only minimal adverse environmental impacts when performed separately, will have only minimal cumulative adverse impacts on the environment and will cause only minor impacts on freshwater wetlands and State open waters" (FWPA Rules). Activities within the CEA study area requiring an IP would provide mitigation to compensate for the loss or disturbance of freshwater wetlands or State open waters. The Rules require that mitigation "shall, at a minimum, fully compensate for the loss of ecological value caused by disturbance, by replacing any freshwater wetlands and/or State open water values and functions lost or disturbed with equal values and functions." Therefore, the intent of the Rules is to minimize cumulative impacts to wetlands to the maximum extent practicable. Hence, through compliance with the Rules, cumulative wetland impacts within the SCEA can be expected to be minimized to the greatest extent practicable.

Figure 4-79 illustrates wetlands within the CEA study area as per the NJDEP GIS database. There are approximately 23,696 acres or 37.025 square miles of NJDEP regulated wetlands within the CEA study area.

Action Alternative Impacts

The Penns Neck Action Alternatives would impact wetlands situated along the Little Bear Brook and Millstone River. Watercourse crossings would likely necessitate fill placement in wetlands and would also require new or increased shading of the watercourse. All the Action Alternatives would replace the Route 1 bridge over the Millstone River with a wider span. Action Alternatives A, A.1, A.2, A.3, A.4, B, B.1, B.2, D, D.1, E, F, and F.1 would include an east-side connector road that would provide a new crossing of Little Bear Brook. These Action Alternatives would require wetland impacts and additional shading of these watercourses (0.08 acres additional shading of the Millstone and 0.08 acres of shading of Little Bear Brook).

In addition, Action Alternatives A, A.1, A.2, A.3, A.4, B, B.1, B.2, C, C.1, D, D.1, E, F, and F.1 would provide a west-side connector road to Harrison Street, thus impacting Millstone River wetlands at that location. The B Action Alternatives would have the greatest amount of wetland impacts, with approximately 0.31 acres of fill. An Action Alternative would require either a general or an individual freshwater wetlands permit, depending on the degree of impacts.

Wetland and Waterbody Impact Trends

In 1987, New Jersey assumed implementation and enforcement of Section 404 of the Clean Water Act from the US Army Corps of Engineers (USACE), and the New Jersey FWPA was created. Although initially no formal records were compiled, in 1996, the NJDEP performed a review of wetland impacts authorized under the FWPA since its inception and summarized their findings in *Environmental Auditing, Review and Comparison of Wetland Impacts and Mitigation Requirements Between New Jersey, USA, Freshwater Wetlands Protection Act and Section 404 of the Clean Water Act* (Torok et al., 1996). This document compiles freshwater wetland impacts data from 1988 to 1993. Beginning in 1994, the NJDEP began preparing formal reports for submission to the US Environmental Protection Agency (USEPA), summarizing wetland permit activities, including the number of applications submitted, permit types, and acres impacted under the FWPA. These data are compiled and maintained by the NJDEP and are summarized in Table 4-36.

Methodology

The growth/trends analysis methodology developed for estimating future cumulative wetland impacts within the CEA study area employed a seven-step process with three main objectives, which are outlined below. This methodology was developed specifically for use in this EIS. It is important to note that although the time frame established for this SCEA ranges from 1978 to 2028, prior to 1988 no wetland impact records exist as the NJDEP did not keep an inventory of such activities prior to 1988. Therefore, the trends analysis methodology used to determine future wetland impacts is based on wetland impact activity from 1988 to 2001.

Objective A: Determine the wetland impact trend in the Millstone River watershed (Steps 1 through 4).

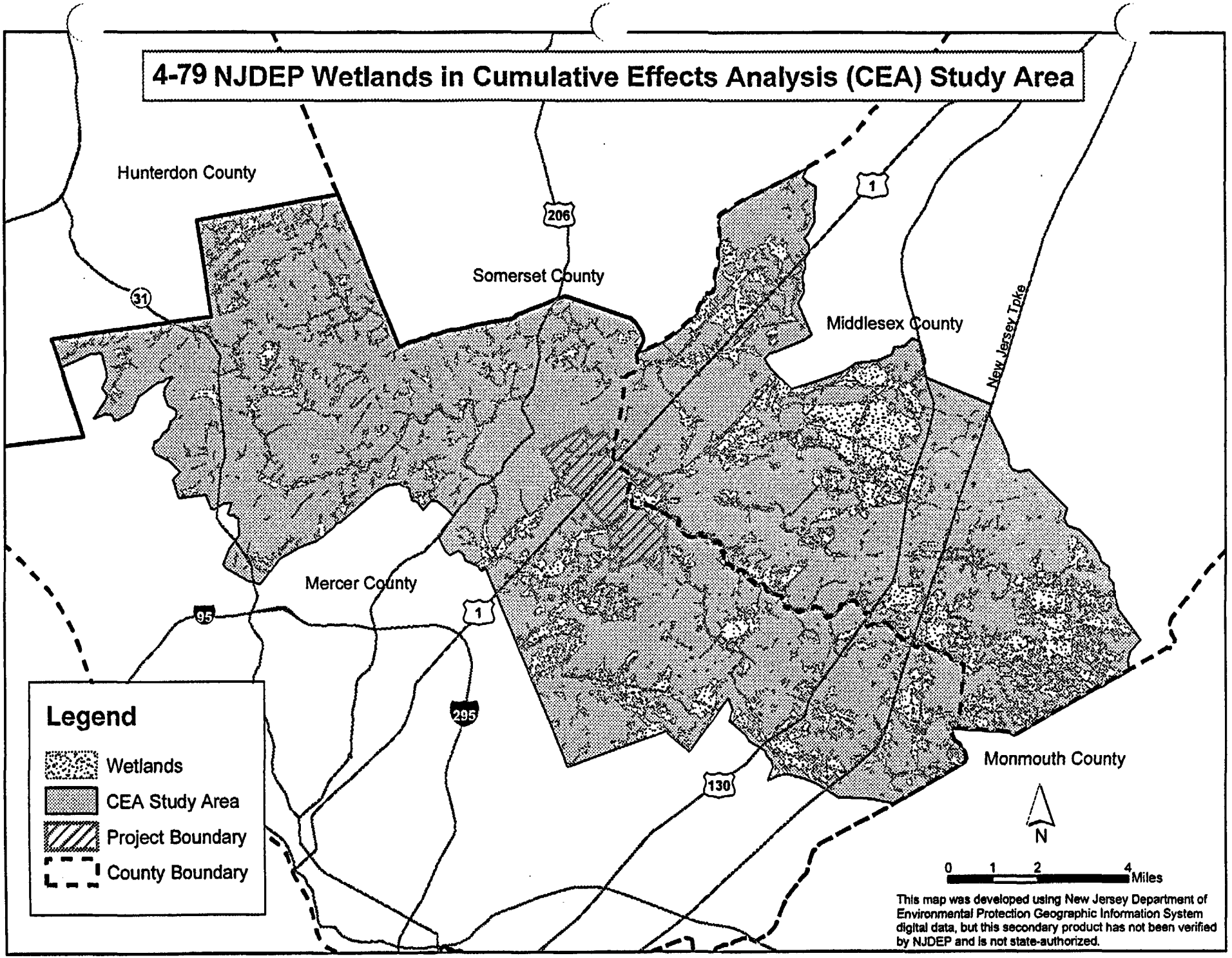
1. Summarize wetland impact data obtained from NJDEP documents for 1988 through 2001.
2. Determine the wetland impacts occurring within the Millstone River watershed (available for 1988-1993 only).
3. Determine what percent of total state wetland impacts occurs within the Millstone watershed, including a breakdown of impacts from SGPs and IPs.
4. Apply the percentages from step 3 to the statewide totals obtained from the NJDEP Annual USEPA Reports (1994-2001) to derive total and annual averages for the Millstone River watershed for the 13-year span of documented statewide data.

Objective B: Using the developed trend, estimate future cumulative wetland impacts in the CEA study area (Steps 5 and 6)

5. Determine what percent of the CEA study area comprises the Millstone watershed.
6. Apply the CEA percentage of the watershed to the estimated wetland impacts within the entire Millstone watershed. The result is an annual average cumulative wetland impact quantity for the CEA study area, including estimates for SGP and IP activities.

Objective C: Estimate wetland mitigation that would occur for IPs in the CEA study area (Step 7)

7. Using the cumulative wetland impact trends analysis for the CEA study area and available mitigation data for the Millstone watershed, estimate future annual wetland mitigation in the CEA study area.


4-79 NJDEP Wetlands in Cumulative Effects Analysis (CEA) Study Area
Hunterdon County
Somerset County
Middlesex County
Mercer County
Monmouth County
New Jersey Turke
206
1
31
95
295
130
Legend
Wetlands
CEA Study Area
Project Boundary
County Boundary
N
0 1 2 4 Miles
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

According to the NJDEP, there were approximately 612,000 acres of wetlands in New Jersey when the FWPA was implemented in 1987. Up to 1996, estimates of wetland losses in New Jersey range from 20% to 39% (NJDEP Mitigation Report, 2002). Within New Jersey, the NJDEP has developed an aerial-photo based data set that shows changes in land use between 1986 and 1995. During this time, New Jersey lost 15,798 acres of wetlands or an equivalent loss of 1,755 acres of wetlands per year (NJDEP Mitigation Report, 2002). Between July 1, 1988 and June 30, 2001, the USEPA reports show that New Jersey lost approximately 1,826 acres or 0.30% of its naturally-occurring wetlands due to authorized SGPs and IPs (Table 4-36). This impact number does not include wetland mitigation required for authorized IPs, nor does it include illegal wetland impact activities. Table 4-37 illustrates that 75% of freshwater wetland impacts in this time frame were for SGPs and 25% were for IPs.

As shown in Table 4-36, a total of 1,826 acres of freshwater wetlands have been impacted since 1988, a 13-year span. This consists of an annual average of 140.49 acres statewide. More accurate records have been kept between 1994 and 2001, over a 7-year span. Total wetlands impacted over this duration consist of 1,224 total acres or an average of 174.87 acres annually within New Jersey.

The NJDEP analysis (1996) suggests a strong correlation between high population density and growth, and those watersheds and basins experiencing the greatest wetland impacts. Much of the growth in the Raritan River basin can be attributed to the network of major interstate highways within the basin providing relatively easy access for commuters to the metropolitan New York area. According to the NJDEP, the Raritan River basin experienced the fourth greatest freshwater wetland impacts in New Jersey. When broken into watersheds, the Lower Raritan River watershed had the greatest freshwater wetland impacts, followed by the Millstone River watershed. The ten most heavily impacted watersheds in New Jersey are listed in Table 4-37. Future impacts within the CEA study area can be expected to resemble past trends due to the availability of vacant land with appropriate zoning and projected population and housing growth. As there are no impact studies specific to the CEA study area or on a county-wide basis, data from multiple sources were compiled to project future freshwater wetland impacts in the Millstone watershed.

Table 4-36
Summary of Wetland Impact Trends in New Jersey

Report #	Report Date	Permit Type	Acres Impacted	Number of Permits Issued
1	7/1/88-12/31/93	SGP (NJDEP)	437.97	2,896
		IP (NJDEP)	164.30	107
		Total	602.27	3,003
2	3/2/94-6/30/94	SGP (NJDEP)	13.07	Not given.
		IP (NJDEP)	1.94	Not given.
		Total	15.01	Not given.
3	7/1/94-6/30/95	SGP (NJDEP)	106.53	848
		IP (NJDEP)	39.88	11
		Total	146.41	859
4	7/1/95-6/30/96	SGP (NJDEP)	116.1380	1,150
		IP (NJDEP)	44.8260	36
			Subtotal = 160.9640	
		SGP (Pinelands)	2.9463	22
		Total	163.9103	1,208
5	7/1/96-6/30/97	SGP (NJDEP)	125.5579	1,132
		IP (NJDEP)	68.9509	30
			Subtotal = 193.9509	
		SGP (Pinelands)	2.9502	20
		Total	197.459	1,182
6	7/1/97-6/30/98	SGP (NJDEP)	142.6337	1,195
		IP (NJDEP)	10.5890	25
			Subtotal = 153.2227	
		SGP (Pinelands)	0.505	10
		Total	153.7277	1,230
7	7/1/98-6/30/99	SGP (NJDEP)	142.6272	1,274
		IP (NJDEP)	52.3190	29
			Subtotal = 194.9462	
		SGP (Pinelands)	2.190	9
		Total	197.1362	1,312
8	7/1/99-6/30/00	SGP (NJDEP)	147.5641	1,311
		IP (NJDEP)	32.1500	22
			Subtotal = 179.7141	
		SGP (Pinelands)	1.7338	16
		Total	181.4479	1,349
9	7/1/00-6/30/01	SGP (NJDEP)	120.9455	1,037
		IP (NJDEP)	37.8650	30
			Subtotal = 158.8105	
		SGP (Pinelands)	10.169	23
		Total	168.9795	1,090
Total General Permits (NJDEP)			**1,353.0364**	**>10,843**
Total Individual Permits (NJDEP)			**452.8199**	**>290**
Total General Permits (Pinelands)			**20.4943**	**>100**
Total General Permits (All)			**1,373.5307**	**>10,943**
TOTAL			**1,826.3506**	**>11,233**

Sources: Report 1: Torok, et al., 1996; Reports 2-9: NJDEP Annual USEPA Reports, 1996-2001.
Notes: Freshwater wetland impacts between 1988 and 1993 were not broken down by year.

Table 4-37
Freshwater Wetland Impacts in the Ten Most Heavily Impacted Watersheds in New Jersey 1988-1993

Watershed/Basin	SGP Impacts	Annual Average	IP Impacts	Annual Average	Total	% of Basin Impacts
Lower Raritan, Raritan	44.32	8.864	7.49	1.498	51.81	29.4
Millstone River, Raritan	36.54	7.308	7.54	1.508	44.08	25.0
Lawrence Brook, Raritan	7.02	1.404	22.31	4.462	29.33	16.6
Wanaque River, Passaic	26.57	5.314	1.06	0.212	27.63	25.2
Whippany River, Passaic	23.76	4.752	1.31	0.262	25.07	25.1
Upper Passaic, Passaic	10.17	2.034	12.28	2.456	22.88	20.5
Coopers Creek, Delaware	17.81	3.562	1.70	0.340	19.51	12.0
Rockaway River, Passaic	16.52	3.304	1.12	0.224	17.64	16.1
Assunpink Creek, Delaware	14.21	2.842	3.28	0.656	17.49	10.7
South River, Raritan	16.37	3.274	0.86	0.172	17.23	9.7

Source: Torok, et al., 1996.

As shown in Table 4-37, total freshwater wetland impacts in the Millstone watershed between 1988 and 1993 comprised 44.08 acres. This total comprises 7.32% of total wetland impacts in New Jersey (602.27 acres) from 1988 to 1993. During this time frame, freshwater wetland impacts from SGPs in the Millstone watershed comprised 36.54 acres or an average of 7.308 acres annually. IPs in the Millstone watershed comprised a total of 7.54 acres or an average of 1.508 acres per year. Hence, SGPs comprised approximately 83% and IPs comprised approximately 17% of total freshwater wetland impacts in the Millstone watershed. Assuming that the Millstone watershed maintains similar wetland impact trends, future impacts can be estimated for the Millstone watershed by applying these percentages to the USEPA reports. From the resulting data, future freshwater wetland impacts within the Millstone watershed could be estimated. These projections are provided in Table 4-38.

Table 4-38
Estimated Wetland Impacts Within the Millstone Watershed
Based On Past Trends

Report No.[1]	Total State SGP	Total State IP Impacts	Total Wetland Impacts, New Jersey	Estimated Total Wetland Impacts, Millstone Watershed (7.32% of State Total)
1	437.97	164.30	602.27	44.08
2	13.07	1.94	15.01	1.10
3	106.53	39.88	146.41	10.71
4	119.0843	44.8260	163.9103	12.0
5	128.5081	68.9509	197.459	14.45
6	143.1387	10.5890	153.2277	11.22
7	144.8172	52.3190	197.1362	14.43
8	149.2979	32.1500	181.4479	13.28
9	131.1145	37.8650	168.9795	12.37
Total	**1,373.5307**	**452.8199**	**1,825.8506**	**133.64**
Annual Average	**105.66** (75% of Total)	**34.8323** (25% of Total)	**140.45**	**10.28**

Source: Torok, et al., 1996.
Notes: [1]See Table 4-36 for report dates.

Cumulative Effects

As shown in Table 4-38, the Millstone watershed is estimated to have incurred approximately 133.64 acres of freshwater wetland impacts over a thirteen-year span. This is equivalent to an average of approximately 10.28 acres per year. As the CEA study area comprises 57.5% of the Millstone watershed, it can be estimated that 76.84 acres of wetland impact occurred within the CEA study area (57.5% x 133.64 acres) between 1988 and 2001 (past impacts). This includes SGPs and IPs and does not consider mitigation compensation required for authorization of IPs or possible illegal wetland disturbance activity. Given the anticipated continuation of growth within the Millstone watershed, this wetland impact trend can be expected to continue.

Using the afore-mentioned trend, in a 27-year span between July 1, 2001 and June 30, 2028 of the Design Year, freshwater wetland impacts within the Millstone watershed would total an additional 277.56 acres (10.28 acres per year x 27 years). The CEA study area (104,850 acres) comprises 57.5% of the Millstone watershed, which is 182,400 acres. Of the 277.56 acres of wetland impacts projected for the Millstone watershed through June 30, 2028, it can be assumed that 57.5% or 159.59 acres would be within the CEA study area. Approximately 75% of the CEA study area wetland impacts, or 119.7 acres would be impacted by SGPs and 25% or 39.89 acres would be impacted by IPs. The formula for estimating future wetland impacts in the CEA study area through the Design Year is shown in Table 4-39, below.

Table 4-39
Summary of Estimated Future Wetland Impacts in the CEA Study Area Through Design Year 2028

Estimated Annual Wetland Impacts – Millstone Watershed (from NJDEP reports)	Wetland Impacts Projected Through 6/30/28 (27-Year Span)	Estimated Annual Wetlands Projected for CEA (57.5% of Millstone Watershed
10.28 Acres	277.56 Acres	159.59 Acres
159.59 Acres X 75% SGPs = 119.7 Acres 159.59 Acres X 25% IPs = 39.89 Acres		

To summarize cumulative wetland impacts, of the total 23,696 acres of wetlands within the CEA study area, 236.74 acres would be impacted by Design Year 2028. Of this total, 159.90 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 236.74 acres of cumulative wetland impact, a maximum of 0.31 acres, or 0.13% is attributable to the potential implementation of one of the Penns Neck Action Alternatives. This 0.31 acres of wetland impact represents 0.0013% 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 4-40 below provides a summary of the above.

Table 4-40
Summary of Past, Present & Reasonably Foreseeable Wetland Impacts in CEA Study Area

TIME FRAME	Wetland Impacts (acres)	% of Cumulative Wetland Impacts	% of Total Wetlands in CEA Study Area
Past (1988-2001)	76.84	32.46%	0.32%
Present & Reasonably Foreseeable (2001–2028)	159.59	67.41%	0.67%
Estimated Time of Completion (2008) – Action Alternative	0.31	0.13%	0.0013%
TOTALS	236.74	100%	1.0%

Wetland Mitigation

In the context of environmental regulation, the term mitigation refers to the broad range of actions that might be taken to avoid, reduce or compensate for the effects of environmental damage. Compensatory mitigation refers to the practice by which unavoidable impacts to wetlands are permitted with the condition that they be replaced. Creation, enhancement, restoration, upland preservation, mitigation banking, land donation and monetary contributions to the Wetlands Mitigation Fund can all be acceptable methods of mitigation.

Since 1995, NJDEP has been an active participant in the National Environmental Performance Partnership System (NEPPS). NEPPS is a performance-based management system that relies on the use of environmental indicators to measure attainment of goals and upon which future allocation of resources can be based.

As of spring 1999, the NJDEP mitigation database included data on 223 mitigation proposals, accounting for approximately 1,249 acres of wetland mitigation. Of this, 177 freshwater wetland mitigation sites were designated as non-tidal freshwater wetland systems. Of the 177 sites in the NJDEP database, 135 had been constructed at the time of the study. Sites evaluated consisted of those that had sufficient information available and focused on creation rather than enhancement and restoration. Sites without sufficient details to accommodate a consistent and complete evaluation were omitted from consideration in the study. Ninety sites were selected for inclusion in the study and subject to subsequent field evaluations, representing approximately 326 acres of proposed freshwater wetlands mitigation. The study included development of three study indicators to measure attainment with the NEPPS goals and to monitor the performance of New Jersey's wetland mitigation program. Field investigations measured individual site's attainment in the following three study indicators:

- Wetland Area Achieved – Determined by conducting a wetland delineation using the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands and use of Global Positioning System (GPS) equipment. Wetlands were delineated at 85 of the 90 sites.
- Concurrence Evaluation – Field inspections were conducted to verify and measure that the site conforms with the NJDEP approved plans and specifications. This was performed at 88 of the 90 sites. Parameters evaluated included grading, hydrology, vegetation cover, vegetation survival, and design.
- Wetland Mitigation Quality Assessment – A score was given to each site evaluated based on readily observable field indicators of wetland variables (i.e., soils, hydrology and vegetation) to provide a qualitative determination as to the presence or absence of designated field indicators representative of the relative probability that a constructed wetland will develop into a natural wetland system and provide desirable functions over time. This method was applied only where wetlands were present, which included 74 of the 90 sites.

Table 4-41 provides a summary of freshwater wetland mitigation sites in Watershed Management Area (WMA) 10 (i.e., the Millstone watershed), including the site designation, age of the site at the time of the study, proposed wetland impacts, creation goal, type of wetland area proposed (forested, scrub-shrub, emergent, or State open water), number of wetland acres evaluated, number of wetland acres achieved, and percent of area achieved.

As shown in Table 4-41, wetland impacts from IPs in WMA 10 represent approximately 16.6% of statewide IP impacts. Wetland impacts from IPs in WMA 10 totaled 13.53 acres, with a one-to-one ratio (100%) mitigation goal, creation to impact area. The Statewide mitigation goal was to create approximately 87% of the acres impacted (less than a one-to-one ratio). Neither of these two goals was achieved. Wetland mitigation achieved in WMA 10 consisted of 67.7% of acres impacted. Wetland mitigation achieved statewide consisted of 57.4% of acres impacted and 65.66% of the creation goal.

Following past trends, wetland mitigation within WMA 10 and the CEA study area can be expected to achieve approximately 67.7% of the goal. Mitigation for the estimated 39.89 acres of wetland impacts for IPs in the CEA study area (Table 4-41) would depend on the creation requirement set for each IP. If a one-to-one creation to impact ratio was required with a mitigation goal of 39.89 acres, it is estimated that only 67.7% or 27 acres of wetland creation would be achieved in the CEA study area. If a 2 to 1 creation to impact ratio was required, whereby a goal of 79.78 acres was set, it is estimated that 67.7% of this goal, or 54.01 acres would be achieved. Based on the former, more conservative scenario, where a one-to-one ratio for wetland mitigation would be achieved, 27 acres of mitigation would occur to compensate for the 159.59 acres impacted in the CEA study area between July 1, 2001 and June 30, 2028. Using the same formula to calculate past mitigation amounts, approximately 13 acres of mitigation would be achieved (76.84 acres of impact x 25% for IPs x 67.7% = 13 acres) to compensate for the 76.84 acres of past (1988-2001) wetland impacts. Therefore, in total, approximately 40 acres of wetland mitigation would be achieved for the cumulative wetland impacts of 236.74 acres.

Mitigation is typically only required for IP applications, not for SGP applications. As Table 4-41 illustrates, the majority of wetland impacts (119.7 acres of 159.59 acres) were authorized via SGPs, not IPs, resulting in these 119.7 acres of wetland impacts to go unmitigated. Unfortunately, this results in a wetland permitting system where "no net loss" of wetlands is not achieved. The NJDEP is currently addressing ways to improve this system such that a greater mitigation ratio can be achieved.

Table 4-41
Summary of Wetland Mitigation for IPs - WMA 10 vs. New Jersey

Mit Site#	Age (yrs)	Total Proposed Impacts	Creation Goal	Mitigation Type				Wetland Acres Evaluated	Wetland Acres Achieved	% Area Achieved
				PFO	PSS	PEM	SOW			
050a	4.27	4.25	4.25	1.64	0.76	1.55	0.30	4.25	3.36	79.06%
050b	4.27	11.15	11.15	4.93	3.23	2.99	---	11.15	6.03	54.08%
119	2.57	25.50	25.50	25.50	---	---	---	25.50	16.15	63.33%
123	8.07	13.20	13.20	2.90	6.57	3.73	---	13.20	11.09	84.02%
Total WMA 10	---	54.10	54.10	34.97	10.56	8.27	0.3	54.10	36.63	67.7%
Average WMA 10	4.80	13.53	13.53	8.74	3.52	2.76	0.3	13.53	9.16	67.7%
State Total	---	**325.60**	**284.65**	**139.71**	**21.96**	**105.77**	**26.69**	**296.87**	**186.91**	**65.66**
State Average	**5.13**	**3.62**	**3.85**	**2.45**	**0.88**	**2.78**	**1.91**	**3.49**	**2.20**	**57.14%**

Source: Torok, 1996.

4.14.3.3 Impervious Surfaces

Existing Conditions

According to a land consumption analysis conducted by the Regional Planning Partnership (RPP), a Princeton-based not-for-profit land use and planning advocacy organization, developed land in the central New Jersey region grew by 61% between 1976 and 1996. The study region used for the analysis included 32 municipalities in Mercer County and the southern portions of Middlesex and Somerset Counties (RPP region). The CEA is located entirely within this analysis region. In 1996, 38% or approximately 127,000 acres of land in the RPP region was developed. This "developed" area included land used for commercial, industrial, residential, transportation, communication and utilities purposes. (Carnegie and Brake, 1999).

Assuming that land use patterns in the RPP region are representative of patterns within the CEA, it is reasonable to estimate that approximately 40,000 acres (104,850 acres x 38%) of the CEA were developed in 1996. According to data provided by NJDEP, in 1996, there were an estimated 10,700 acres of impervious surfaces in the CEA study area. This would indicate that impervious surfaces represent approximately 27% of developed land.

Cumulative Effects

It is reasonable to assume that historic development trends and patterns in this portion of central New Jersey will continue into the foreseeable future. As development occurs, the amount of impervious surface will increase. Past development trends and

data regarding existing impervious surface in the CEA was used to estimate the acreage of impervious surfaces that could be present in the CEA study area in 2028.

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 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 4-42, the worst case action alternative in terms of new road-related impervious surface (Alternative B.2) would contribute less than half of one percent to the cumulative impervious cover effects that can be anticipated in the CEA.

Table 4-42
Summary of Past, Present and Reasonably Foreseeable Impervious Surfaces in CEA Study Area

Timeframe	Impervious Surfaces (acres)	Percent of Cumulative Impervious Surfaces
1996	10,700	50.6%
1996-2028	10,400	49.2%
Worst Case Action Alternative B.2 (e.g., greatest amount of impervious surface)	33	0.2%
CUMULATIVE TOTAL	21,133	100%

4.14.3.4 Floodplains

Existing Conditions
The CEA study area contains portions of the National Flood Insurance Program (NFIP) and NJDEP mapped floodplains for the Millstone River, Little Bear Brook, Stony Brook, Carnegie Lake and the D&R Canal.

Floodplains are present within the CEA study area generally along stream corridors, and in areas immediately surrounding lakes and reservoirs. Figure 4-80 exhibits flood-prone areas within the CEA study area, totaling approximately 16,989 acres or 26.55 square miles. The NJDEP regulates floodplain development under the Flood Hazard Area Control Act N.J.A.C. 7:13. These regulations require that a stream encroachment permit must be acquired for development proposed within the regulated floodplain. Stream encroachment permits are classified as major or minor. Projects with minor floodplain impacts and simplified circumstances require a minor

permit while larger, more complex projects involving complex calculations that could potentially have major flooding impacts will require a major permit.

Regulated activities proposed within the flood fringe area must meet the "20 percent net-fill rule" in which the volume of net fill to be placed within the flood fringe shall be limited to 20% of the total volume of flood storage on that portion of the property. Plans and calculations must be submitted with the permit application to demonstrate this to the NJDEP's satisfaction.

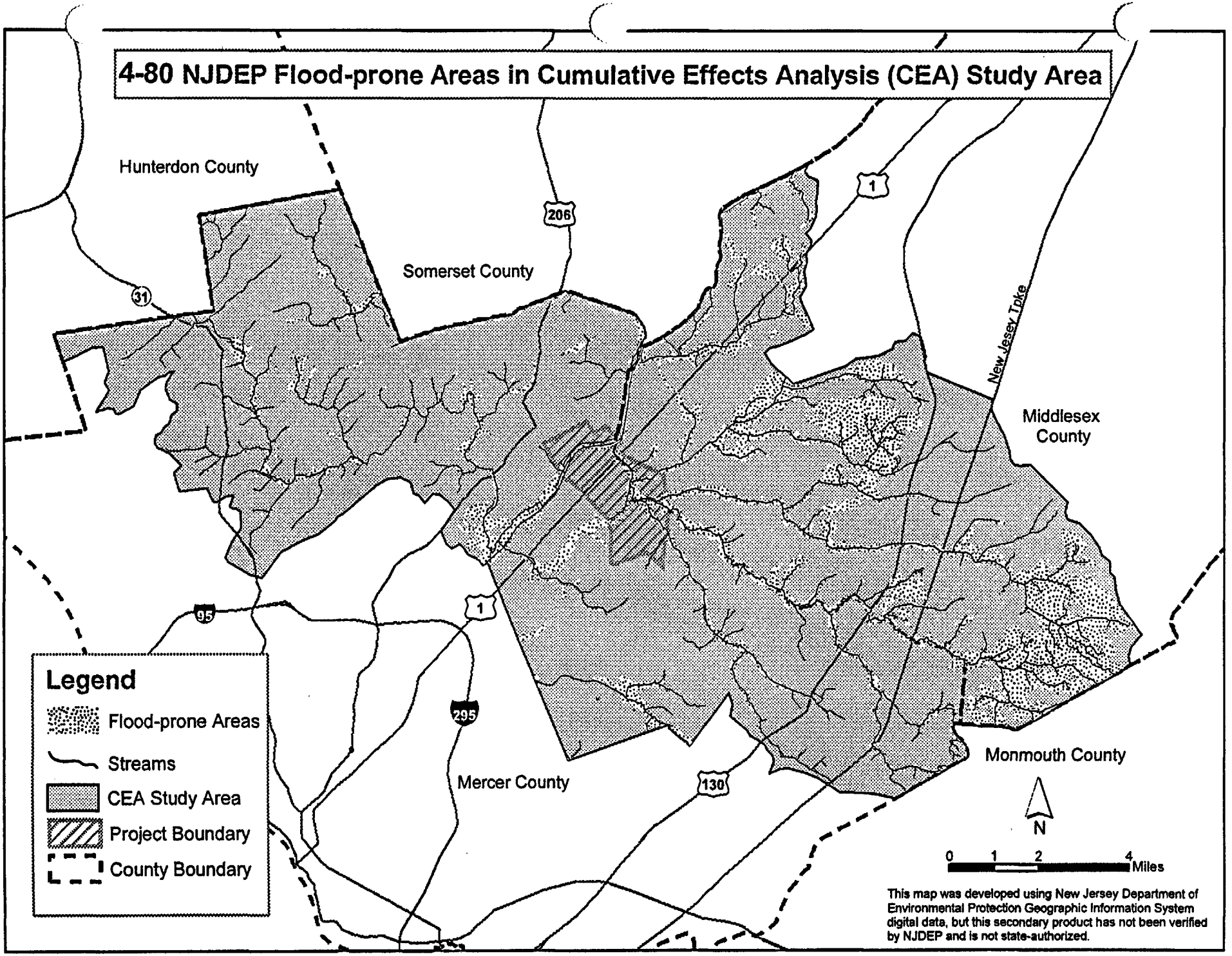
Within the study area, the floodplain of the Millstone River ranges in width from 1,000 to 1,500 feet. The 1,600-foot width of the Little Bear Brook floodplain is generally consistent within the study area. Floodplain characteristics feature broad, gradually sloping land forms in which the water channels wind and meander in response to sediment movements. In this environment, flooding is quick during storms. The Millstone River and Little Bear Brook share these characteristics. The floodplains of each are broad and topographically subtle. The Millstone River floodplain elevation varies from +67 feet at the Amtrak Northeast Corridor crossing to +58 feet downstream of the confluence with Stony Brook at Carnegie Lake. The 100-year floodplain extends upstream along the Millstone River to the confluence with Little Bear Brook and Big Bear Brook. At the Route 1 crossing, the 100-year discharge of the Millstone River is 9,030 cubic feet per second (cfs) with a mean velocity of 1.3 feet per second (fps) (FEMA, 1983).

Unlike NJDEP's annual reporting to the USEPA of wetland losses, there are no such losses reported for floodplain impacts. Therefore, it was not possible to attach a number to the past floodplain impacts.

Action Alternative Impacts

Each Action Alternative includes replacing the Route 1 bridge over the Millstone River and therefore, would impact the river's floodplain. Action Alternatives A, A.1, A.2, A.3, A.4, B, B.1, B.2, D, D.1, F, and F.1 include a west-side connector road that would impact the river's floodplain south of Harrison Street. A structure would also be required for the east-side connector road crossing of Little Bear Brook, including fill within the floodplain in Action Alternatives A, A.1, A.2, A.3, A.4, B, B.1, B.2, D, D.1, E, F, and F.1.

The B Action Alternatives would result in the greatest floodplain impacts. Action Alternatives B and B.1 would each impact approximately 4.10 acres of floodplains, whereas B.2 would impact 3.98 acres. The C Action Alternatives would have the least floodplain impacts, with 0.72 acres each.


4-80 NJDEP Flood-prone Areas in Cumulative Effects Analysis (CEA) Study Area
Hunterdon County
Somerset County
Middlesex County
Monmouth County
Mercer County
New Jersey Toke
206
1
31
95
295
130
Legend
Flood-prone Areas
Streams
CEA Study Area
Project Boundary
County Boundary
N
0 1 2 4 Miles
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

Cumulative Effects

Using the impervious-based method, a total of approximately 21,100 acres of impervious surfaces may cover the CEA study area by 2028, as shown on Table 4-42. The addition of the Penns Neck Action Alternative with the greatest amount of paved surfaces (32.77 acres for Alternative B.2) brings this total to approximately 21,133 acres. The project portion of cumulative impervious surfaces in the CEA would be negligible as compared to cumulative impacts overall.

The Flood Hazard Area Control Act provides numerous provisions for mitigation of adverse environmental impacts that are associated with stream encroachment activities. Permittees are required to take all measures necessary to minimize adverse environmental impacts. Where impacts are unavoidable, mitigation is required. Subchapter 3 of the regulations sets forth standards for soil erosion and sediment control, and the exposure and handling of acid-producing soils, and also contains provisions for the protection of near watercourse vegetation, trout associated waters and other fish resources, freshwater wetlands and threatened and endangered species.

Executive Order 11988, Flood Plain Management (1977), requires agencies to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. The Order is intended to ensure that where impacts to floodplains cannot be avoided, every reasonable effort is made to minimize the impact such that an existing flooding condition is not exacerbated and a new flooding condition is not created. Examination of the Action Alternatives in the context of this Order and the federal guidance promulgated from that Order, 23 CFR 650, has determined that the primary floodplain impacts contemplated constitute perpendicular crossings. These crossings would be minimized in terms of their scope of floodplain impact so as not to cause or exacerbate a flooding problem. This conclusion is based on the understanding that any Action Alternative would require an NJDEP Stream Encroachment Permit and that the permit review process mandates a demonstration of the effectiveness of planned minimization efforts. Moreover, none of the impacts contemplated under the Action Alternatives would constitute a longitudinal, or parallel, physical impact on floodplains. For these two reasons, none of the Action Alternatives would constitute a significant floodplain encroachment as defined in the Federal Aid Policy Guide 23 CFR 650, Subpart A.

The Flood Hazard Area Control Act and the permitting process an applicant must go through are designed to make sure that functions and values of floodplains are preserved to the greatest extent practicable. The regulations prohibit and discourage development within the regulatory floodplain.

4.14.3.5 Surface Water Quality

Existing Conditions

Five major waterbodies are found within the CEA study area. These are the Millstone River, Little Bear Brook, Stony Brook, the D&R Canal, and Carnegie Lake.

Section 3.7.4 describes each waterbody, with the exception of Stony Brook which is described below.

The Stony Brook flows west to east and has a drainage area of 58.7 square miles at its confluence with the Millstone River. The headwaters of the Stony Brook are located in East Amwell Township in Hunterdon County, from where it flows in an easterly direction for 21 miles before discharging into Carnegie Lake in Princeton Township.

Action Alternative Impacts

Each of the Penns Neck Action Alternatives would introduce new impervious roadway surface areas, thereby increasing stormwater runoff volume within the study area. Vehicular traffic using new roadways in the study area would deposit pollutants on the roadway surfaces. These pollutants would be washed off paved surfaces during storm events and could have an adverse impact on receiving waterbodies. Estimates of pollutant loading of runoff from the Action Alternatives were obtained and compared to appropriate water quality standards.

Examination of the existing water quality data is from the confluence of the Millstone River and Devils Brook. Data collected indicates that there are no current exceedances of the water quality standards for sampled parameters at this location. The results for each of the Action Alternatives indicate that exceedances would occur for total phosphorus for all Action Alternatives, except G.1.

These statistics account for water quality control strategies that would be required if an Action Alternative is selected. If an Action Alternative is selected, these strategies would treat stormwater prior to its discharge to receiving waterbodies so as to avoid or minimize water quality impacts to the greatest practicable extent. When the results are compared among the Action Alternatives, Action Alternative G.1 would produce the least pollutant discharge load of the Action Alternatives analyzed. The pollutant loads for Alternative B.2 are the highest.

Cumulative Effects

The predominant nonpoint pollution sources in the Millstone watershed are those associated with suburban development, which is on the increase throughout the watershed. Runoff and erosion from construction sites, paved surfaces, landscaped areas, storm sewers and roads all contribute to excessive sediment loading. Septic systems are also believed to be a potential pollution problem throughout the watershed.

All discharges to surface and groundwater are required to be in compliance with the specifications of the New Jersey Pollutant Discharge Elimination System (NJPDES) program. Additionally, all proposed actions must meet stringent stormwater management requirements set forth in the Flood Hazard Area Control Act. The Delaware and Raritan Canal Commission has set forth their own stormwater management standards under which they will review major projects under D&RCC jurisdiction.

Anticipated future stresses on surface water in the CEA study area includes stormwater runoff from developed areas, agricultural runoff and sedimentation/siltation from soil erosion disturbance due to residential, research/development and office development.

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 continue to adversely effect 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. The project will strive for better than average performance in its BMPs, so as to have a minimal water quality impact.

4.14.3.6 Groundwater Recharge

Existing Conditions
Section 3.7.3 of the EIS describes the existing groundwater recharge conditions in the study area and environs.

Action Alternative Impacts
The Penns Neck Action Alternatives would reduce groundwater recharge as a result of adding new impervious roadway surfaces. The CEA study area comprises areas of high, moderate, and low recharge capability. Action Alternative B.2 would have the greatest impact on groundwater recharge, reducing recharge in the study area by 1.37%. Action Alternative G.2 would have the lowest impact on groundwater recharge of the Action Alternatives, reducing recharge by 0.18%. Of the VDC Alternatives, VDC 3 would have the greatest impact, reducing recharge by 0.12%. Therefore, the potential area available for infiltration of precipitation into the aquifer would be reduced. Some of this recharge water will be collected and allowed to recharge through the use of retention/detention basins. A portion of this highway runoff will enter the soil and become part of the groundwater supply through infiltration.

Cumulative Effects
A cumulative impact resulting from anticipated development within the CEA study area is the reduction of groundwater recharge capability due to increased impervious surfaces. Impervious surfaces are estimated to be approximately 21,133 acres by 2028. This is almost doubling the impervious surface area present in 1996.

Municipal land use and zoning regulations govern the type and extent of development, including impervious surface area and the management of stormwater runoff from these surfaces. Current state regulatory programs pertain specifically to groundwater withdrawals and discharges, as well as stormwater management, where an action would impact a regulated area such as a floodplain or wetland. While these regulatory programs provide some protection of groundwater resources, requirements are relatively weak on groundwater recharge.

The NJDEP proposes to enhance existing regulations with new design and performance standards that would focus on water quality protection and recharge enhancement. These regulations, which are likely to be adopted during the design time frame of an Action Alternative, would establish guidelines for the development of municipal and regional stormwater management plans. It is anticipated that an Action Alterative, 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.

4.14.3.7 Historical and Archaeological Resources

Existing Conditions
Cultural resources include standing historic resources, historic districts or farmsteads, and archaeological sites. A review of existing documentation was conducted with the intent to identify any cultural resources currently listed on, or determined to be eligible for listing on the National and/or State Register of Historic Places that are located within the CEA study area. Following is the list of historic architectural and archaeological resources in the project study area.

- Aqueduct Mills Historic District (SHPO Opinion 12/20/88)
- Aqueduct Mills Historic District Extension (SHPO Opinion 07/08/98)
- Covenhoven-Silvers-Logan House (SHPO Opinion 03/10/97)
- David Voorhees House (SHPO Opinion Pending)
- Delaware and Raritan Canal State Park and Historic District (National Register Listed: 5/11/75)
- Lake Carnegie Historic District (National Register Listed: 6/28/90)
- Penns Neck Cemetery (SHPO Opinion 03/10/97)
- Pennsylvania Railroad Historic District (SHPO Opinion Pending)
- Princeton Baptist Church at Penns Neck (National Register Listed: 12/28/98)

- Princeton Branch, D&R Canal Bridge (SHPO Opinion 07/08/98)
- Princeton Operating Station (SHPO Opinion 07/08/98)
- Sarnoff Corporation (SHPO Opinion 01/03)
- Washington Road Elm Allee (National Register Listed: 01/18/99)
- Archaeological Site 28 ME 2 (SHPO Opinion 9/13/76)
- Archaeological Site 28 ME 23 (SHPO Opinion 3/10/97)
- Archaeological Site 28 ME 86 (SHPO Opinion Pending)
- Archaeological Site 28 ME 291 (SHPO Opinion Pending)

Action Alternative Impacts

Archaeological Resources
In total, four archeological sites would be impacted from construction activities associated with one or more of the proposed Action Alternatives: Sites 28ME2, 28ME23, 28ME86, and 28ME291.

Historic Architectural Resources
Of the Action Alternatives, each would have an adverse effect on at least one historic architectural resource. All of the alternatives would require the removal of the stone wall along Route U.S. 1 in the Aqueduct Mills Historic District. Alternatives B, B.1, B.2, C, and G.1 would require the removal of one or more trees of the Washington Road Allée, while A, A.1, A.2, A.3, A.4, B, B.1, B.2, F, and F.1 could require the demolition of the Princeton Operating Station. Alternatives A, A.1, A.2, A.3, A.4, B, B.1, and B.2 would require the demolition of the Covenhoven-Silvers-Logan House.

Assessment of indirect project impacts was made by consideration of the proximity of alternative and by use of available noise level predictions and traffic volume projections. Based on this information, 18 alternatives (No-Action, A, A.1, A.2, A.3, A.4, B, B.1, C, C.1, D, D.1, E, F, F.1, G, G.1, and G.2) appear to have the potential of introducing audible or visual elements that may adversely affect historic architectural resources.

Cumulative Effects
The pressures on cultural resources in the CEA study area are great due to on-going development. 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. Often municipal ordinances are weak in terms of requiring 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. The recognition of the area as part of the *Crossroads of the American Revolution* is an example of an initiative that may foster protection of cultural resources.

Historically, societal decisions about what is important to history have often determined what should be protected versus what is expendable. Throughout the CEA study area, historic resources that can be traced to key moments in history, such as the American Revolution or key figures, have been the subjects of protection and investment. In contrast, more mundane artifacts, such as farmsteads, have received less attention. Thus, in some instances, the historical "picture" of the region is one of differential preservation.

Losses of cultural resources in the CEA study area have occurred over the years. Farm complexes and other resources have succumbed to development. In particular, commercial growth along Route 1 has led to the loss of resources alongside the highway. Technological improvements have resulted in the demise of outdated artifacts. An example is the Camden and Amboy Railroad complex alongside the D&R Canal.

Today, the CEA study area remains rich in cultural resources. Some are contextual, such as the elm allee, while others have lost their context but remain important in their own rights, such as the Princeton Baptist Church. In aggregate, however, cultural resources serve as a "scrapbook" of area history. As growth and traffic demand pressures become greater throughout the CEA study area, cultural resources will be increasingly threatened both by public and private development.

Depending upon the Action Alternative selected, up to 13 cultural resources in the study area could be adversely affected. Although this is a relatively small number of resources in the context of the many resources in the CEA study area, it is a notable number considering the small size of the study area and extent of the contemplated alternatives. As with the other NEPA issues, selection and development of an Action Alternative must consider means to avoid, or at least minimize adverse cultural resource impacts, and must provide appropriate mitigation to overcome adverse impacts.

4.14.3.8 Open Space Resources

Existing Conditions

Forest/Open Space/Recreational

Forest/open space/recreational land uses comprise a significant portion of the CEA study area. Approximately 9,300 acres or 14.5 square miles of the CEA study area is comprised of this land use type. Like agricultural areas, these land uses are subject to development for residential and commercial purposes. Policies have been instituted to conserve forest and open spaces, and the NJDEP Office of Green Acres collaborates with local, state, and federal governments, as well as with non-profit organizations, to buy and manage open space in the state.

Parkland

The CEA study area was reviewed for lands meeting the requirements of the FHWA Section 4(f), Recreational and Parkland Evaluation. The D&R Canal State Park is both parkland and an historic resource as defined by Section 4(f). The New Jersey Green Acres Program provides funding to preserve land and develop parks. Each municipality in the state maintains a Recreation and Open Space Inventory (ROSI), which is a block and lot listing of all municipally-owned lands preserved by Green Acres funding. Lands on the ROSI have a Green Acres restriction on them such that they can be used only for conservation and/or recreational purposes. If the municipality holds any conservation easements or leases for conservation and/or recreational purposes, these also must be listed on the ROSI. An inventory of all municipal and county parks within the CEA study areas was taken. This inventory was based on best available information provided by the county and municipal parks departments and information obtained from county and municipal land use plans, USGS maps and Hagstrom maps. Based on this inventory, parkland resources total approximately 8,650 acres within the CEA study area.

West Windsor's ROSI is currently being amended, but does include a Greenbelt deed restriction along Little Bear Brook, between Alexander and Washington Road, for the purpose of conservation and floodplain protection.

In addition, the Sarnoff Corporation has agreed to grant a Greenbelt deed restriction to West Windsor as part of their approved General Development Plan.

Examination of Plainsboro's ROSI identified no recreation or open space lands in the portion of the study area north of the Millstone River.

Action Alternative Impacts

Parkland

Some Action Alternatives would improve traffic movement on Washington Road and Harrison Street by eliminating the traffic signals at Route 1 that cause peak period queues. These alternatives are A, A.1, A.2, A.3, A.4, B, B.1, B.2, C, C.1, D, D.1, E, F, F.1, and G.2. As demonstrated in the traffic analyses, some of these alternatives would accommodate traffic and reduce queuing more effectively than others. Alternatives with loop interchanges and right in/right out configurations would operate more effectively than the diamond interchanges requiring left turns onto Route 1 northbound. The extent to which these Action Alternatives would reduce traffic congestion and queues across the canal bridges would be a benefit to the park in terms of minimizing air quality and visual impacts, as well as improving park user/motorist interaction at crossings.

Alternatives G and G.1 would preserve the existing traffic signals and would have a limited ability to improve traffic movements and reduce congestion on east-west roadways. Little benefit to the canal park would occur as a result of G and G.1.

Some Action Alternatives would straighten the through movement approach to the canal bridge at Harrison Street. Currently, Harrison Street has a sharp curve just east of the bridge that limits sight distance for both motorists and park users trying to cross the street either on foot or by car from the parking area. Action Alternatives A, A.1, A.2, A.3, A.4, B. B.1, B.2, D, F, and F.1 would extend the west-side connector to the bridge in a straight alignment. Harrison Street would tie into this connector at a new T-intersection east of the canal bridge. This configuration would increase sight distance for motorists and canal users.

Action Alternatives B and B.1 include a west-side connector that would parallel the canal between Harrison Street and Washington Road at a close distance. This roadway would be visible from a portion of the park near Harrison Street where the wooded area is somewhat thinner than other areas and the topography is relatively flat. Visibility through the trees in this area would be somewhat greater in winter when the deciduous trees and shrubs are leafless.

None of the Action Alternatives would impact NJ Green Acres funded tracts within the study area

Action Alternative D would provide a covered section over Route 1 in a cut at Penns Neck. This covered area would comprise approximately 55,000 square feet, and could be developed as public open space. The area is sufficiently large to consider an array of landscape and hard scape amenities.

In summary, the adverse impacts to parklands/open space caused by any Action Alternative would be negligible, especially in light of the benefits to the D&R Canal in terms of enhanced access and safety. Furthermore, a bike/pedestrian component of the Commute Options Package would be part of any Action Alternative. The Package would find ways to create and improve connections between parks and open space areas in the study area (in particular, the D&R Canal and Millstone River).

Cumulative Effects

Growth in the PSA and CEA through Design Year 2028 will usurp remaining lands except as reserved by federal, state, county, and municipal plans. The pressures to preserve land for parks and open space in the CEA study area are great due to on-going development. Federal and state funded projects are required to recognize and assess impacts on parks and open space. This regulatory requirement provides some measure of protection. Protection of parks and open space threatened by private development is the purview of municipalities. Municipal and county master plans typically outline existing and future plans for parkland and open space preservation and development. Land earmarked for preservation must be set aside, purchased, deed restricted, or conserved through easement, trust, or other mechanism to ensure "planned" park and open space becomes a reality.

In looking at land use preservation trends in the central region of New Jersey, between 1976 and 1998, land preserved as farmland, parks, and/or open space

increased by 304%. In consideration of state, county and municipal open space funding initiatives, there is some indication that the region may be able to sustain a pace of land conservation equal to the aggressive acquisition performance of the past two decades.[8] This will in some measure offset the impact of undeveloped land being lost to commercial, industrial and residential development. In the cumulative context, an Action Alternative would have a negligible adverse impact on the open resources in the CEA.

If an Action Alternative is implemented, the opportunities for improved bicycle and pedestrian access and connections to parks and open spaces in the core study area portion of the CEA will be investigated.

4.14.3.9 Summary

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.

4.15 Relationship of Short-Term Uses to Long-Term Productivity and Energy

New roadway construction involves short-term uses of resources and energy in terms of materials, labor, and temporary environmental impacts. These resources are committed to the project for the duration of the construction period. Upon construction completion, resources and energy which are no longer required are re-allocated to other activities (in the case of labor and materials), or restored (in the case of temporarily disturbed areas).

Long-term productivity refers to the social, economic, and environmental well-being of the area influenced by a transportation project. Transportation improvements are an outgrowth of planning which considers the need to accommodate existing and foreseeable future traffic requirements in the context of existing and foreseeable future land use development.

This EIS discusses the short-term uses inherent in advancing any one of the Action and No-Action Alternatives. As well, this EIS provides extensive discussion of the extent to which each alternative would maintain and enhance long-term productivity

[8] Carnegie and Brake, 1999. *Land Consumption Patterns in Central New Jersey.* Working Paper for Middlesex Somerset Mercer Regional Council.

within the area of project influence. The relationship between short-term uses and long-term productivity constitutes a trade-off between unavoidable temporary impacts and long-term benefits. Discerning this relationship in each alternative, weighing the alternatives, and selecting a preferred alternative with the knowledge of short-term and long-term trade-offs are products of this Penns Neck Area EIS process.

A determination of approximate annual vehicle operating costs was made on the basis of the traffic modeling work. Vehicle operating costs include fuel and typical maintenance. The annualized AM peak hour costs are shown in Table 4-43. This information indicates that, under the No-Action Alternative, vehicle operating costs on Route 1 in the Core Study Area would be approximately $874,900 and $3,060,980 in the Core Study Area network. All Action Alternatives, except G.2, would decrease vehicle operating costs. On Route 1, operating costs would decrease by $21,580 or 2% (Alternative D) to $168,480 or 19% (Alternative B.2). Throughout the network, the savings would range from $11,180 or less than 1% (Alternative E) to $275,340 or 9% (Alternative C). Alternative G.2 would increase vehicle operating costs on Route 1 by $183,560 or 21%, and $86,320 or 3% in the Core Study Area network.

Table 4-43
Vehicle Operating Costs - Annualized AM Peak Hour (Dollars)

Alternative	Route 1 in Core Area	Change From No-Action ($)	Change From No-Action (%)	Entire Network in Core Area	Change From No-Action ($)	Change From No-Action ($)
Base No-Action	$377,780 $874,900			$1,495,520 $3,060,980		
A	$813,800	-$61,100	-7	$2,965,560	-$95,420	-3
A.1	$790,140	-$84,760	-10	$3,019,380	-$41,600	-1
A.2	$780,520	-$94,380	-11	$2,933,060	-$127,920	-4
A.3	$805,480	-$69,420	-8	$3,024,060	-$36,920	-1
A.4	$776,620	-$98,280	-11	$2,913,560	-$147,420	-5
B	$839,020	-$35,880	-4	$3,011,840	-$49,140	-2
B.1	$824,980	-$49,920	-6	$2,981,420	-$79,560	-3
B.2	$706,420	-$168,480	-19	$2,855,580	-$205,400	-7
C	$718,380	-$156,520	-18	$2,785,640	-$275,340	-9
C.1	$765,700	-$109,200	-12	$2,849,860	-$211,120	-7
D	$853,320	-$21,580	-2	$3,010,020	-$50,960	-2
D.1	$827,320	-$47,580	-5	$3,004,820	-$56,160	-2
D.2	$796,640	-$78,260	-9	$2,893,280	-$167,700	-5
E	$821,860	-$53,040	-6	$3,049,800	-$11,180	0
F	$781,040	-$93,860	-11	$2,849,860	-$211,120	-7
F.1	$751,140	-$123,760	-14	$2,837,640	-$223,340	-7
G	$760,500	-$114,400	-13	$2,877,680	-$183,300	-6
G.1	$760,500	-$114,400	-13	$2,877,680	-$183,300	-6
G.2	$1,058,460	$183,560	21	$3,147,300	$86,320	3

Note: Costs are for AM Peak hour Annualized (Hourly Cost x 260)

4.15.1 No-Action Alternative

The No-Action Alternative would involve no new construction activity. As such, no short-term uses of resources would occur. However, as discussed in this EIS, the No-Action Alternative would neither maintain nor enhance long-term productivity into the Design Year. Increased traffic demand from planned development will place greater pressure on existing roadways, increase congestion, and lengthen VHT and VMT. Impaired productivity will be felt most keenly in travel delay, and the cost of congestion for residents and workers. The reader is referred to Section 4.1 for greater discussion of these issues.

4.15.2 Action Alternatives

The Action Alternatives share similarities in terms of the quantity and types of short-term uses. All Action Alternatives would have temporary vegetative and soil disturbance impacts associated with construction activity. Disturbance areas would occur within the right-of-way and construction easements of the selected alternative. To the greatest extent practicable, disturbed areas outside the pavement section would be restored prior to construction completion.

Each Action Alternative would address traffic mobility and access into the Design Year. The assessments in this EIS indicate that advancing an Action Alternative, as opposed to the No-Action Alternative, would enhance the social, economic, and environmental well-being of the area at minimal adverse impact. Thus, in the relationship between short-term resource use and long-term productivity in the Action Alternatives, the short-term, adverse impact is minimal while the long-term, beneficial impact is the great.

4.16 Irreversible and Irretrievable Commitment of Resources

This section qualitatively summarizes the permanent commitment of resources to the project. Resources included in this description are natural, physical, human, and fiscal. Commitment implies both the positive and negative effects of an action. On the one hand, implementation of an action can have certain unavoidable, adverse effects. Such negative effects may be environmental impacts, business and residential impacts, or visual impacts, to name a few. Positive impacts consist of benefits such as improved mobility and access in a community. The desirable relationship between the positive and negative effects of an action is a balance.

4.16.1 No-Action Alternative

The No-Action Alternative would involve no new construction activity. Nevertheless, the No-Action Alternative would have adverse effects on local air quality, noise, and water quality as discussed within this EIS. At the same time, the No-Action Alternative would neither maintain nor enhance mobility and access into the Design

Year. Increased traffic demand from planned development will place greater pressure on existing roadways, increase congestion, and lengthen VHT and VMT. Thus, the relationship among the effects of the No-Action Alternative is negative.

4.16.2 Action Alternatives

The Action Alternatives share some similarities in terms of the quantity and types of positive and negative natural, physical, human, and fiscal impacts. Each Action Alternative would address traffic mobility and access into the Design Year. The assessments in this EIS indicate that advancing an Action Alternative, as opposed to the No-Action Alternative, would enhance the social, economic, and environmental well-being of the area at minimal adverse impact. Thus, in the relationship among permanent resource commitments in the Action Alternatives, the unavoidable, adverse impacts are minimal while the beneficial impacts are great.

4.17 Permits and Approvals

Various permits at the federal, state, and local levels would be required for the construction of the Action Alternatives as known now. Permit applicability would be re-evaluated during design through agency coordination and would involve examining the current regulations at the time. These permitting processes have procedures for analysis that are distinct from those used in the NEPA process. These permit-specific analyses provide an additional measure of environmental protection and insurance after the NEPA process. A description of these permits is given below, including the jurisdiction and requirements of the different regulatory agencies.

4.17.1 No-Action Alternative

The No-Action Alternative would require no permits.

4.17.2 Action Alternatives

Delaware and Raritan Canal Commission

The DRCC was created pursuant to the Delaware and Raritan Canal State Park Law of 1974, NJSA 13:13A-1 et seq. The DRCC Master Plan for the Delaware and Raritan Canal State Park specifies zones in which it reviews all private and public actions that impact this park. This review process is an attempt to ensure that actions conform as closely as possible to the Master Plan. Land subject to review by the DRCC includes those areas in Zone A and Zone B of the Review Zone. Zone A is defined as the area within 1,000 feet of either side of the centerline of the Canal. Zone B consists of the rest of the Review Zone. Action Alternatives A, A.1, A.2, A.3, A.4, B, B.1, B.2, C, D, E, F, and F.1 are within Zone A of the DRCC Review Zone. Action Alternatives C, C.1, D.1, G, G.1, and G.2 and the VDC Alternatives are not within Zone A. All the Action Alternatives are within Zone B of the DRCC Review Zone.

The DRCC review addresses impacts on storm drainage and water quality, visual and natural quality, the stream corridor, and traffic. The size and location of the proposed project determines the scope of review. The Penns Neck Area EIS would be considered a major project by the DRCC because the Action Alternatives would impact land within Zone A. If an Action Alternative is selected, it would be reviewed for these impacts, and the appropriate approval would be issued by the D&RCC prior to project implementation.

New Jersey Department of Environmental Protection

- Freshwater Wetlands Permit

Permits for encroachment upon wetlands and state open waters are administered by the NJDEP under the Freshwater Wetlands Protection Act (NJSA 13:9B-3). All Action Alternatives would likely require a Freshwater Wetlands Statewide General Permit (SGP) or Individual/Open Water Permit as they would impact wetlands associated with the Millstone River. This permit process would address the following activities: unavoidable disturbance of wetland vegetation, discharge of dredge or fill material, drainage or disturbance of the water table, excavation, and the erection of structures within state-regulated wetlands.

- New Jersey Pollution Discharge Elimination System (PDES) – Statewide General Permit

To improve the quality of New Jersey's surface waters, the NJDEP has instituted its Statewide Industrial Stormwater Permitting Program in conjunction with the existing Soil Erosion and Sediment Control Program under Chapter 251. This program is implemented by the USDA Soil Conservation Service (SCS) through the Mercer County Natural Resources Conservation District. Projects that require a NJPDES permit are those that would include clearing, grading and excavating 5 or more acres or those that would disturb less than 5 acres but that are part of a larger plan of development or scale. The Action Alternatives would require this permit.

- Stream Encroachment Permit (SEP)

Pursuant to the N.J. Flood Hazard Area Control Act, a SEP is required for the construction, installation, or alteration of any structure or permanent fill along, in, or across the channel or floodplain of any stream. This includes any alteration of the stream or floodplain. A SEP would be required for the Action Alternatives for crossing the Millstone River and/or Little Bear Brook.

- Section 401 Water Quality Certificate (WQC)

The issuance of a WQC by the NJDEP is required in conjunction with the Freshwater Wetlands Permit to ensure that state water quality standards will be met.

The NJDEP has proposed new rules and amendments to existing regulations pertaining to water quality and floodplain protection. The proposed Watershed Management regulations (NJAC 7:8) are new rules that include amendments to other rules, including Freshwater Wetlands (NJAC 7:7A), Coastal Zone Management (7:7E), Flood Hazard Area Control (NJAC 7:13), Water Quality Management Planning (NJAC 7:15), and Dam Safety Standards (NJAC 7:20).

The purpose of the new stormwater regulations is "to designate additional sources that need to be regulated to protect water quality and to establish a comprehensive stormwater program to regulate these sources." The proposed regulations would establish design and performance standards for stormwater management measures required by the rules implementing the Flood Hazard Area Control Act, the Coastal Area Facility Review Act, the Waterfront Development Law, the Freshwater Wetlands Protection Act, and the Dam Safety Act. The regulations would establish guidelines for the development of municipal and regional stormwater management plans. The NJDEP would use the adopted regional stormwater management plans as the basis for reviewing the stormwater management aspects of projects or activities regulated pursuant to the aforementioned Acts.

These proposed rules are currently under consideration. Adoption of these rules and amendments will likely occur within the design time frame of an action alternative, if selected for construction. Consequently, the design of any action alternative would be subject to these more stringent regulations.

- New Jersey No Net Loss Reforestation Act

The project would have to comply regarding unavoidable losses of forested areas. The Act mandates that the project replace disturbed forest. An assessment of the applicability of the project to the Act and development of a specific mitigation plan would be undertaken during design.

United States Environmental Protection Agency (USEPA)

- Sole Source Aquifer (SSA) Area Review

Section 1424(e) of the Safe Drinking Water Act of 1974 (PL 93-523) charges the USEPA with the protection of SSAs. The 1984 Memorandum of Understanding between the USEPA and FHWA on SSAs calls for FHWA to provide EPA with early notification and groundwater quality assessments for projects in SSA areas that involve:

- Construction of additional through-traffic lanes, interchanges, or rotaries on existing roadways;
- Construction of a two or more lane highway on new alignment;
- Construction of rest areas with on-site sewage disposal facilities; and

- Construction of other projects that in the opinion of FHWA may have a serious effect on groundwater quality.

This notification and subsequent coordination should be carried out as part of the normal project development whenever possible. This EIS and the *Natural Resources Technical Environmental Study, Penns Neck Area EIS* contain information needed by the USEPA to evaluate the project's effect on the underlying SSA, including a groundwater recharge assessment, pollutant loading analysis, and Toler analysis.